



# TEXTURE

A hydrocolloid recipe collection



*Edited by Martin Lersch*

## Texture – A hydrocolloid recipe collection (v. 2.2, December 2008) edited by Martin Lersch

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### Disclaimer

All recipes have not been tested by the editor so there is no guarantee that they actually work as intended and that the directions are complete, accurate and correct.

### Words of caution

Always make sure that the hydrocolloid you use is indeed intended for consumption. Chemicals come in different purities. Note that some chemicals are sold "for research use only". Many of the hydrocolloids mentioned herein are available in "technical grade" purities which might be intended for non-food applications only. If using PVC tubes to make noodles only "food grade" tubes should be used.

### Cover picture

The picture shows agar noodles made from 40 g soy sauce, 60 g water and 1.1 g agar. Everything was heated to dissolve the agar. Using a syringe, the solution was sucked into a PVC tube (2 m, 2mm i.d.) and left to cool for 1 min. The noodle was blown out of the tube, coiled into a spiral and then cut with a sharp knife. (Photo: Martin Lersch)

## Table of contents

Agar .....	7
Carrageenan.....	13
Cornstarch .....	17
Gelatin .....	21
Gellan .....	30
Guar gum.....	35
Gum arabic .....	37
Konjac.....	38
Lecithin .....	39
Locust bean gum .....	41
Maltodextrin .....	42
Methyl cellulose .....	44
Pectin.....	48
Sodium alginate.....	52
Xanthan .....	58
Multi-hydrocolloid recipes .....	62
Non-hydrocolloid foams.....	69
Appendix.....	71
Comparison of gel texture in common gelling agents.....	71
Volume-weight conversion of hydrocolloids.....	71
texturePro measuring spoon-weight conversions.....	71
Synergies .....	72
List of common chemicals.....	72
Conversion table for brand names.....	73
Gelatin gels with alcohol .....	73
Gelatin and bloom strength.....	74
Formula for conversion of bloom strengths .....	74
Miscellaneous .....	74
Comparison of hydrocolloid properties .....	75
Glossary.....	78
References .....	79
Suppliers.....	80
Texture index .....	81
Overview of texture-hydrocolloid combinations represented in recipe collection .....	81
List of recipes according to texture and hydrocolloid used.....	82
Index of alcoholic preparations.....	87
Keyword index .....	88

## **Version history**

### *v. 1 (August 2007)*

First version with 111 recipes.

### *v. 2 (May 2008)*

Several new recipes added (now counting more than 220 in total), including recipes with cornstarch, gum arabic, konjac and locust bean gum. In each section recipes are now sorted according to amount of hydrocolloid used. The appendix has been updated with tables for comparison of hydrocolloid properties, hydrocolloid densities and synergies. A major improvement is that recipes have been indexed according both to the texture/appearance of the resulting dish and according to hydrocolloids.

### *v.2.1 (June 2008)*

Gelatin section updated to reflect the fact that the size of gelatin sheets compensates for the different bloom strengths available. Supplier list updated. Typos corrected. Recipes added/deleted.

### *v.2.2 (December 2008)*

Recipes added, now counting more than 270 in total. Supplier list updated. Typos corrected. Some additions/changes in appendix. New index for alcoholic preparations added.

## Foreword

A hydrocolloid can simply be defined as a substance that forms a gel in contact with water. Such substances include both polysaccharides and proteins which are capable of one or more of the following: thickening and gelling aqueous solutions, stabilizing foams, emulsions and dispersions and preventing crystallization of saturated water or sugar solutions.

In the recent years there has been a tremendous interest in molecular gastronomy. Part of this interest has been directed towards the “new” hydrocolloids. The term “new” includes hydrocolloids such as gellan and xanthan which are a result of relatively recent research, but also hydrocolloids such as agar which has been unknown in western cooking, but used in Asia for decades. One fortunate consequence of the increased interest in molecular gastronomy and hydrocolloids is that hydrocolloids that were previously only available to the food industry have become available in small quantities at a reasonable price. A less fortunate consequence however is that many have come to regard molecular gastronomy as synonymous with the use of hydrocolloids to prepare foams and spheres. I should therefore emphasize that *molecular gastronomy is not limited to the use of hydrocolloids* and that *it is not the intention of this collection of recipes to define molecular gastronomy*.

Along with the increased interest in hydrocolloids for texture modification there is a growing scepticism to using “chemicals” in the kitchen. Many have come to view hydrocolloids as unnatural and even unhealthy ingredients. It should therefore be stressed that the hydrocolloids described in this collection are all of biological origin. All have been purified, some have been processed, but nevertheless the raw material used is of either marine, plant, animal or microbial origin. Furthermore hydrocolloids can contribute significantly to the public health as they allow the reduction of fat and/or sugar content without losing the desired mouth feel. The hydrocolloids themselves have a low calorific value and are generally used at very low concentrations.

One major challenge (at least for an amateur cook) is to find recipes and directions to utilize the “new” hydrocolloids. When purchasing hydrocolloids, typically only a few recipes are included. Personally I like to browse several recipes to get an idea of the different possibilities when cooking. Therefore I have collected a number of recipes which utilize hydrocolloids ranging from agar to xanthan. In addition to these some recipes with lecithin (not technically a hydrocolloid) have been included. Recipes for foams that do not call for addition of hydrocolloids have also been included for completeness. Some cornstarch recipes have been included to illustrate its properties at different concentrations. Recipes where flour is the only hydrocolloid do not fall within the scope of this collection as these are sufficiently covered by other cook books.

All recipes have been changed to SI units which are the ones preferred by the scientific community (and hopefully soon by the cooks as well). In doing so there is always uncertainty related to the conversion of volume to weight, especially powders.<sup>1</sup> As far as possible, brand names have been replaced by generic names. Almost all recipes have been edited and some have been shortened significantly. To allow easy comparison of recipes the amount of hydrocolloid used is also shown as mass percentages and the recipes are ranked in an ascending order. In some recipes, obvious mistakes have been corrected. But unfortunately, the recipes have not been tested, so there is no guarantee that they actually work as intended and that the directions are complete, accurate and correct. It appears as if some of the recipes are not optimized with regard to proper dispersion and hydration of the hydrocolloids which again will influence the amount of hydrocolloid used. It is therefore advisable to always consult other similar recipes or the table with the hydrocolloid properties. The recipes have been collected from various printed and electronic sources and every attempt has been made to give the source of the recipes.

Since recipes can neither be patented nor copyrighted, every reader should feel free to download, print, use, modify, and further develop the recipes contained in this compilation. The latest version will be available for download from <http://khymos.org/recipe-collection.php> and will also be announced at <http://blog.khymos.org>. I would like to thank readers for giving me feedback and suggestions on how to improve the collection. Feedback, comments, corrections and new recipes are always welcome at [webmaster@khymos.org](mailto:webmaster@khymos.org).

Martin Lersch  
Oslo, May 2008

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<sup>1</sup> Conversion has been done at <http://www.convert-me.com/en/convert/cooking>. Hydrocolloid densities are found in the appendix.

## Quick guide

There are several ways of using this collection of recipes. You can search the recipes by...

### 1. Hydrocolloid

Turn to the section covering the hydrocolloid of interest. In each section, recipes are arranged in an ascending order according to the amount of hydrocolloid used in the recipe. Or you can use the index on page 88 to find particular recipes in the multi-hydrocolloid section.

### 2. Texture

In the texture index starting on page 82 all recipes have been grouped according to the texture produced and the hydrocolloid used. A table on page 81 shows the different texture-hydrocolloid combinations which are exemplified in the recipe collection.

### 3. Properties

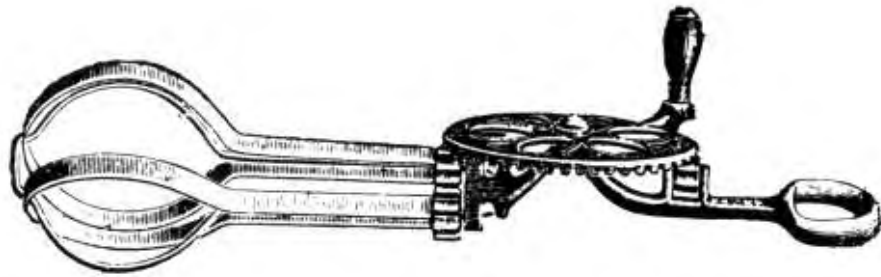
When looking for a hydrocolloid with special properties, start by looking at the table "Comparison of hydrocolloid properties" on page 75. Having found a hydrocolloid which fits your application you can either turn to the appropriate section or use the texture index.

### 4. Fulltext search

Download the pdf and use the search function of Acrobat reader to search the whole document for any ingredient, technique or keyword you are interested in.

Before proceeding with a recipe, check the table starting on page 75. Pay special attention to the details regarding dispersion and hydration. Also note possible interactions with promoters and inhibitors.





# Agar

## Tips and tricks

- Addition of glycerol or sorbitol can prevent dehydration of the gel.
- When replacing gelatin or pectin for gels, use 2-3 and 10 times less agar respectively
- For "raw" preparations dissolve agar in small quantity of water. Heat remaining solution to 35-45 °C and mix with agar solution.
- If left uncovered agar gels dry out, but if immersed in water or other liquid it swells and retains its original shape.
- A special property of agar is the large difference between the gelling temperature and the melting temperature. This is known as hysteresis

<b>Name</b>	<b>agar (E406)</b>
<i>Origin</i>	polysaccharide obtained from red algae (several species)
<i>Properties, texture</i>	thermoreversible, heat resistant, brittle gel; high hysteresis
<i>Clarity</i>	clear to semi-opaque
<i>Dispersion</i>	in cold or hot water
<i>Hydration (dissolution)</i>	> 90 °C; heating to boil necessary for gelling.
<i>pH</i>	2.5-10
<i>Setting</i>	35-45 °C, rapid (minutes)
<i>Melting</i>	80-90 °C%
<i>Promoter</i>	sugar; sorbitol and glycerol improve elasticity.
<i>Inhibitor</i>	tannic acid (counteracted by add. of glycerol); prolonged heating at pH outside the range 5.5-8
<i>Tolerates</i>	salt, sugar, alcohol, acid, proteases
<i>Viscosity of solution</i>	low
<i>Typical concentration</i>	0.2% will set, 0.5% gives firm jelly, [0.24-3%] *
<i>Synergies</i>	locust bean gum (only with certain agar types)
<i>Syneresis</i>	yes (can be prevented by replacing 0.1-0.2% agar with locust bean gum)

\* Concentrations in [square brackets] show range exemplified in this collection.

### Clear liquid by agar filtration

1000 mL cloudy liquid or purée  
0.7-1.8 g agar (0.07-0.18%)

Strain liquid to remove particles. Bring to simmer, add agar and stir to dissolve. Let cool and freeze. Line a strainer with a cheese cloth or a coffee filter and place the strainer over a bowl. Place the frozen block in the strainer and allow the clear liquid to drain out of the agar network. An agar filtration typically takes 8 hours compared to 2-3 days for a gelatin filtration.

<http://foros.chefuri.net/viewtopic.php?p=36649>

### Turkish delight

350 ml water  
100 ml orange juice  
1 lemon, juiced  
1.2 g agar agar (0.13%)  
450 g sugar  
pink or yellow food colouring (optional)  
25 g pistachios, skinned/chopped (optional)  
25g almonds, skinned/chopped (optional)  
icing sugar for dusting

Heat water, orange and lemon juices. Add agar agar and stir to dissolve. Add the sugar and food colouring and bring to boil. Then simmer on low heat for 20 minutes, stirring occasionally. Add the nuts. Remove from heat and cool mixture, stirring from time to time until it comes to room temperature. Pour into a square or rectangular dish, cover and leave in fridge until set. Cut into 24 squares using a greased knife, and dust with icing sugar. Store in an airtight container, or wrap in cellophane.

<http://globalveggie.wordpress.com/2008/09/26/turkish-delight/>

### Hot lobster gelatin

250 g lobster stock  
0.6 g agar (0.24 %)  
salt

Mix the lobster stock, salted to taste, with the agar. Bring to a boil over medium heat while stirring continuously. Allow to gel in the refrigerator for at least 2 hours and heat under the salamander (hot air heater) before serving.

<http://www.texturaselbulli.com>

### Coconut jelly with strawberry sauce

250 mL milk  
15 g grated coconut  
75 g sugar  
1 g agar (~ 0.26%)  
1/2 lemon, juiced (~20 mL)  
25 g cream

*Strawberry sauce:*  
250 g strawberries  
50 g sugar

Cook the milk together with the grated coconut and the sugar. When it boils, add the agar and cook for 3 minutes. Leave it to cool down until it is tepid and add the lemon juice and the cream. Pour the liquid in a mold and cool it in the fridge. Cut it into different shapes.

Wash and chop the strawberries, add the sugar and grind. Serve the coconut jelly with a little bit sauce on the top.

*Adapted from <http://www.inicon.net>*

### Hot vegetable mousse

2.5 g agar (0.33 %)  
500 g water  
50 g dairy cream (thick)  
200 g vegetable purée (mashed and thinned)  
pepper  
(xanthan)

Prepare the vegetables (try French sweet peas), blend with cream and water and strain. Bring to boil and add agar. Stir well for a few minutes (can use blender). Add flavoring (pepper, etc.). Leave to set for a few hours.

When cold, put into blender and blitz the gel into a mashed runny purée. Pour into 1 L heat resistant whipper. If not runny, add a little water and if too runny add a small pinch of xanthan. Blend again a few minutes.

Follow recommendations of dispenser supplier and charge with nitrous oxide. Heat whipper in saucepan of water till warm (~70 °C). Layer hot vegetable purée on a soup or a very hot plate

<http://www.gastronomie.kalys.com>

### Dehydrated lime curd

270 g lime juice  
270 g eggs  
270 g sugar  
4 g agar (0.34%)  
350 g butter, cold, cut in cubes

Bring lime juice, eggs, sugar and agar to a boil, whisking constantly. Boil for 1 minute. Transfer to blender, and with blender running at low speed, add butter 1-2 cubes at a time until combined. Strain through chinois, let cool, cover and refrigerate for 12 hours. Spray sheet of acetate with nonstick cooking spray. Spread out chilled curd, about 2 mm thick. Dehydrate at 50 °C for 12 hours or until crispy, preferably in a dehydrator.

*Grant Achatz in Alinea*



### Lemon curd with agar

2-3 lemons, juiced  
250 g sugar  
50 g butter  
3 eggs  
2 g agar (0.35%)

Bring all ingredients to a boil. Add lemon zest and/or bergamot oil if desired.

<http://www.chefsimon.com>

### Terrine of basil

250 g basil water  
0.9 g agar (0.36 %)  
salt

Combine 1/4 of the basil water and the powdered agar. Bring to a boil over medium heat while stirring continuously, remove from heat and add the rest of the basil water, salted to taste. Allow to gel in the refrigerator for at least 3 hours, in a square container so that it has a thickness of 1 cm.

<http://www.texturasebulli.com>

### Fruity flan dessert

3.0 g agar (0.38 %)  
750 mL whole milk  
50 g dairy cream  
1 t vanilla extract  
30 g sugar  
pieces of fruit, raisins or gelled dulce

Blend agar, milk and cream and heat to boiling point. Maintain boil for a few minutes. Strain and pour into small pots or ramekins. To flavor, add flavors and aromas at boiling point and stir in. Pour onto pieces of fruit or gelled dulce. You might also try adding some sodium alginate pearls or raisins.

If you mix the gel in a blender and then expand in a whipper or use a whisk you can produce a light heat stable mousse.

<http://www.gastronomie.kalys.com>

### Cold sauce with green cardamom

1000 mL water  
50 g glucose  
12 capsules of cardamom  
3-4 cm fresh ginger, peeled and minced  
zest of 1 lime

*For thickening use one of the following*

4 g agar (0.38%)  
20 g pectin (1.9%)  
10 g gelatin (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

<http://www.chefsimon.com>

### Fruit jelly

5 g agar (~ 0.42 %)  
500 g halved peaches in syrup  
500 g halved peaches/pears without syrup  
200 g sugar (or use 50 g maltitol, 50 g maltodextrin and 100 g glucose)

*Flavoring to taste:*

1 spent vanilla pod  
basil  
lemon/orange rind  
nutmeg  
ginger  
green pepper  
orange liqueur  
orange cordial

Strain the fruit. Collect the syrup from the cans and add the agar. Bring to boil.

Heat the fruit and sugar in a large saucepan. Blend to purée. When boiling add agar and canned fruit syrup. Add flavoring.

Stir well and evaporate 20% of the solution. If desired, add some orange liqueur or orange cordial for extra bitterness. Pour into jam jars or ramekins and leave to set all night.

Variation: With 10 g of agar, you obtain a harder gel closer to a firm jam.

<http://www.gastronomie.kalys.com>

### Chocolate mousse

300 g cocoa (60%)  
250 g whipped cream  
200 g milk  
1/2 vanilla pod  
70 g egg yolk  
50 g icing sugar  
4 g agar (0.46%)

*For citrus marmalade*

1/2 lemon  
1/2 lime  
1/4 orange  
150 g sugar  
2 g agar (~ 0.5%)  
50 g sugar  
120 g water

Cut the chocolate into small pieces and melt it in a double boiler. Boil the cream, milk and vanilla. Once it boils, add the agar and cook for

some minutes. Mix the egg yolks and the sugar and add it to the cream mixture. Add the melted chocolate as well and mix very well together. Pour in a bowl and let it rest in the fridge over night.

Citrus marmalade: cut the lemon, the lime and the orange (like for a fruit salad). Cook and add 150 g sugar. Let it cook until getting a coarse purée. Mix 50 g sugar and the agar in the water and heat to dissolve. Put it together with the fruits and cool to set.

<http://www.inicon.net>

### Marshmallows with agar

160 mL water  
3.6 g agar agar (0.53%)  
290 g sugar  
230 g light corn syrup  
1 t pure vanilla extract  
pinch of salt  
vegetable-oil cooking spray  
corn starch

Sprinkle agar agar into 80 mL cold water in bowl of mixer. Bring remaining water, sugar, corn syrup and salt to 114 °C in saucepan. Whisk agar agar mixture while slowly adding syrup in a steady stream down the side of the bowl. Gradually increase mixer to high. Beat until mixture is thick, white and has almost tripled in volume (~ 12 minutes). Add vanilla (or other flavoring/food coloring) and beat 30 seconds more. Pour mixture into 30 x 40 cm rimmed baking sheet coated with cooking spray. Smooth with spatula sprayed with cooking oil. Let sit uncovered overnight. Cut out with knife or scissors sprayed with cooking oil. Roll marshmallows in corn starch to keep them from sticking to each other. Store in air tight container, with wax paper between layers.

<http://kanten-world.blogspot.com/2007/12/vegetarian-marshmallows>

### Yokan

5 g agar (~0.8%)  
2-300 g water  
1-200 g sugar  
150-300 g inverted sugar  
0.2 g citric acid  
flavor and color  
azuki beans (enough to produce a hard gel)

Agar is dissolved in boiling water with sugar and inverted sugar and maintained at 106 °C for a few hours to reduce the volume. After brief cooling, the azuki bean purée previously prepared and the acid are added together with flavors and colorings. It is left to cool overnight at room temperature. This gel has a dried weight of 70–75%. It is placed in an oven at 55

°C as long as needed to reach a dry weight of 84–86% and is cut in small pieces that are first folded in an oblate (edible paper made of) and later in plastic.

*T. Matsuhashi in CRC Handbook of hydrocolloids*

### Cold cod-fish salad with agar wrapping

*For agar film:*  
100 mL water  
1 g agar (1.0 %)  
1 g glycerol

*For cold cod-fish salad:*  
assorted chopped salad  
cod-fish  
chick peas  
red pepper  
minced olives  
parsley  
oil  
salt  
vinegar

For agar film: dissolve agar in water. Bring to boil for 1 min on low heat. Remove from heat and leave to cool. When lukewarm, add glycerol. Mix well and pour over a plastic foil to obtain a thin film of agar which gels within minutes.

Once the film has gelled, a little bit of salad is added and is rolled in such a way that the film of agar and glycerol wraps the salad in a roll.

For cold cod-fish salad: chop cod-fish, red pepper, olives and parsley in small pieces and mixed with the chick peas. Next, oil, vinegar and salt are added. All should be mixed well and served on the plate together with the agar and glycerol roll garnishing previously prepared with salad.

*Adapted from <http://www.inicon.net>*

### Battered baby squids with agar noodles

*Noodles:*  
300 mL white wine vinegar  
200 mL concentrated fish stock  
100 mL soy sauce  
30 g squid ink  
7 g agar (1.1%)

*Garlic oil:*  
3 cloves garlic  
250 mL extra virgin olive oil

*Battered baby squids:*  
tempura  
500 g baby squids  
sunflower oil

Noodles: Bring vinegar, fish stock, soy sauce and squid ink to boil. Add agar and leave boiling for 2 minutes. Cool mixture in a mold in the fridge. When cold, cut the mixture to flat noodles with a very sharp knife or with a special device for making noodles. You can also fill a suitably sized pvc tube using a syringe.

Garlic oil: Slice cloves and fry with the olive oil in a pan until light brown color.

Squid: From the baby squid only the tentacles will be used. Clean and salt the tentacles before dipping them in tempura and fry with generous hot oil. Strain.

Serve on spoons, the noodles at the bottom, dress with garlic oil and the baby squid on the top.

*Adapted from <http://www.inicon.net>*

### Agar gel cubes

125 mL orange juice (for color add some cordial or red food color)  
1.3 g agar (1.0 %)

*or*

200 g strawberry cordial  
500 mL water  
10 g agar (1.4 %)

*or*

80 g violet cordial  
450 mL water  
8 g agar (1.5 %)

Bring the liquid(s) and agar to boil. Stir well. Pour into containers. Set aside 2 hours to cool down. Turn agar gel out and cut into cubes.

*<http://www.gastronomie.kalys.com>*

### Hot foam of red fruits

250 mL syrup or purée of red fruits/berries  
3-4 g agar (1.2-1.6%)

Disperse agar in purée and bring to boil. Leave to set. Blitz with an immersion blender and heat to 70 °C (if agar melts, start over again). Sieve and transfer to an iSi whipper designed for use with hot preparations, charge with nitrous oxide and dispense while still hot. This yields a hot, stable, fluid foam. Keep whipper in a warm bath to avoid blocking of the nozzle.

*<http://www.chefsimon.com>*

### Orange marmalade

1000 mL fresh orange juice

14 g agar (~1.4%)  
3 T honey  
vanilla  
peel from 3 oranges

Peel oranges carefully (leaving the white behind) and slice thinly. Boil the peel with vanilla, honey and orange juice and reduce to 750 mL. Add agar to the boiling juice. Fill jars or glasses.

*Henrik Schellhoss via <http://kochmuetzen.net>*

### Agar drink with lime

*Agar jelly*  
25 g agar (1.5 %)  
1200 mL water  
480 g sugar  
food coloring

*Syrup*  
150 g rock sugar  
4 pandan leaves

*Drink*  
freshly squeezed lime juice  
ice water  
ice cubes

For agar jelly: Put agar, water and sugar in a pot. Mix well and bring to a boil. Once it reaches boiling point, lower heat and simmer for about 15 minutes till the mixture is somewhat clear. Add coloring and stir well. Put into a mold and set in the fridge. When it is set, grate it finely.

For syrup: Put sugar, pandan leaves or pandan essence and water into a pot. Bring to a boil and lower heat. Simmer for another 15 minutes until sugar has melted and the syrup has thickened slightly.

Put into a tall glass some grated agar, syrup, lime juice and top up with ice cubes and ice water.

*<http://www.recipezaar.com/147596>*

### Sweet potato jelly

200 g sweet potatoes, diced  
200 mL coconut milk  
20 g agar (1.6 %)  
100 g sugar  
750 mL water  
1 pinch salt  
2 screwpine leaves, knotted (pandan)  
*or* 1/2 t pandan extract

Steam sweet potatoes until soft. Combine the sweet potatoes and coconut milk in a blender. Strain mixture through a fine sieve. Combine agar powder, sugar, water and pandan leaves

in a saucepan and bring to a boil until agar dissolves. Stir in puréed sweet potato and coconut mixture and simmer over low heat. Add a pinch of salt and pour the jelly mixture into a wet tray or mold. Leave aside at room temperature to set, then chill well before cutting into desired shapes.

<http://www.recipezaar.com/92942>

### **Parmesan spaghetti**

200 mL fond/stock (not too salt)  
100 g parmesan, grated  
5 g agar (1.7%)

Stir parmesan into boiling fond. After one hour filter through chinois and store over night in fridge. Filter again if necessary. Bring filtrate to boil while adding agar and stirring constantly.

For thick spaghettis: close one end of drinking straw (diameter ~ 5 mm) and fill with parmesan mix.

For thin spaghettis: fill a suitable plastic tube (typically 2 m length, 2-3 mm diameter) with the mix using a syringe. Immerse the filled tube into ice water for 2-3 minutes. Fill the syringe with air to blow out the spaghetti.

*Adapted from Henrik Schellhoss via <http://kochmuetzen.net>*

### **Vinaigraitte sheets**

100 g rice vinegar  
50 g sugar

300 g spring water  
1 g salt  
16 g agar (2.6%)  
150 g olive oil

Bring vinegar, water, sugar and salt to a boil. Add agar and stir until dissolved. Remove from heat and add olive oil while mixing with an immersion blender. Spread the mixture on a silpat or a baking sheet to a thickness of about 1 mm. Let cool and cut to desired shapes.

*Pierre Gagnaire via <http://www.pierre-gagnaire.com>*

### **Chocolate flavored doughnut icing**

64 % sugar  
12 % water  
9 % alkalized cocoa powder  
9 % vegetable shortening  
3 % agar (cold soluble)  
3 % skimmed milk powder

Blend all dry ingredients. Slowly add dry ingredients to stirred water at 50 °C. Blend until smooth. Yields a soft icing with minimal flow suitable for doughnuts.

<http://www.cybercolloids.net>

Further recipes with agar can be found in the section “Multi-hydrocolloid recipes” on page 62.



# Carrageenan

## Tips and tricks

- Used at low levels (0.025-0.035%) iota carrageenan provides a rich mouth feel to milk based drinks.
- The shear thinning property of iota carrageenan gives a certain "melt-in-mouth" feeling
- If used for products with pH < 4.3 carrageenan should be added immediately before cooling to avoid excessive hydrolysis with resulting loss of gel strength/viscosity

Name	<i>carrageenan (E407) iota type</i>	<i>carrageenan (E407) kappa type</i>
Origin	polysaccharide obtained from red seaweed	polysaccharide obtained from red seaweed.
Properties, texture	thermoreversible, soft, shear-thinning, elastic gel with calcium	thermoreversible, firm, brittle gel with potassium
Clarity		clear/slightly turbid
Dispersion	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol
Hydration (dissolution)	> 70 °C; for high sugar concentrations: add sugar after hydration.	> 70 °C
pH	4-10	4-10
Setting	40-70 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.	30-60 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.
Melting	5-10 °C above setting temperature (unless mixed with starch)	10-20 °C above setting temperature (unless mixed with certain proteins)
Promoter	calcium yields soft and elastic gels	potassium, milk protein
Inhibitor	hydrolysis of solution at low pH with prolonged heating; gels are stable	salts; hydrolysis of solution at low pH with prolonged heating; gels are stable
Tolerates	salt	
Viscosity of solution	medium	low
Typical conc.	1-1.5% for gel [0.02-1.5%]	1.5% for gel [0.02-1.5%]
Synergies	starch	locust bean gum (increased elasticity, improves clarity, reduced syneresis), konjac, tara, milk protein
Syneresis	no	yes

## Frappuccino

### Unflavored mix

1000 mL milk  
0.5 g carrageenan (0.04%, 0.02% in drink)  
125 g sugar  
115 g nonfat powdered milk

### For Frappuccino

200 mL unflavored mix  
200 mL ice  
30 mL ground chocolate (Ghirardelli or similar)  
1 espresso shot

Unflavored mix: Mix ingredients in blender, at least one day ahead. Chill.

Frappuccino: Pour unflavored mix into blender. Add ground chocolate and a single shot of chilled espresso. Add ice, blend until smooth, and pour into cup.

JR at <http://www.coffeegeek.com>

## Pineapple gel

250 g pineapple juice  
0.3 g iota carrageenan (0.12%)

Mix the pineapple juice with iota carrageenan and pour into a saucepan. Bring to a boil and allow to gel in the refrigerator.

<http://www.texturaselbuli.com>

## Frappuccino

500 mL ice  
2-4 shots of espresso  
150 mL milk  
1 g carrageenan (~0.13%)  
chocolate syrup to taste  
sugar to taste

Blend the espresso, chocolate and milk on low speed, then add carrageenan gingerly, but quick. Then add all the ice right away, and blend on high for about 30 seconds to a minute. Substitute some of the milk with heavy cream if desired.

CoffeeKid at <http://www.coffeegeek.com>

## Chocolate foam, chantilly and dessert

3.5 g carrageenan (0.28%)  
600 mL water  
200 g melted chocolate  
400 g dairy cream  
50 g sugar  
1 teaspoon of instant coffee

Heat all ingredients to minimum 80 °C a few minutes.

Gel: Leave to set. A gel will form.

Fluid gel: Beat the gel into a smooth thick solution. Serve chilled or heated as a hot sauce.

Foam: Pour fluid gel into a heat resistant whipper and charge with nitrous oxide. Shake well. Dispense onto a plate as decoration or onto a hot cocoa or coffee drink. Serve hot or cold.

Alternative preparation: Melt chocolate in a double boiler. Whisk cream and sugar and fold into chocolate. Heat water to boiling point and add carrageenan while stirring. Add the chocolate and cream mix using blender. Add flavoring to taste (amaretto, cordial, instant coffee, liqueur or nuts). Pour hot into ramekins or a large dish. Leave to cool down a few hours. Serve room tempered or chilled. Variation: Blitz this chocolate flan into a rich unctuous cream (add chunky flavoring after this step i.e. nuts, agar drops, sodium alginate pearls, pieces of fruit...)

<http://www.gastronomie.kalys.com>

## Milk gel

200 g milk  
0.6 g iota carrageenan (0.3%)

Mix the milk with the iota carrageenan and blend with a hand-held mixer until completely dissolved. Pour into a saucepan, heat to 80 °C and allow to gel in the refrigerator.

<http://www.texturaselbuli.com>

## Basic foam with carrageenan

1 g iota carrageenan (0.5%)  
2 g emulsifier (milk/plant protein, e.g. lecithin)  
200 mL liquid (e.g. dairy based)

Disperse carrageenan and emulsifier into cold liquid. Allow some time for hydration. Whisk at high speed or dispense from whipper charged with nitrous oxide to make foam.

<http://www.inicon.net>

## Fruit-flavored water dessert jelly

sugar 15–20%  
carrageenan (kappa/iota blend) 0.60–0.90%  
potassium citrate 0.20–0.35%  
citric acid 0.30–0.45%  
color  
flavor  
water to 100%

Mix ingredients. Heat. Cool to set.

CRC Handbook of hydrocolloids

### Beer gel

200 g white ale  
50 g sugar  
50 g glucose  
0.25 g potassium citrate (0.08%)  
2.0 g kappa carrageenan (0.67%)

In a blender combine ale, sugar, glucose, potassium citrate and carrageenan. Blend on high speed for 3 min. Transfer to medium saucepan and bring to a boil. Pour onto a sheet tray lined with plastic wrap. Leave in fridge for 1 hour or until set.

<http://www.grantachatz.com>

### Gelatinated cucumbers in bloom

20 cucumbers in bloom  
100 g brine from pickled gherkins  
0.75 g kappa carrageenan (0.75%)

Wash the cucumbers in bloom and refrigerate. Combine 100 g of brine from pickled gherkins with the kappa carrageenan in a saucepan. Bring to a boil. Dip the cucumbers twice in the warm mixture and refrigerate.

<http://www.texturasebulli.com>

### Peanut butter panna cotta

540 g milk  
300 g peanut butter  
10 g vanilla extract  
210 g white sugar  
10 g salt  
9.6 g iota carrageenan (0.9%)

Mix all the ingredients in a blender except for the peanut butter and carrageenan. Sprinkle carrageenan into the vortex to disperse. Pour into a sauce pan and bring to boil. Whisk in peanut butter and when thoroughly combined pour into desired cups or molds. Let cool and leave to set in fridge.

<http://chefb.blogspot.com/2008/09/not-beyond-our-limits.html>

### Dill custard

100 g dill, pick fronds, discard stems  
1500 g heavy cream  
12 g salt  
18 g simple syrup  
15 g iota carrageenan (0.91%)

Bring cream, salt and syrup to a simmer. Transfer to blender, add dill and blend on high speed for 90 s. Pass through chinois twice, first with pressing on the solids, then without pressing. In a medium saucepan, combine liquid and carrageenan. Disperse with an immersion blender for 1 min. Bring to boil and

blend for another 2 min. Remove from heat and rest pan in ice water to cool.

<http://www.grantachatz.com>

### Kefir custard

375 g kefir  
375 g heavy cream  
7 g salt  
100 g sugar  
10 g calcium lactate (1.1%)  
9 g iota carrageenan (1.0%)

Gently warm kefir, cream, salt and sugar over medium heat. When mixture is warm, add calcium lactate and carrageenan, increase heat, bring to simmer and disperse the hydrocolloid with an immersion blender. Continue blending for another 2 min when mixture comes to a boil. Remove from heat, strain and pour into a pan lined with plastic wrap. Let cool at room temperature until set. Cut into squares and cover with plastic wrap and refrigerate until serving.

<http://www.grantachatz.com>

### Basic gel recipe with iota carrageenan

1-1.5 g kappa carrageenan (1-1.5%)  
100 mL milk

Disperse carrageenan in cold milk with hand held mixer. Bring to boil and pour solution into desired form/mold. Cool.

<http://www.inicon.net>

### Spherification with iota carrageenan

3 g iota carrageenan (1-1.5%)  
100 mL water (or flavored liquid)

*Setting bath*  
5 g calcium lactate  
100 mL water

Disperse carrageenan in cold water with hand held mixer. Allow to hydrate in refrigerator overnight. Drip or pour with a spoon into the calcium solution. Leave until set. Remove and rinse.

<http://www.inicon.net>

### Basic gel recipe with kappa carrageenan

1.5 g kappa carrageenan (1.5%)  
100 mL water (or flavored liquid)

Disperse carrageenan in cold water with hand held mixer. Bring to boil and pour solution into desired form/mold. Cool.

<http://www.inicon.net>

### **Spherification with kappa carrageenan**

1.5 g kappa carrageenan (1.5%)  
100 mL water (or flavored liquid)

#### *Setting bath*

5 g potassium phosphate (5%)  
100 mL

Disperse carrageenan in cold water with hand held mixer. Allow to hydrate in refrigerator over night. Drip or pour with a spoon into the potassium solution. Leave until set. Remove and rinse.

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<http://www.inicon.net>

### **Porcini amber**

5 fresh porcini  
200 g porcini stock  
3 g kappa carrageenan (1.5%)

Slice the porcini to a thickness of 0.3 cm. Mix the stock with the kappa carrageenan and bring to a boil until dissolved. Dip a porcini slice into the mixture and place on a flat tray. Repeat with the rest of the slices.

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<http://www.texturasebulli.com>

### **Celery pudding**

530 mL celery juice  
56 g skim milk powder  
1/2 t iota carrageenan  
salt to taste

Combine all ingredients in bowl and combine with immersion blender. Transfer to saucepan and heat to 82 °C. Divide mixture among eight rocks glasses and refrigerate until pudding is set. Cover and keep refrigerated until 15 minutes before serving.

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*Wylie Dufresne via Art Culinaire, Spring 2006*

Further recipes with carrageenan can be found in the section “Multi-hydrocolloid recipes” on page 62 .





# Cornstarch

## Tips and tricks

- Corn starch has about twice the thickening power of flour.

<b>Name</b>	<b>cornstarch</b>
<i>Origin</i>	polysaccharide extracted from maize/corn
<i>Properties, texture</i>	<i>thermoirreversible</i> thickener
<i>Clarity</i>	opaque
<i>Dispersion</i>	cold water
<i>Hydration (dissolution)</i>	62-72 °C
<i>pH</i>	
<i>Setting</i>	thickens when heated > 70 °C
<i>Melting</i>	
<i>Promoter</i>	
<i>Inhibitor</i>	pH around 2-3 lowers viscosity
<i>Tolerates</i>	
<i>Viscosity of solution</i>	high once fully hydrated
<i>Typical conc.</i>	[0.4-10.4%]
<i>Synergies</i>	
<i>Syneresis</i>	

### Soft meringue for pie filling

#### Cornstarch gel

10 g cornstarch (0.4-0.8% in final preparation)  
80 mL water

#### Meringue

6 egg whites  
30 mL water  
140 g sugar  
2-3 g cream of tartar

Stir cornstarch into 80 mL cold water. Heat to form a thick gel. Beat egg whites with 30 mL water and cream of tartar. Once soft peaks form, add sugar a little at a time. Then add 1-2 T of the cornstarch gel. It prevents the meringue from shrinking, beading and weeping. Use meringue for pie filling.

*Shirley O'Corrher in Cookwise*

### John Nott's wine chocolate

350 mL port wine  
60 g bittersweet chocolate, grated  
65 g sugar (or to taste)  
3.2 g cornstarch (~0.7%)

Put all the ingredients into a heavy saucepan and heat well. Bring to a boil, beating constantly. Then serve in 4 cups or mugs, that have been warmed.

<http://www.recipezaar.com/262183>

### Vanilla sauce (No-egg custard)

800 mL milk  
20 g cornstarch (~2.4%)  
25 g sugar  
10 g vanilla sugar or 5 mL vanilla essence

Mix everything while cold in a pan. Bring to boil a simmer for 2-3 min while stirring. Cool and serve.

<http://krydder.org/2007/11/23/vaniljesaus-uten-egg/>

### Grapefruit soufflés

250 mL grapefruit juice (or lemon/lime/orange)  
rind of 1/2 grapefruit, finely minced  
100 g sugar  
15 g cornstarch (~3.2%)  
30 mL water  
2 egg whites

Combine juice, 50 g sugar and rind in a small saucepan over medium-low heat. Simmer until juice is reduced to 150 mL. Strain out rind pieces. Mix starch and water together. Whisk starch mixture into hot juice and continue to whisk over low heat until juice is substantially thickened. Remove from heat and immerse pan into a cool water bath. Whisk until the juice

mixture is cold, about 3 minutes. Set aside. Whip egg whites until soft peaks form. Add 50 g sugar and continue whipping until firm peaks form. Fold egg whites into grapefruit mixture in two batches. Divide between 6 soufflé cups and bake at 180 °C for 15 min or until puffed and browned.

It is possible to bake the soufflés in the spent grapefruit halves: Use a grapefruit spoon to clean any remaining pulp and membrane from the inside of 6 grapefruit halves. Dust the inside of the pith with sugar. Fill and bake as above.

*Australian Gourmet Traveller, March 2006 via  
[http://gorgeoustown.typepad.com/lex\\_culinaria](http://gorgeoustown.typepad.com/lex_culinaria)*

### Halva balls with feta cheese and pistachio

1 kg feta cheese  
400 mL water  
80 g cornstarch (~4.2%)  
325 g sugar  
200 mL crumbled pistachios

Put the feta cheese in cold water to get soft. Then, filter very well and crumble with a fork. Dissolve the corn starch in a cup of water. Bring to boil the remaining water and the sugar. Add the corn starch with the water and let it cook over low fire for 10 minutes. After that time, add the cheese and go on cooking for 15 minutes more. While the halva is still warm, take small portions in the amount of a walnut and make balls with your hands. Sprinkle the halva balls with crumbled pistachios. Serve warm or cold.

<http://turkishanddelicious.blogspot.com>

### Cornstarch ice cream

600 mL cream, half-and-half or milk  
100 g sugar  
pinch of salt  
1 vanilla bean or 1 t vanilla extract  
30 g cornstarch (4.1%)

#### Flavorings (use one of the following)

- Substitute honey for half the sugar. Add 120 mL good jam to mixture before freezing.
- Substitute buttermilk or yogurt for half the cream or milk.
- Add 240 mL halved, pitted cherries just before freezing.
- Add 240 mL hulled, sliced strawberries, blueberries, or peeled and chopped peaches before freezing.
- 120 mL very strong coffee for 120 mL cream or milk.

- 240 mL coconut milk for 240 mL cream or milk; add 120 mL toasted dried coconut if you like.
- Add 120 mL minced mint and 120 mL chopped dark chocolate just before freezing.

Bring 500 mL of cream/milk mix, sugar, vanilla seeds/bean (if using) and salt to boil. Let it simmer for some minutes and remove from heat. In a bowl, add remaining cream/milk mix a little by little to the cornstarch while stirring to avoid formation of lumps. Add cornstarch mixture to pot and remove vanilla pod. Cook, stirring, until it starts to thicken and barely reaches a boil, about 5 minutes. Immediately reduce heat to very low and stir for 5 minutes or so until thick. Stir in vanilla extract, if using. If mixture has lumps, strain it into a bowl. Chill until cool, a couple of hours (you can skip this step if you have a machine with a built-in freezer). When cool or if there are no lumps, pour into an ice cream machine and freeze according to the manufacturer's instructions.

<http://www.nytimes.com/2007/08/01/dining/011mrex.html>

### Chocolate Cornstarch Pudding

100 g sugar  
20 g unsweetened cocoa powder  
40 g cornstarch (4.8%)  
pinch of salt  
650 mL milk  
25 g margarine or butter  
5 mL vanilla extract

In a saucepan, stir together sugar, cocoa, cornstarch and salt. Place over medium heat, and stir in milk. Bring to a boil, and cook, stirring constantly, until mixture thickens enough to coat the back of a metal spoon. Remove from heat, and stir in margarine and vanilla. Let cool briefly, and serve warm, or chill in refrigerator until serving.

*Kelly Powers via <http://allrecipes.com>*

### Pastry crème

1 vanilla bean, split and scraped  
240 mL whole milk  
120 mL heavy or whipping cream  
65 g sugar  
salt  
30 g cornstarch (5.5%)  
5 large egg yolks

Heat milk, cream and vanilla. Mix sugar, cornstarch and a pinch of salt in another pan. Pour hot milk into sugar mixture, whisking constantly. Heat until the mixture thickens. Add 60 mL of the hot mixture to the egg yolks. Then add the egg mix to the remaining milk. Heat

and stir until the custard becomes thick and smooth. The cornstarch prevents the egg yolks from curdling.

*Shirley O'Corriher*

### Liquorice candy

125 g all purpose flour  
75 g cornstarch (~7.2%)  
120 mL wheat gluten  
1 1/2 T powdered licorice root  
1 1/2 T powdered star anise  
700 g molasses

In a 2 L microwave pot, mix all dry ingredients. Mix in molasses and mix thoroughly with a plastic spoon until mixture is smooth. Place mixture in microwave oven and cook for 1.5 minutes. Stop oven and stir mixture. Repeat cook/stir cycle (8 times) for a total cooking time of 13.5 minutes in the microwave oven. Remove pot from oven. Pour liquorice on Teflon cookie sheet. While warm, press licorice to a patty about 1-1.5 cm thick. Allow to cool. Use a plastic knife to cut into strips, then roll into sticks. Sticks may be cut into bite-sized pieces with scissors.

*Ken Heintz and Peter D'Souza via <http://www.uwstout.edu/chd/rendezvous/Licorice%20Candy.htm>*

### Turkish delight

1000 mL water  
900 g sugar  
225 g cornstarch (~10.4%)  
20 mL rosewater  
10 mL lemon juice  
6.5 g cream of tartar  
red food coloring (optional)

*For coating*  
60 g cornstarch  
225 g icing sugar

Place the sugar, 250 mL water, and lemon juice in a heavy saucepan over medium heat. Stir until the sugar dissolves and the mixture boils. Reduce the heat and simmer gently, without stirring, until the mixture reaches the soft-ball stage 114 – 118 °C. Remove the saucepan from the heat.

In a second large heavy saucepan over medium heat, stir together cornstarch and the cream of tartar. Gradually stir in the remaining water until no lumps remain. Stir constantly, until the mixture boils and forms a thick, gluey paste.

Slowly pour the hot sugar syrup into the cornstarch mixture, stirring constantly. Reduce the heat and simmer, stirring often, to prevent

sticking, for about 1 hour, or until the mixture has become a pale golden color. Stir in the rosewater and add food coloring (if used).

Pour the mixture into the prepared baking tin and spread evenly. Cool to room temperature, uncovered, allow to stand overnight to set. Sift the icing sugar and a little cornflour onto a large cutting board. Turn out and cut into 2.5 cm squares with an oiled knife. Roll pieces in the icing sugar mixture to coat well.

Store in an airtight container with sheets of waxed paper, dusted with the sugar mixture, separating every layer. Makes approx.80 pieces.

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*<http://thefoody.com/sweets/turkishdelight.html>*

Further recipes with cornstarch can be found in the section “Multi-hydrocolloid recipes” on page 62.



# Gelatin

## Tips and tricks

- If using sheets, bloom gelatin in water, squeeze out water and dissolve in desired liquid. If using powder, bloom and dissolve gelatin in the same liquid.
- When making sorbets, try substituting agar, locust bean gum, pectin or gellan for gelatin.
- In ice cream addition of 0.25% gelatin inhibits crystallization of ice and sugar
- Heat stable gelatin gels and foams can be made by addition of transglutaminase which catalyses crosslinking of proteins.
- Gelatin comes with different bloom strengths (= different gelling strength). The size of sheets is normally scaled so as to compensate for this.

Name	Bloom strength	g/sheet
Bronze	125-155	3.3
Silver	160	2.5
Gold	190-220	2.0
Platinum	235-265	1.7

<b>Name</b>	<b>gelatin (E441)</b>
<i>Origin</i>	protein obtained from collagen in animals
<i>Properties, texture</i>	thermoreversible, soft, elastic gel; melts in mouth
<i>Clarity</i>	clear, transparent
<i>Dispersion</i>	bloom in cold water.
<i>Hydration (dissolution)</i>	~50 °C
<i>pH</i>	4-10
<i>Setting</i>	< 15 °C, slow (hours)
<i>Melting</i>	25-40 °C
<i>Promoter</i>	transglutaminase (1-3%), milk, sugar, low alcohol conc.
<i>Inhibitor</i>	salts; acids; prolonged heating; proteases in fresh kiwi, papaya, pineapple, peach, mango, guava, fig; high alcohol conc.; tannins can cause precipitation
<i>Tolerates</i>	alcohol up to ~40%
<i>Viscosity of solution</i>	low
<i>Typical conc.</i>	0.5-1.5% for espumas; 0.6-1.7% for gels; [0.12-7.9%]
<i>Synergies</i>	
<i>Syneresis</i>	

- The following formula (see comments in appendix) can be used for conversion between gelatin A and B with different bloom strengths

$$\text{massB} = \text{massA} \times \frac{\text{bloomstrengthA}}{\text{bloomstrengthB}}$$

- Unless otherwise stated all recipes give the amount of gelatin in grams (platinum type, 240 bloom) and sheets.
- Gelatin of unknown bloom strength is indicated with \*

### Rhubarb strawberry sorbet

250 mL water  
300 g sugar  
500 g rhubarb, peeled and sliced  
100 g strawberries  
1.7 g gelatin; 1 sheet (0.12%)  
seeds from ½ vanilla pod  
300 mL champagne

Mix water and sugar, boil and skim. Add rhubarb, strawberries and vanilla. Stir in bloomed gelatin and cool. Blend in a food processor or blender until smooth. Stir in the champagne and freeze in ice cream maker.

*Bo Jensen via <http://aftenbladet.no>*

### Key lime cloud

300 mL key lime juice  
300 mL water  
300 g sugar  
1.1 g gelatin; 2/3 sheet (0.12%)  
50 g egg white powder \*

*\* 1 egg white equals approximately 5 g egg white powder + 35 g water*

Bring 150 mL water and all sugar to a boil. Mix rest water with egg white powder to hydrate. Dissolve bloomed gelatin in syrup, cool to 45-50 °C, mix with lime juice, then rehydrated egg whites. Strain, chill to 4 °C, then mount until fluffy.

*<http://willpowder.net>*

### Cranberry ginger sorbet

450 g cranberries  
470 mL boiling water  
4.5 g gelatin; ~2½ sheets (0.25%)  
60 mL cold water  
380 g sugar  
470 mL ginger ale

Combine cranberries and boiling water. Cook for 15 minutes in a covered pan. Mash through strainer. Bloom gelatin in cold water and add to strained cranberries. Add sugar and stir until dissolved. Cool. Add ginger ale and freeze to a mushy consistency. Beat with food processor or electric mixer. Re-freeze until firm.

*<http://www.cooks.com>*

### Citrus foam

375 mL orange juice  
25 g sugar  
375 mL heavy cream  
1/2 lemon, juiced  
2.5 g gelatin; 1½ sheets (0.42%)

Combine orange juice and sugar and reduce over medium heat by half. Add the juice of half a lemon. Bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to warm juice reduction. Add juice to heavy cream and strain through a chinois. Fill 0.5 L whipper and charge 1-2 times with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

*[http://www.isinorthamerica.com/recipe/print/print\\_17.html](http://www.isinorthamerica.com/recipe/print/print_17.html)*

### Fruit espuma

250 g fruit purée (raspberry, strawberry, passion fruit, etc.)  
65 g corn syrup  
60 mL water  
1.7 g gelatin; 1 sheet (0.45%)

Pass fruit purée through a sieve or chinois to remove fruit chunks and seeds. It is very important that the purée be as smooth as possible. Combine purée, water (eliminate if you use juice) and corn syrup in a sauce pan. Over low heat, gently heat fruit mixture until warm and add your gelatin. Remove from heat and stir until gelatin is dissolved. Pour fruit purée into an 0.5 L whipper making sure not to fill it more than halfway. Charge with nitrous oxide. Chill for about 1 hour, and shake well before using.

*Ferran Adria via <http://fooddownunder.com>*

### Clear liquid by gelatin filtration

1000 mL cloudy liquid or purée  
5 g gelatin; ~3 sheets (0.5%)

Strain liquid to remove particles. Bring to simmer. Add bloomed gelatin. Let cool and freeze. Line a strainer with a cheese cloth or a coffee filter and place the strainer over a bowl. Place the frozen block in the strainer and allow 1-2 days for the clear liquid to drain out of the gelatin network.

*Adapted from Gerd Klöck*

### Mango espuma

375 g ripe mangoes  
50 g sugar  
3.4 g gelatin; 2 sheets (0.62%)  
125 mL orange juice  
(add rum to taste if desired)

Soak the gelatin in cold water. Boil diced mangoes, orange juice and sugar, purée and pass through a fine sieve. Heat 100 mL of the purée to a temperature of 60 °C and stir in the squeezed out gelatin. Add the remaining purée and allow to cool. Beat with a whisk before pouring into a 0.5 L whipper. Charge with

nitrous oxide and shake vigorously. Chill in the refrigerator for several hours. Shake the whipper vigorously upside-down before dispensing. Serve with fresh or marinated mango dices.

<http://www.espumas.com/>

### Gazpacho sorbet

4.5 g gelatin\* (~0.6 %)  
15 mL hot water  
1 garlic clove  
1/2 t salt  
450 g ripe tomatoes, cored and quartered  
1/2 large red bell pepper, coarsely chopped  
40 g coarsely chopped sweet onion  
1 piece Kirby cucumber, peeled and quartered  
30 mL Sherry vinegar  
15 mL orujo, grappa, or aquavit  
1 1/4 t sugar  
30 mL mild extra-virgin olive oil

Soften gelatin in hot water 1 minute. Mash garlic to a paste with salt using a mortar and pestle (or mince and mash with a large knife). Blend garlic paste, tomatoes, bell pepper, onion, cucumber, vinegar, orujo, and sugar in a food processor until as smooth as possible. Add oil and gelatin mixture with motor running, then force purée through a sieve into a bowl, pressing firmly on solids. Discard solids. Chill until cold, about 1 hour, then freeze in ice cream maker. Transfer sorbet to an airtight container and put in freezer to harden.

[Sergio López Domínguez via http://www.epicurious.com](http://www.epicurious.com)

### Asparagus espuma

1000 g peeled white asparagus  
8.5 g gelatin; 5 sheets (0.6% of final comp.)  
salt  
sugar  
1 lemon  
100 mL heavy cream (33%)

Boil the asparagus in salt water with the sugar and a slice of lemon until done. Purée the asparagus with 300 mL of asparagus juices in a mixer, and pass through a fine sieve. Season to taste. Soak gelatin in cold water. Heat 100 mL of the asparagus purée to a temperature of 60 °C, stir in the pressed out gelatin, then add in the remaining mixture. Allow to cool thoroughly and stir in the cream. Pour into the 1 L whipper, charge with nitrous oxide, shake and leave to cool in fridge. The resulting consistency is firm and creamy.

Tip: To make a green asparagus Espuma, simply replace some of the white asparagus with blanched and puréed spinach.

[iSi North America via http://www.prairiemoon.biz](http://www.prairiemoon.biz)

### Cold coffee espuma

325 mL cold espresso  
125 mL heavy cream (33% fat)  
75 g sugar  
3.4-4.3 g gelatin; 2-2½ sheets (~ 0.65-0.82%)

Soak gelatin sheets in cold water until soft. Heat 100 mL of espresso to 60 °C and remove from heat. Dissolve sugar. Squeeze water from gelatin sheets well, add to hot espresso and stir to dissolve. Add remaining cold espresso and set aside to cool slightly. Before gelatin sets, add cream, then stir. Pour mixture into 0.5 L whipper, charge with nitrous oxide and shake well. Chill for several hours before dispensing. Keep refrigerated.

[Ferran Adria via http://www.movable-feast.com/2006/09/espesso.html](http://www.movable-feast.com/2006/09/espesso.html)

### Saffron foam

440 mL heavy cream  
60 mL whole milk  
2 t saffron threads  
170 mL white wine  
3.4 g gelatin; 2 sheets (0.75%)  
salt  
white pepper

Combine the white wine and saffron in a small sauce pot and simmer over medium heat until liquid is reduced to 60 mL. Add the heavy cream and milk and gently bring to a simmer. Meanwhile, bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to the cream mixture. Season with salt and white pepper and strain through a chinois. Chill to room temperature and fill 0.5 L whipper. Charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

<http://www.isinorthamerica.com>

### Cheese cake with lemon

225 g digestive crackers  
125 g butter  
10 g gelatin; 6 sheets (~0.8% of cream mix)  
220 mL water  
30 mL lemon juice  
lemon zest  
110 g sugar  
125 g powdered sugar  
225 g cream cheese  
vanilla pod  
250 mL sour cream

250 mL heavy cream (38% fat)

Crumble crackers and mix with melted butter. Spread in a spring form (24 cm diameter). Add bloomed gelatin to boiled water, sugar and lemon juice. Set aside to cool. Mix cream cheese, powdered sugar and sour cream with seed from vanilla pod and lemon zest. Whip cream and fold into cream cheese mix. Once gelatin mix has cooled, but before it sets, fold it into the cream mix. Pour into spring form and cool before serving.

*Adapted from Andreas Viestad*

### Cucumber yoghurt espuma

500 g salad cucumbers  
500 g yoghurt (3.5% fat)  
8.5 g gelatin; 5 sheets (0.85%)  
dill  
garlic  
salt  
white pepper

Wash the cucumbers and cut them into pieces without peeling them. Combine cucumber pieces, yoghurt and spices, purée in a blender and strain through a fine sieve. Soak gelatin in cold water. Place the squeezed out sheets into a saucepan with a little bit of the mixture and, constantly stirring, dissolve the gelatin. Next, add the cucumber blend to the gelatin, pass through a fine sieve and pour this mixture into the 1 L whipper. Charge with nitrous oxide and shake. Chill in the refrigerator for several hours. Shake the whipper vigorously upside-down before dispensing.

<http://www.espumas.com/>

### Raspberry espuma

900 g raspberries  
110 g sugar (add to taste)  
8.5 g gelatin; 5 sheets (0.85%)  
(raspberry brandy)

Soak the gelatin in cold water. Boil raspberries with sugar, purée and pass through a fine sieve. Heat 200 mL of the raspberry purée to 60 °C and stir in the pressed out gelatin. Add the remaining purée and leave to cool. Beat with a whisk before pouring into a 1 L whipper and charge with nitrous oxide.

*iSi North America via <http://www.prairiemoon.biz>*

### Carbonated yuzu jelly

300 g water  
25 g yuzu juice  
50 g sugar  
3.4 g gelatin; 2 sheets (0.9%)

Place water, yuzu and sugar in a heavy duty saucepan and bring to boil. Add bloomed gelatin to the hot mixture. Place in whipper and charge twice with carbon dioxide. Release a small amount of the carbon dioxide and place in the fridge overnight. Screw off the top the next morning and play (careful – it might be a good idea to release some more pressure before unscrewing the top!).

*Ian Kleinman via <http://food102.blogspot.com>*

### Panna cotta

600 mL heavy cream (~38% fat)  
1 vanilla pod  
45 g sugar  
6.8 g gelatin; 4 sheets (~1%)

#### Flavoring

grated zest from 1 lemon or lime  
or  
100 g blue veined cheese  
walnuts for serving

Split vanilla pod, scrape out seeds and simmer with cream, sugar and zest for 3-5 min. Add bloomed gelatin to cream mixture, pour into desired molds or cups and cool in refrigerator for at least 4 hours. Serve with lime marinated strawberries or other fruit if desired.

<http://www.tine.no>

### Cold sauce with green cardamom

1000 mL water  
50 g glucose  
12 capsules of cardamom  
3-4 cm fresh ginger, peeled and minced  
zest of 1 lime

#### For thickening use one of the following

4 g agar (0.38%)  
20 g pectin (1.9%)  
10 g gelatin\* (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

<http://www.chefsimon.com>

### unBloody Mary (gelatin filtration)

1000 g ripe tomatoes  
lemon juice, to taste  
3 stalks celery  
120 mL water  
jalapeno hot sauce, to taste  
120 mL lovage leaves



salt and pepper  
2 scallions  
dash Worcestershire sauce  
gelatin\* (~1%)

Pass vegetables and herbs through a juicer or liquefy in a blender with the water. Add remaining ingredients, adjust seasoning to taste. Strain through a sieve, measure the volume and transfer to a saucepan. Add 2 t powdered gelatin (~10 g) for each liter by sprinkling it over the surface. Let stand for 5 minutes, then whisk it in over medium high heat until base just begins to simmer and gelatin has completely melted. Remove from heat, let cool and transfer to a bowl and place in freezer overnight or until frozen solid. The next day, line a colander with cheesecloth, pop out the frozen base and place it in the prepared colander, set over a large bowl and transfer to the refrigerator to drain for 24 to 48 hours. When it appears that the base has fully drained, remove colander and discard the solids. When ready to serve, add 1 part vodka to 2 parts of clarified base.

<http://www.playingwithfireandwater.com>

### Watermelon foam

500 mL watermelon juice  
5 g gelatin; 3 sheets (1.0%)

Heat half of the watermelon juice. Dissolve the gelatin sheets in the hot watermelon juice. Add the rest of the juice. Strain the juice and transfer to a 0.5 L whipper. Charge the whipper with nitrous oxide and refrigerate until chilled.

*José Andrés*

### Red beet foam

1800 g red beets  
250 mL heavy cream  
4.3 g gelatin; 2½ sheets (1.0% of final prep.)  
salt  
white pepper

Peel and juice the beets. This yields approx. 1 L of juice. Reduce beet juice to 180 mL over medium heat. Bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to the warm beet juice. Gently heat heavy cream until tepid. Combine cream and beet reduction. Season with salt and white pepper then strain through a chinois. Chill to room temperature, fill 0.5 L whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

[http://www.isinorthamerica.com/recipe/print/print\\_23.html](http://www.isinorthamerica.com/recipe/print/print_23.html)

### Piña colada espuma

600 mL pineapple juice  
350 mL coconut milk  
50 mL brown rum

10 g gelatin; 6 sheets (1.0%)

or

1 g xanthan (0.1%)

Bloom gelatin. Heat a little of the pineapple juice and dissolve gelatin. Add remaining liquids. If using xanthan, it can be added directly to the liquids using a blender or immersion blender. Strain liquid, transfer to whipper and charge with nitrous oxide. Leave in fridge for some hours before serving. Serving tip: top pineapple juice with piña colada espuma.

*From Fizz magazine via <http://www.cuisine-concept.de>*

### Stabilization of whipped cream

500 mL heavy cream  
5 g gelatin, powdered (1%)  
15 mL water

Bloom gelatin in water. Heat carefully to dissolve. Add to cream and whip.

<http://www.baking911.com>

### Orange and grapefruit consommé

14 g gelatin, powdered (~1%)  
30 mL water  
200 mL unsweetened orange juice  
450 mL unsweetened grapefruit juice  
2 grapefruits, peeled and cut into segments  
few drops of Angostura bitters  
mint leaves

Bloom gelatin in 30 mL cold water. Heat carefully until gelatin is dissolved. Mix fruit juices in a bowl. Add gelatin solution, grapefruit (save some segments for garnish) and Angostura bitters and stir. Chill for 2 hours, until the consommé is very lightly gelled. Serve in soup plates, garnished with grapefruit segments and mint leaves.

<http://www.cookitsimply.com/recipe-0010-03229t.html>

### Salmon mousse

200 g cooked salmon, chopped  
150 g smoked salmon, chopped  
100 mL water  
200 mL sour cream  
½ onion, chopped  
½ lemon, juiced  
1 t ground pink pepper  
3 T dill, chopped  
6.8-8.5 g gelatin; 4-5 sheets (1-1.2%)

Bring water to boil, add bloomed gelatin and stir to dissolve. Mix in remaining ingredients. Pour into pan and leave to set in refrigerator for at least 4 hours.

<http://www.matoppskrift.no/sider/oppskrift8191.asp>

### Filled mozzarella balloons

6 g gelatin; 3.5 sheets (1.2%), bloomed  
500 g tomato water  
1000 g water  
250 g salt  
250 g mozzarella curd

Bring tomato water to simmer. Remove from heat and stir in squeezed gelatin sheets until dissolved. Strain through chinois and transfer to whipper and charge with nitrous oxide. Chill whipper in ice water, shaking frequently.

Heat water and salt to 71 °C, add mozzarella curd and heat for about 5 min or until soft. Tear small pieces (about 15 g) from curd, knead and stretch until elastic. Cover tip of whipper and gently inflate mozzarella balloon with tomato foam. Twist ends together to close the balloon. Transfer balloon to paper towel to dry.

*Grant Achatz in Alinea*

### Bavarian cream

3 eggs  
70 g sugar  
300 mL heavy cream (~38% fat)  
10 g gelatin; 6 sheets (1.3-1.6%)  
50 mL water  
flavoring (see below)

Whisk eggs and sugar to eggnog. Whip cream and add eggnog. Bring water to boil and pour over bloomed gelatin. Mix gelatin solution with desired flavoring (see below). Carefully mix flavoring with the cream mix. Cool in refrigerator for a couple of hours to set.

Suggested flavorings:

juice and peel from 1 orange or lemon  
100 g canned pineapple  
200 mL jam or marmalade  
200 mL fresh berries stirred with sugar  
50 mL sherry  
50 g grated or melted chocolate

<http://www.tine.no>

### 90 years of aviation

*Violette caviar*  
120 mL violette  
60 mL lemon juice  
60 mL Parfait Amour  
3.4 g gelatin; 2 sheets (1.4%)

### Drink

75 mL gin  
15 mL maraschino liqueur  
15 mL lemon juice

For violette caviar: Place all into a sauce pan and warm until gelatin is dissolved. Place into a squeeze bottle. Refrigerate until a thick sauce-like texture. Slowly drip violette sauce into a tall container of almost frozen canola oil. Strain from canola oil and rinse oil off the caviar with cold water.

For drink: Shake and strain into a cocktail glass. Serve along-side violette caviar

*Jamie Boudreau via <http://smallscreennetwork.com>*

### Sweet lemon foam

200 g squeezed lemon juice  
5 g gelatin; 3 sheets (1.6%)  
5 g honey  
100 g sugar

Bloom and melt the gelatin in the lemon juice by gentle heating. Add honey and sugar and stir to dissolve. While still warm whisk the solution at full speed. Cool the mixture by putting the bowl in ice water to let the gelatin foam set.

<http://www.inicon.net>

### Olive oil gummy bears

25 g glucose  
2.5 vanilla pods  
80 g caster sugar  
8.5 g gelatin; 5 sheets (1.6%)  
100 mL water  
100 g isomalt  
200 mL olive oil (use best quality available)  
5 g citric acid

Bloom gelatin. Heat water, sugar, glucose and isomalt to 90 °C, stirring continuously till all has dissolved. Mix in olive oil using blender or immersion blender. Stir in seeds from vanilla pods and gelatin (squeeze out water first). Pour into mold or tray and leave to set in fridge. Cut in pieces and cover with caster sugar and citric acid.

*Paco Roncero via <http://www.chefkoch.de>*

### Fruit jelly

1000 mL clear fruit juice, sweetened  
17 g gelatin; 10 sheets (1.7%)

Bloom gelatin in 300 mL juice. Bring remaining juice to boil. Add bloomed gelatin and juice and stir to dissolve gelatin. Leave to set in

refrigerator for at least 4 hours, preferably over night.

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### Olive caviar

jar of black olives  
4.3 g gelatin; 2½ sheets (1.8% of final prep.)

Open and wash a jar of black olives. Purée olives. Push olive purée through a chinois to make olive water. Take 240 mL of olive “water” and place in a pot on medium heat. Add bloomed gelatin and stir to dissolve. Immediately remove from heat and refrigerate. Place mixture into a squeeze bottle. Place a container of vegetable oil in a freezer until almost frozen. Squeeze droplets of olive mixture from the squeeze bottle into the almost frozen oil. When enough “caviar” is made, strain out of oil and rinse off with water.

*Jamie Boudreau via <http://spiritsandcocktails.wordpress.com>*

### Red wine jelly

500 mL red wine  
35 g sugar  
10 g gelatin; 6 sheets (1.8%)  
1 whole star anise

Let 200 mL wine, sugar and anise simmer for 5-10 min. Add bloomed gelatin. Add remaining wine and divide between 6 wine glasses. Leave in refrigerator for at least 4 hours to set. Serve with whipped heavy cream and garnish with a star anise.

*Adapted from <http://www.saveur.com>*

### Frozen champagne

280 g champagne  
200 g elderberry syrup  
100 g mineral water  
20 g orange juice  
20 g lemon juice  
14 g gelatin; 8 sheets (2%)  
60 g egg white

Bloom gelatin in orange juice and heat carefully until it dissolves. Add remaining ingredients, finishing off with the egg white. Add to whipper and use 2 nitrous oxide chargers. Cool for at least 2 hours. Dispense into liquid nitrogen and serve immediately.

*Henrik Schellhoss via <http://kochmuetzen.net/koch-blog-16-161-488.de.html>*

### Heat stable gelatin gel and foam

flavored water base  
gelatin 2-3%  
transglutaminase 0.35-0.7%

Bloom gelatin and dissolve in water base. Cool. Add transglutaminase and leave to set for gel. For foam, pour mix into siphon before it sets, charge with nitrous oxide and leave in fridge over night. Dispense. Vary concentrations according to desired texture and stability.

*Jorge Ruiz*

### Marshmallows

400 g sugar  
240 g corn syrup  
60 mL water  
21 g gelatin (2.5%), 225 bloom  
120 mL water  
1.5 g salt  
15 mL vanilla extract

Bloom gelatin with 120 mL water. Boil sugar, corn syrup and water until 120 °C. Add slowly to gelatin solution while mixing. Add salt. Turn up speed and whip until marshmallow has fluffed up. Add vanilla extract. Cool in greased pan for 3 hours. Cut and powder with sugar/starch.

*Michael Chu/Thomas Keller,  
<http://www.cookingforengineers.com/recipe/106/Marshmallows>*

### Fruit marshmallows

65 g water  
200 g sugar  
10 g gelatin; 6 sheets (2.9%)  
65 g fruit purée (mango, strawberry etc.)

Bring water and sugar to boil while stirring. Remove from heat when temperature reaches 110-115 °C. Add bloomed gelatin sheets and mashed bananas. Whip for 10 minutes (much longer than you think!). Grease a pan, sprinkle with powdered sugar and spread mixture in pan. When set, invert pan on a surface dusted with plenty of powdered sugar and starch. Cut up in desired pieces and coat every cut surface with powdered sugar and starch.

*Martin Lersch*

### Grape sponge

12 g gelatin; 7 sheets (3.1%), bloomed  
375 g grape juice

Heat 100 g grape juice and whisk in bloomed gelatin until dissolved. Transfer to a metal bowl set over ice water. Add remaining grape juice and whisk vigorously until ribbons begin to form. Transfer to stand mixer with whisk attachment and whip on high speed until stiff peaks form. Use plastic pastry bag and dispense into molds lined with nonstick cooking spray. Freeze for 1 hour if desired.

*Grant Achatz in Alinea*

## Jellied gin and tonic

### *Lime slices*

1 lime  
60 g simple syrup  
1 t citric acid

### *Sugar-soda-acid mixture*

1/4 t bicarbonate of soda  
1/4 t confectioner's sugar  
1/4 t citric acid

### *Jellied gin and tonic*

2.5 g gelatin; 1½ sheets (3.3%)  
25 mL gin  
50 mL tonic water

Freeze lime and cut into chips with deli slicer.  
Coat slices in simple syrup and citric acid.  
Bake at 65 °C until crisp.

Mix bicarbonate of soda, sugar, and citric acid.

Soften sheet gelatin in cold water for two minutes. Warm gin and add gelatin and tonic water. Pour into a shallow baking pan lined with plastic wrap and refrigerate for two hours. Cut into 1.5 cm cubes. Put cube onto lime chip, sprinkle on sugar-soda-acid mixture (the acid combines with the baking soda for a carbonated feeling on the tongue), and serve.

*Eben Freeman via <http://www.wired.com>*

## Wine gum

### *Base*

50 mL cold water  
100 g sugar  
70 g glucose  
3 T gelatin\* powder (approx. 14 g, 5.6%)  
50 mL boiling water  
A heavy-duty plastic icing bag

### *Pineapple wine gums*

1/4 tsp. citric acid  
0.5 ml yellow coloring  
1.5 ml pineapple essence

### *Cola wine gums*

1/4 tsp. citric acid  
1 ml red coloring  
1.25 ml cola essence

### *Strawberry wine gums*

1/4 tsp. citric acid  
1 ml red coloring  
1.25 ml strawberry essence

### *Salt liquorice wine gums*

2 ml black coloring  
1 t ammonium chloride (sal ammoniac)  
5 ml liquorice flavoring

## 0.5 anise oil

Mix cold water, sugar and glucose in a pan. Using a candy thermometer, heat until 145-150 °C depending on desired firmness. Cool. At 110 °C, remove thermometer and add gelatin, bloomed in 50 mL water and brought to boil. Add coloring and flavoring. Blend thoroughly into the mixture, but do not whip because the coloring will become murky.

Place icing bag in a measuring cup or bowl and pour wine gum mixture the bag and tie a knot at the top. Avoid burns by holding the bag with a clean cloth. Cut a very small hole in the tip of the icing bag. Squeeze mixture onto an oiled cake pan or a silpat, little by little. After 10 to 12 hours the dried wine gums can be removed slowly and carefully.

The mixture can also be poured directly from the pot onto a sheet of baking paper to form one large wine gum. When the mixture has dried and can be removed from the baking paper, it can be cut into various shapes and sizes.

Dip the wine gums in sugar or glucose to prevent them from sticking together, or let them dry uncovered for 8-10 days. They will remain edible for around one month.

*Helle Beisheim via <http://www.pingvin.com>*

## Wine gum

125 mL water  
200 g sugar  
250 g glucose  
50 g gelatin\* (7.9%)  
1.5 g citric acid  
1.5 mL strawberry essence  
1 mL red food coloring (20 drops)  
vegetable oil for greasing

Bloom gelatin in 75 mL of water and heat while stirring on a bain marie til gelatin dissolves. Keep gelatin warm to prevent it from setting. In a 2 L pan bring 50 mL water, 200 g sugar, 250 g glucose to 135 °C. Cool to 100 °C. Add citric acid, gelatin solution, flavor and color. Mix. Scum of foam. When cooled to 70 °C, pour into greased molds or onto a silpat (0.5-1 cm thick). Dust with powdered sugar or glucose. After 30 min the gum can be cut or shaped.

*<http://www.urtegaarden.dk>*

## Kientzheim butter foam

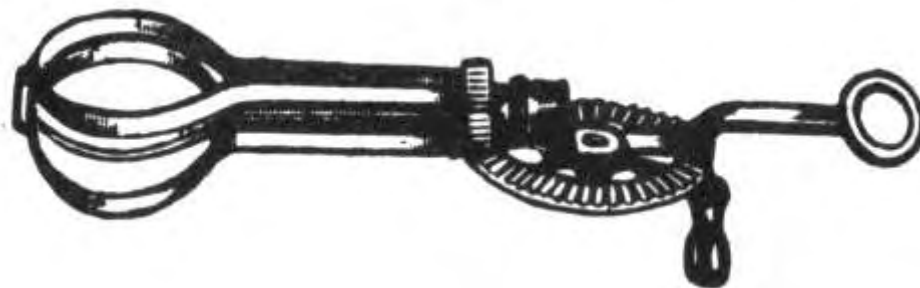
20 g water  
4 g gelatin  
clarified butter  
pinch of salt

Bloom and dissolve gelatin in water. Add a pinch of salt. Start whisking and add clarified butter slowly. Whisking on an an ice bath promotes setting of the foam. If desired 20 g egg white can be substituted for the water and gelatin.

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*Hervé This via <http://nicon.net>*

Further recipes with gelatin can be found in the section “Multi-hydrocolloid recipes” on page 62.



# Gellan

## Tips and tricks

- Presence of sodium and in particular calcium inhibits proper hydration. Addition of a sequestrant such as sodium citrate binds calcium and helps hydration.

Name	<i><b>gellan (E418) low acyl (LA)</b></i>	<i><b>gellan (E418) high acyl (HA)</b></i>
Origin	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>
Properties, texture	<i>thermoirreversible</i> , hard, brittle gel; sodium/potassium ions give thermoreversible gels	thermoreversible, soft, elastic gel; thickener if not heated
Clarity	transparent	opaque
Dispersion	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.
Hydration (dissolution)	90-95 °C; keep pH > 3.9; add sugar after hydration; inhibited in presence of sodium and calcium, but 0.1-0.3% sodium citrate helps	85-95 °C; can be hydrated at pH < 4; less sensitive to ions; add sugar after hydration
pH	4-10	3-10
Setting	10-60 °C, rapid (minutes)	70-80 °C
Melting	does not melt	70-80 °C
Promoter	gelling promoted by calcium, magnesium, sodium, potassium and acids	gelling is not sensitive to ions
Inhibitor	will not hydrate at pH < 3.9 or with sodium/calcium salts present	
Tolerates		salts, acidic foods
Viscosity of solution	low	high
Typical conc.	0.4-0.7% for gels (self supporting from 0.05%); [0.03-2.6%]	0.4-0.7% for gels (self supporting from 0.2%); [0.03-2.6%]
Synergies		
Syneresis	no (if left untouched)	no

## Fluid gel for beverages

### Part 1

112 g sucrose  
0.60 g tri sodium citrate dihydrate  
0.28 g low acyl gellan (0.027% in final prep.)  
0.20 g sodium benzoate  
862 g deionized water

### Part 2

5.00 g citric acid  
0.25 g calcium lactate (0.025% in final prep.)  
15 g deionized water

Blend sucrose, tri sodium citrate dihydrate, gellan and sodium benzoate and disperse in the deionized water of Part 1. Heat the dispersion to 70–80 °C. Dissolve the citric acid and calcium lactate in the deionized water of Part 2 and add to the hot gum solution. Cool to below 15 °C undisturbed. Gently agitate the sample to form a fluid gel.

*CRC Handbook of hydrocolloids*

## Pulp suspension beverage (fluid gel)

338 g water  
100 g fruit juice  
60 g sugar  
0.25 high acyl gellan (0.05%)  
0.25 g tri sodium citrate dihydrate  
0.9 g citric acid anhydrous  
0.5 g potassium citrate

Blend gellan with tri sodium citrate dihydrate and disperse in the water. Heat the dispersion to 90 °C to hydrate the gum. At 90 °C add the remaining dry ingredients and the fruit juice. Cool to room temperature whilst mixing to form the fluid gel.

*CRC Handbook of hydrocolloids*

## Banana-cocoa raviolis

### Banana-cocoa ravioli base

800 g sugar  
480 g glucose  
120 g chocolate powder  
600 g water

### Raviolis

1 kg banana purée  
237 g base  
137 g water  
1.5 g low acyl gellan (0.11%)

Banana-cocoa ravioli base: Take the sugar and glucose to a medium caramel and slowly whisk in the water and chocolate. Cool.

Raviolis: Freeze banana purée into tubes and cut into 1 inch-slices. Bring ravioli base with water to a boil and add the gellan. Cool to

40 °C and quickly dip the frozen banana slices. Allow to thaw.

*Sam Mason via <http://www.star chefs.com>*

## Bake-stable fruit preparation

210 g apples  
160.8 g sucrose  
8 g modified waxy maize starch (THERMFLO)  
0.32 g low acyl gellan (0.08%)  
0.8 g citric acid solution (50% w/w)  
0.88 g tri sodium citrate dihydrate

Pre-blend the dry ingredients, add to the apple and heat with stirring to boiling. Remove from heat, add the citric acid solution, mix well and deposit. Leave to gel before use. Shear, and use as required.

*CRC Handbook of hydrocolloids*

## Fruit juice jelly

250 g water  
250 g fruit juice  
90 g sugar  
2.4 g citric acid, anhydrous  
1.8 g tri sodium citrate dihydrate  
0.9 g low acyl gellan (0.15%)

Pre-blend all the dry ingredients. Heat the water to boiling and dissolve the dry ingredients in the hot water. Add the fruit juice, mix and chill. The gel sets at approximately 40–45 °C and the use of chilled fruit juice with dry-mix desserts ensures a rapid set.

*CRC Handbook of hydrocolloids*

## Reduced sugar jam using HA/LA blend

450 g frozen strawberries  
283.5 g sugar  
260 g water  
2.5 g gellan\* (0.25%)  
0.5 g tri sodium citrate dihydrate  
1 g potassium sorbate  
2.5 g citric acid solution (50% w/w)

*\* Mix high acyl (HA) and low acyl (LA) gellan for desired texture. HA gives a soft and spreadable jam. LA gives a firmer texture.*

Dry blend the gellan gum, tri sodium citrate dihydrate and potassium sorbate with the sugar and disperse into the water. Add the fruit and heat to boiling. Cook for 1–2 minutes to ensure hydration of the gellan gum. Check the soluble solids. Remove from the heat and add the citric acid solution. Fill into jars and cap immediately.

*CRC Handbook of hydrocolloids*

### Apple purée gel

#### *Apple purée*

20 apples, cored, peeled and chopped  
130 g sugar  
1 vanilla bean  
750 mL white wine

#### *Apple purée gel*

810 g apple purée  
203 g water, cold  
203 g white wine, cold  
2.6 g high acyl gellan (0.21%)  
1.9 g low acyl gellan (0.16%)  
1 g maltodextrin (0.08%)

In large sauté pan, cook apples with sugar, vanilla bean, and white wine over medium heat until liquid becomes syrupy. Discard vanilla bean, then purée apples until smooth. Heat apple purée in a pot until warm.

Blend water and wine with high and low acyl gellan and maltodextrin for 2 minutes with hand held electric blender. Heat in sauce pot until it is thick then becomes loose again. Working quickly, add wine mixture to apple purée and mix well using hand held blender then pour into a plastic container lined with plastic wrap, pressing wrap down over top. Chill for one hour and cut into desired shapes. Warm in an oven or microwave, sprinkle top with sugar then caramelize using torch.

*Sam Mason via <http://www.starchefs.com>*

### Almond fluid gel

800 g skimmed milk  
300 g roast almonds  
3 bay leaves  
30 drops almond essence  
18 g sugar  
7.5 g salt  
5 g gellan gum (0.44%)

Heat all ingredients except the gellan gum and roughly blend with the hand blender. Leave to infuse for 10 minutes. Pass through a fine mesh sieve, discarding the almond, and then return to the boil. Using a hand blender, blitz in the gellan gum until dissolved and remove from heat. Place in fridge and blend repeatedly whilst cooling until smooth.

*Heston Blumenthal via <http://www.nespresso.com>*

### Onion purée

onions  
low acyl gellan 0.45%

*<http://seanbrock.wordpress.com/2008/01/07/onion-purée/>*

### Amaretto jelly

3 g gellan gum (0.46%)  
150 g water  
300 g Amaretto  
200 g sugar

Hydrate the gellan gum in the water. In a small pan heat the amaretto and sugar. Combine both mixtures and cool. Pour into a half sheet pan and allow to set. Cut into cubes.

*Tom Wellings via <http://www.starchefs.com>*

### Spherification with gellan

1 g gellan (0.5%)  
200 mL water (or flavored liquid)

#### *Setting bath*

2 g calcium lactate  
100 mL water

Disperse gellan in water with hand held mixer. Allow to hydrate in refrigerator over night. Drip or pour into the calcium solution. Leave until set. Remove and rinse.

*<http://www.inicon.net>*

### Pomegranate and vodka fluid gel

1 g low acyl gellan (0.5%)  
100 g pomegranate juice  
100 g vodka

Heat pomegranate juice to 65 °C. Add gellan, blitz with immersion blender. Continue mixing by hand until cool and partially set. Add vodka and blitz with immersion blender.

*Larry at <http://chiantiblue.blogspot.com>*

### Mint gel

250 g water  
50 g glucose  
200 g sugar  
2.5 g low acyl gellan (0.5%)  
1 g peppermint oil

In a saucepan, combine all ingredients and blend for 1 min with immersion blender. Bring to a rolling boil over high heat. Remove from heat, pour into desired mold or shape and leave to set in fridge for 2 h or until set. Serve as is or chop gel into irregular shards.

*Grant Achatz in [Alinea](#)*

### Warm tomato jelly

735 g tomatoes, oven roasted  
18 g clear agave nectar  
5 g fresh basil  
1.5 g crushed black pepper  
2 g sea salt



low acyl gellan 0.7%

Purée and strain the mixture and add gellan. Mix with a hand blender, bring it to a boil for 1 minute, pour and allow to set. The gel will set while still warm. At this point, purée the gel in a blender.

<http://chadzilla.typepad.com/chadzilla/2008/01/you-gellan.html>

### Raisin gel

500 g raisins  
500 g water  
1 g sodium citrate (0.2%)  
0.75 g high acyl gellan (0.15%)  
3 g low acyl gellan (0.6%)

Bring water to boil and pour over raisins. Leave to steep over night. Drain through chinois. Transfer raisins to blender and blend for 3 min or until smooth. Pass through chinois. In a small saucepan, bring 500 g raisin purée to a boil. Transfer to a blender, and with the blender running at high speed add sodium citrate, high acyl gellan and low acyl gellan. Blend for another minute. Pour onto flat tray to form a layer 3 mm thick. Let cool until set. Cut into small squares and serve.

*Grant Achatz in Alinea*

### Carrot lolly

100 g carrot juice  
10 g icing sugar  
10 g maltodextrin  
1 g gellan gum (0.83%)  
orange zest as needed

Preheat the oven to 100 °C. Blend all the above ingredients and bring to the boil, continue to boil for 2 minutes. Pour into a container and cool over ice rapidly. Once this mixture has cooled it will have a hard consistency, which is then blended into a smooth paste. Cut out of cardboard an oblong template 2 cm x 3 cm. Line a baking sheet with a non-stick mat. Using the template, spread the mix over the sheet. Sprinkle some grated orange zest over the lollies. Place a toothpick or lolly stick into the mix half way up the tuile and half sticking out of the mix. Bake in the preheated oven for 2.5 hours.

*Heston Blumenthal via <http://www.nespresso.com>*

### Jelly sweets

159 g sucrose  
159 g glucose syrup (42DE)  
120 g water  
5 g citric acid anhydrous  
5 g tri sodium citrate dihydrate  
3.75 g low acyl gellan gum (0.83%)

0.2 g calcium hydrogen orthophosphate  
flavor and color as required

Blend gellan gum and calcium hydrogen orthophosphate with 1 g of tri sodium citrate dihydrate and 40 g of sucrose and disperse in the water. Heat to boiling to hydrate the gellan gum then add the remainder of the sugar while continuing to boil. Add pre-warmed glucose syrup while maintaining the temperature above 90 °C. Cook the liquor to 80–82% total solids then cool to 90 °C. Dissolve the citric acid and remainder of the tri sodium citrate dihydrate, color and flavor in 20 mL of water and stir into the liquor. Deposit at 76–78% total solids into starch molds. Stove to final solids as required.

*CRC Handbook of hydrocolloids*

### Maple gel

50 g maple syrup  
250 g cold water  
3 g gellan (1.0%)

Hydrate the gellan in cold water. Boil the maple syrup. Blend together and chill.

*Sam Mason*

### Olive oil gelatin

350 g water  
6 g gellan (1.2%)  
1.5 g mono-/diglycerides (0.3%)  
150 g extra virgin olive oil  
2 g salt

Disperse gellan in water and bring to boil. Add emulsifier (one recipe actually omits this), olive oil and while mixing vigorously at 90 °C. Pour into flat tray and allow to gel. Cut into desired pieces.

*Nova Kuirejo via <http://www.gourmantis.de>*

### Bourbon whiskey gel

600 g bourbon whiskey  
7 g gellan (1.2%), *Kelcogel JJ*

*Note: Kelcogel JJ is a blend of low acyl and high acyl gellan*

In a saucepan, disperse gellan into whiskey with immersion blender. Bring to simmer and remove from heat. Pour into shallow pan and leave to set at room temperature. Cut into desired shape for serving.

*Grant Achatz in Alinea*

### Apple noodles

95 g green apple juice  
5 g glucose

1.2 g low acyl gellan (1.2%)

Juice about 4 green apples. Let the mixture set for 5 minutes. Scrape off all of the brown solids from the top. Weigh out the Apple juice and place the gellan on top. Blend with a hand mixer. Place in a saucepan with the glucose. Heat the mixture until it boils for 1 minute. Take a large syringe and fill it with the Apple mixture. Place a plastic tubing on the end and push the juice through. Place in ice cold water for 1 minute. Push the noodle through using the syringe.

---

*Ian Kleinman via <http://food102.blogspot.com>*

### **Hot potatoe ice cubes**

200 g mealy potatoes  
600 g water  
salt  
pepper  
6 g gellan (1.6% in final prep.)

Boil peeled potatoes in water until soft. Measure out 375 g of the water, add salt and pepper to taste and mix in gellan. Pour into ice cube tray and leave to set. Heat in pan with butter and vegetable stock before serving.

---

*Rolf Caviezel in Molekulare Küche*

### **Saffron tagliatelle**

250 g unsalted consommé  
10 saffron threads  
4.8 g gellan (1.9%)

Combine the three ingredients and bring to a boil. Allow to gel in a flat tray. Cut into 0.5 mm thick strips to make tagliatelle.

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*<http://www.texturasebulli.com>*

### **Consommé macaroni**

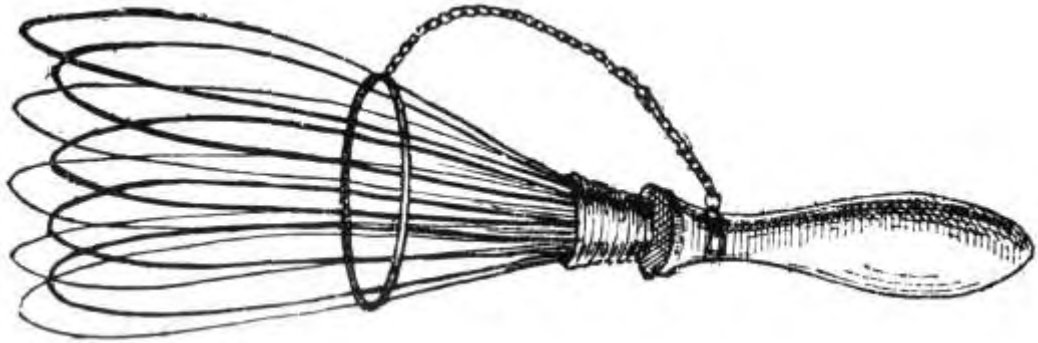
250 g beef and chicken stock  
6.5 g gellan (2.6%)

Mix gellan with stock and blend. Bring to a boil and transfer to a container. Allow to gel and slice with a mandolin into 0.15 cm thick rectangles. Roll each rectangle with the help of a pvc-rod (0.3 cm in diameter) to make macaroni.

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*<http://www.texturasebulli.com>*

Further recipes with gellan can be found in the section “Multi-hydrocolloid recipes” on page 62.



# Guar gum

## Tips and tricks

- In many recipes guar gum can be used interchangeably with xanthan gum
- Guar has a high water binding capacity (4 times greater than that of locust bean gum)
- Guar gum is often used together with xanthan in gluten free recipes to improve elasticity of doughs (see recipe for gluten free flour in the section "Multi-hydrocolloid recipes")
- Guar gum has almost 8 times the thickening power of corn starch and about 16 times the thickening power of flour.

Name	<i>guar gum (E412)</i>
Origin	polysaccharide extracted from the seeds of the legume <i>Cyamopsis tetragonolobus</i>
Properties, texture	very stable, quick acting thickener, suitable for suspending particles
Clarity	transparent
Dispersion	cold water, d. is improved by mixing with sugar (3-5x) or small amounts of alcohol
Hydration (dissolution)	cold or hot water
pH	4-10
Setting	
Melting	
Promoter	
Inhibitor	low pH
Tolerates	salt and sugar
Viscosity of solution	high in cold low in hot
Typical conc.	0.2-0.5% (very sticky solutions above 1%)
Synergies	locust bean gum, xanthan
Syneresis	

### Tonka bean ice cream

230 g invert sugar (trimoline)  
230 g sucranant (evaporated cane sugar)  
1200 mL cream  
1200 mL milk  
1 tonka bean  
8 g guar gum (0.28%)

Over medium heat, dissolve the sugars in the milk and cream. Add the tonka bean, bring to a boil, and reduce the heat. Add the guar gum to the mixture and blend with an immersion blender. Chill the ice cream overnight and spin for service with a Pacojet.

*Elizabeth Falkner via <http://www.star chefs.com>*

### Applewood ice cream

200 g apple-wood sawdust  
1000 g whole milk  
100 g heavy cream  
75 g sugar  
50 g egg yolk  
25 g glucose  
3 g guar gum (0.46%)

Toast sawdust for 20 min at 180 °C. Bring milk to boil and pour over sawdust. Leave to steep in refrigerator over night.

Bring 400 g infused milk and cream to a simmer. In a bowl, whisk together sugar and egg yolk. Slowly whisk cream mixture into yolk mixture to temper. Return combined mixtures to saucepan. Over medium-low heat, whisk until mixture is thick enough to coat back of spoon. Remove from heat and add glucose. Transfer to blender, add guar gum and blend on high speed for 3 min or until smooth. Freeze and process with pacojet.

*Grant Achatz in Alinea*

### Fruit sauce

140 g ripe berries or chopped fruit  
50 g sugar or 85 g honey  
40-60 mL water  
1/2 t guar gum (or 1/4 t xanthan)  
1/4 t fresh lemon juice

Bring fruit, sugar and water to boil. Remove from heat and cool for 10-20 min. Add more sugar if desired. Stir in the gum and mix with a stand blender or an immersion blender. Stir in the lemon juice and strain. Adjust taste with more lemon juice and consistency with water.

*Elizabeth Falkner in Demolition desserts*

### Red raspberry freeze drink

500 mL low fat milk, rice milk or soy milk  
240 mL frozen raspberries

120 mL frozen apple juice concentrate  
10 ice cubes  
1 t vanilla  
1/2 tsp guar gum

Place all ingredients in blender and blend on high speed for 1 to 2 minutes.

*Clair & Rita Bingham via <http://www.bobsredmill.com>*

### Banana ice cream

1000 mL very cold water  
120 g pecans, walnuts or cashews, chopped  
2 large ripe bananas  
170 g honey  
1-1/2 t cinnamon  
3/4 t guar gum

Whirl pecans in blender until ground very fine. Gradually add 750 mL very cold water. Blend on high until pecan mixture is very smooth. Add bananas, honey, cinnamon and guar gum. Blend until mixture is very smooth. Pour approximately half of the mixture into a 2 L ice cream maker. Blend 250 mL cold water with mixture left in blender container and pour into ice cream maker. Stir to mix. Freeze according to manufacturer's instructions.

*Marilyn Goannini via <http://www.bobsredmill.com>*

Further recipes with guar gum can be found in the section "Multi-hydrocolloid recipes" on page 62 .



# Gum arabic

## Marshmallows

2 egg whites  
15 g marsh mallow roots  
500 g gum arabic (22%)  
500 g sugar  
1250 mL water  
color (optional)  
15 mL orange blossom extract  
2 T starch

Wash the roots (peel fresh roots) and slice into small pieces. Whisk egg whites hard. Bring the pieces of root to boil in the water. Leave to simmer for 30 min. Strain through strainer, coffee filter or towel. Pour the gum arabic into the hot water. Under mild heat stir with a wooden spoon to dissolve completely.

Continue to stir. Disperse the sugar in the solution and evaporate till the liquid is syrupy. Add in the egg whites and flavoring. Continue to evaporate while whisking. Add any coloring now. Whisk in. Sift the starch over a tray or a piece of baking paper or foil. Pour the paste over the starch. Leave to set several hours. Unmold or remove from container and cut into pieces or strings.

Variation: Replace 250 mL water and 50 g sugar by 150 g flavored cordial (mint, violet, poppy, raspberry...)

<http://www.gastronomie.kalys.com>

## Hard gums

12.7 kg gum arabic (36%)  
11.3 kg water  
6.8 kg sugar  
1.8 kg glucose syrup  
2.26 kg water  
0.45-0.68 kg glycerol  
flavor and acids as desired

Soak gum arabic in 11.3 kg water with gentle warming and stirring until gum is dissolved. Strain to remove particles and foreign matter. Dissolve sugar and glucose syrup in 2.26 kg water and boil to 124 °C. Pour syrup mixture into gum solution and gently mix. Skim off any scum that rises upon standing. Deposit the

clear solution in starch (dried to 4-5% moisture). Leave for 6-10 days at 49 °C. Brush of starch. Glaze/polish as desired.

*B. W. Minifie in Chocolate, Cocoa and Confectionary*

## Soft gums and pastilles

4.1 kg sugar  
4.1 kg glucose  
3.1 kg fruit concentrate or pulp  
water  
citric acid  
3.1 kg gum arabic (56%)  
3.1 kg water  
0.45 kg gelatin, bloomed

Dissolve sugar and glucose in fruit juice concentrate or pulp. Add water and citric acid as desired. Boil to 121 °C. Dissolve gum arabic in 3.1 kg water. Bloom gelatin and dissolve in gum solution by heating. Add gum/gelatin solution to syrup and mix well. Pour into dry starch. Leave in a hot room until desired texture is obtained. Remove starch, steam and coat with sugar.

*B. W. Minifie in Chocolate, Cocoa and Confectionary*

## Candied rose petals

1 T gum arabic  
1 T warm water (or rose water)  
20 rose petals  
30 g powdered sugar

Gently rinse petals and pat them dry. Dissolve gum in water until smooth. Strain to remove any remaining lumps. With a brush, paint both sides of the petals with the gum mixture. Sprinkle with superfine powdered sugar. Leave to air dry. When dry, store in air tight container for up to 3 months. Variation: rose petals can be replaced by violets, borage or dianthus.

*Kitty Morse in Edible flowers*



# Konjac

## Tips and tricks

- Konjac is sold under several different names including konjac flour, konjac mannan and konjac glucomannan.
- Under alkaline conditions konjac forms a thermoirreversible gel well known in Japan as *konnyaku* (gel) or *shirataki* (noodles).

Name	<i>konjac glucomannan (E425)</i>
Origin	polysaccharide extracted from the tuber <i>Lasioideae Amorphophallus</i>
Properties, texture	shear-thinning viscous sol. with fatty mouth feel; thermoreversible elastic gels w. xanthan/kappa carrageenan; <i>thermoirreversible</i> gels at pH 9-10
Clarity	transparent
Dispersion	cold water; d. can be improved by mixing with sugar or flour (3-5x).
Hydration (dissolution)	cold water with continuous stirring for at least 2h
pH	~3-10
Setting	
Melting	w. xanthan: yes, alkaline gels: no
Promoter	xanthan, kappa carrageenan
Inhibitor	viscosity decreases with decreasing pH; gelling occurs at higher pH.
Tolerates	salt, acidic foods
Viscosity of solution	low temperature: high high temperature: lower
Typical conc.	0.1-0.3% for viscous solutions
Synergies	xanthan, kappa carrageenan, locust bean gum
Syneresis	

## Alkaline konjac gel

6 g konjac flour (~1%)  
500 mL water  
¼ t pickling lime (food grade lime, Ca(OH)<sub>2</sub>)  
75 mL water

Bring 500 mL water and konjac flour to boil stirring continuously. Keep boiling for about 3 min. In a separate pot dissolve lime in 75 mL water. Add it to the boiling solution and continue stirring for about 5 minutes without taking it off the flame. Upon cooling a thermoirreversible gel is formed. It is known in Japanese as *konnyaku* (gel) or *shirataki* (noodles) depending on the shape.

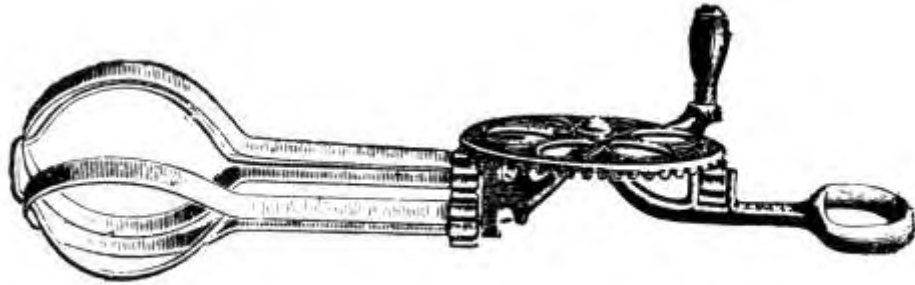
<http://www.konjacfoods.com>

## Konjac dondurma (chewy ice cream)

3 g konjac flour (1.1%)  
70 mL milk  
80 mL cream  
2 egg yolks  
50 g sugar  
20 g honey  
vanilla extract

Pour milk in saucepan and stir in konjac flour. Add cream and heat until gooey and smooth. Use immersion blender if necessary. Do not boil the mixture. Mix egg yolks and sugar in a separate bowl, add to the saucepan and blend until smooth. Add vanilla extract. Pour into a container and freeze for 2 hours, take it out and mix well. Freeze again, and mix again.

<http://cookpad.com/mykitchen/recipe/267889> via  
<http://www.chowhound.com/topics/484961>



# Lecithin

Technically not a hydrocolloid, but it is included here for completeness regarding texture modifiers. Lecithin is a phospholipid and most frequently encountered in egg yolks. Commercially available lecithin is normally produced from soya beans.

## Tips and tricks

- lecithin has good emulsifying properties
- lecithin enhances elasticity of flour based doughs
- when using lecithin for airs and foams, use a wide flat container to allow the air to collect
- very little lecithin is needed for foaming, the exact amount depends on proportion of water and oil in mix; adding too much will destabilize the foam

## Emulsified vinaigrette

50 g vinegar or lemon juice  
100 g olive oil  
herbs & spices, mustard, garlic, onion etc.  
0.3 g lecithin (0.2%)  
0.15-0.60 g xanthan (0.1-0.4%)

Mix everything with an immersion blender. If desired, thicken with xanthan.

*Martin Lersch*

## Lime air

225 g lime juice  
275 g water  
1.5 g lecithin (0.3%)

Combine the three ingredients and use a hand-held mixer on the surface of the liquid; allow to stabilize for one minute and collect the air that has formed on top.

<http://www.texturaselbulli.com>

## Frozen parmesan air

*Parmesan solution*  
500 g grated parmesan  
450 g water

*Parmesan air*  
250 g parmesan solution  
1.3 g lecithin (0.52%)

Mix the parmesan with the water and gradually heat to 80 °C. Steep for 30 minutes and strain. Add 1.3 g of lecithin for every 250 g of parmesan solution obtained. Use a hand-held mixer on the surface of the liquid, allow to stabilize for one minute and collect the air that

has formed on top. Freeze the air in a container of choice.

<http://www.texturaselbulli.com>

### **Peachy soy ice cream**

700 mL soy milk  
350 mL fresh or frozen peaches, sliced  
100-200 g sugar (to taste)  
60 mL soy oil (optional)  
6.9 g lecithin (0.56%)  
1 t vanilla flavoring or 1 whole vanilla bean  
pinch of salt

If using a whole vanilla bean, split it down the sides and halve it lengthwise. Scrape out the insides and use the inner vanilla bean scrapings for flavoring (Do not use the bean casing). Blend all the ingredients together in a blender until smooth and creamy. If you prefer chunks of peaches, chop the peaches separately and fold into the soymilk mixture just before freezing. Freeze according to your ice cream maker instructions.

<http://www.recipezaar.com/123833>

### **Soy sauce air**

300 g soy sauce  
200 g water  
3 g lecithin (0.6%)

Mix all the ingredients with the help of a hand blender and let it rest for a few minutes. Blend once again with the hand blender, bringing in as much air as possible into the mix, to build a foam layer on top of it. Let it rest for 1 minute and pick up the foam with help of a kitchen skimmer.

<http://souschef.co.nz/Emulsifiers-Gelifiers.pdf>

### **Tea air**

1000 mL milk  
200 g muscovado sugar  
20 g lapsang soochong  
10 g lecithin (0.83%)

Bring milk and sugar to a boil, infuse tea four minutes. Strain, add lecithin, and froth with emulsifying blade of immersion blender.

<http://willpowder.net>

### **Orange air with olive oil**

300 mL orange juice  
15 mL rose water  
250 mL olive oil  
5 g lecithin (0.88%)

Heat rose water with a portion of the orange juice. Add the remaining juice, olive oil and

lecithin. Pour into a wide, flat container which allows foam to collect on the sides. Foam with an immersion blender held on the surface of the liquid. Freeze air with liquid nitrogen and serve immediately.

[Heiko Antoniewicz](http://www.khymos.org)

### **Apple strudel**

6 apples, thinly sliced  
250 mL currents or chopped raisins  
250 mL blanched almonds  
120 mL chopped dates  
1 t vanilla  
1 t cardamom

#### *For pastry*

180 g whole wheat flour  
120 mL cold water  
2 t oil  
6.9 g (1T) lecithin (2.2%)  
pinch of salt

Mix flour and salt together, add oil and lecithin; mix well. Add water, handling as little as possible. Roll pastry out very thin on a large smooth slightly floured kitchen towel (stretch pastry).

Combine all ingredients for filling. Spread the apple filling on pastry to about 5 cm of one end of pastry and all over the rest. Lift one end of the towel so it begins to roll. Roll it onto a cookie sheet and tuck ends under. Bake at 160-180 °C for 1 hour. Slice like a jelly roll and serve with vanilla ice cream.

<http://www.cooks.com>

### **Bread machine dough enhancer**

230 mL lecithin granules  
1 T vitamin C powder  
1 T ground ginger

Mix ingredients and store in a tightly closed glass jar. Use the same amount of enhancer as the yeast. The ginger boosts the yeast, and makes it act more swiftly. The ascorbic acid (vitamin C), strengthens the gluten. The lecithin granules aids the oil in causing the strands of gluten to slip against each other more easily.

<http://www.recipezaar.com/89744>

Further recipes with lecithin can be found in the section "Multi-hydrocolloid recipes" on page 62 .





# Locust bean gum

## Tips and tricks

- In frozen products locust bean gum retards ice crystal growth which improves the mouth feel, especially after several thaw-freeze cycles
- Addition of 0.2% locust bean gum renders bakery fillings in pumpkin pies and fruit tart fillings bake stable and less prone to boil out

<b>Name</b>	<b>locust (carob) bean gum (E410)</b>
Origin	polysaccharide extracted from the seeds of the legume <i>Ceratonia siliqua</i>
Properties, texture	thickener, often used in ice cream; elastic gel in 1:1 ratio with xanthan
Clarity	
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x).
Hydration (dissolution)	> 90 °C
pH	
Setting	
Melting	
Promoter	will only gel in presence of agar or kappa carrageenan or xanthan
Inhibitor	
Tolerates	
Viscosity of solution	low temperature: high highest viscosity obtained > 60 °C
Typical conc.	0.1-1.0%
Synergies	xanthan, kappa carrageenan
Syneresis	

## Lemon sorbet

500 mL water  
550 g caster sugar  
100 g glucose  
5-6 g locust bean gum (0.32-0.38%)  
500 mL lemon juice  
citric acid

Bring water, sugar, glucose and lemon juice to a boil. Boil until 15° Baume. Add locust bean gum while stirring. Strain to remove lumps and cool in a refrigerator. Transfer to a low container and freeze. When frozen, transfer to a food processor and churn to introduce air (the color changes from yellow to white). Return to freezer. Serve.

<http://www.chefsimon.com>

## Super foamy milkshake

2 g locust bean gum (0.9%)  
10 g inulin  
10 g sweet whey powder  
200 mL skimmed milk (0.1 % fat)  
flavor, syrup and sweetener as desired

Add locust bean gum, inulin powder and sweet whey powder to milk in a blender or mix in a bowl with an electric mixer. When choosing flavors, consider that fats/oils will make the foam collapse.

<http://en.wikibooks.org/wiki/Cookbook:Milkshake>

Further recipes with locust bean gum can be found in the section "Multi-hydrocolloid recipes" on page 62 .



# Maltodextrin

## Tips and tricks

- Several commercially available hydrocolloids are preblended with maltodextrin. This helps dispersion.

## Roasted flour nuggets

40 g all purpose flour  
8 g confectioners sugar  
0.5 g salt  
13 g tapioca maltodextrin (14%)  
30 g unsalted butter, melted

*Note: Roasting alters the starch and gluten, and the flour loses much of its elasticity and yields a sandy texture.*

Preheat oven to 160 °C. Spread flour in an even layer on a baking sheet and roast in oven for about 45 minutes, stirring often until fragrant and golden. Cool completely. Toasted flour can be made ahead and kept in a sealed container. Preheat oven to 180 °C. Place the flour, sugar, salt and maltodextrin in a bowl and toss to combine. Slowly drizzle in melted butter while tossing with a fork. Remove rounded nuggets as they form and place on a baking sheet. Bake for 10-12 minutes and allow to cool completely before handling.

<http://www.playingwithfireandwater.com/foodplay/2008/07/blueberry-pie.html>

## Olive oil powder

80 g olive oil  
25 g tapioca maltodextrin (24%)  
3 g salt

Whisk together oil, maltodextrin and salt to form a powder. Reserve in airtight container.

*Grant Achatz in Alinea*

## Dry caramel

*Caramel base*

375 g sugar  
350 g sugar  
500 g heavy cream  
100 g butter

*Dry caramel*

210 g caramel base  
65 g tapioca maltodextrin (24%)

Caramel base: Heat sugar, glucose, cream and butter over medium heat to 110 °C. Pour onto sheet tray lined with silicone mat. Let cool to room temperature.

Dry caramel: Combine caramel base and maltodextrin in food processor and process until caramel base is completely absorbed.

*Grant Achatz in Alinea*

## White chocolate powder

80 g tapioca maltodextrin (40% of final composition)  
120 g melted white chocolate

Place starch in Robot Coupe and add melted white chocolate. Spin machine and scrape side and bottom with spatula. Add starch as needed to create desired texture. For a fluffier chocolate powder, pass through tamis.

*Adrian Vasquez via <http://www.star chefs.com>*

## Nutella powder

80 g tapioca maltodextrin (40% of final composition)  
120 g Nutella

Combine ingredients in a food processor. Process until the mixture has the texture of soil. Pass mixture through a tamis or fine-meshed sieve to lighten its texture. Store in a cool dry place until ready to serve.

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<http://hungryinhogtown.typepad.com>

### **Bitter almond oil crumbs**

12 g virgin almond oil  
10 g green almond oil of prune  
40 g maltodextrin (65% of final composition)

Mix the two oils and reserve. Add the oil mixture slowly to the maltodextrin, mixing constantly with a hand blender until individual crumbs begin to appear. Set aside at room temperature. Heat the crumbs in a frying pan until they begin to take on a round shape and light crunchy coating.

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<http://www.texturasebulli.com>

### **Bacon powder**

60 mL tapioca maltodextrin (N-Zorbit M)  
120 mL rendered bacon fat

Add most of the maltodextrin to a bowl and drizzle in the bacon fat, scraping the sides of the bowl with a spatula and mixing well. Add more maltodextrin until desired texture is achieved.

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Morou via <http://baconshow.blogspot.com>

### **Sour mix recipe**

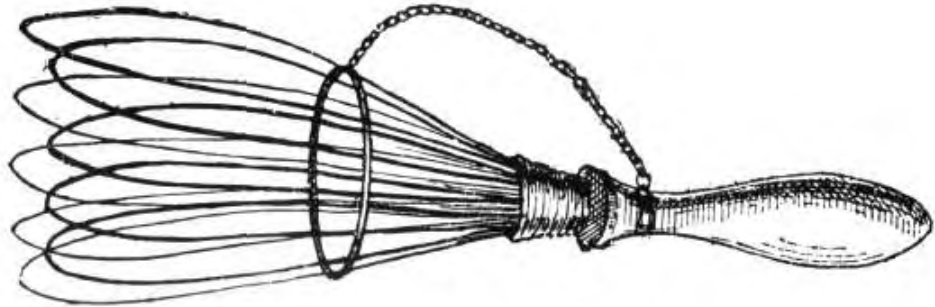
360 mL sugar  
60 mL corn syrup  
120 mL maltodextrin  
120 mL fresh lemon juice  
120 mL fresh lime juice  
30 mL lime zest  
8 g dehydrated egg white (optional)  
12 g citric acid  
480 mL water

Mix water, sugar, maltodextrin and zest in a pot and gently heat until all the sugars have dissolved. Turn off the heat and add the remaining ingredients, stirring until dissolved. Strain the mix into a 1 liter bottle. Maltodextrin increases the viscosity of the sour mix, and if egg whites are skipped, it also provides some foaming capability.

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<http://www.theartofdrink.com>

For more recipes, please refer to the keyword and ingredient index.



# Methyl cellulose

## Tips and tricks

- A very large range of methyl cellulose (and other cellulose based hydrocolloid) is available. Consult specialized text books or the manufacturer for details for your particular application.
- Since methyl cellulose gels when heated it is often used for shape retention in products that tend to fall apart when heated
- Methyl cellulose can be used to prevent boil out of fruit fillings in bakery

<b>Name</b>	<b><i>methyl cellulose (E461)</i></b>
Origin	a modified polysaccharide derived from cellulose rich plants.
Texture	thermoreversible soft elastic gel when heated; helps form and stabilize foams when cold
Clarity	
Dispersion	hot or cold water, use slow speed to avoid foaming; mix with small amount of hot water to avoid lumps and stir into the rest of the cold water
Hydration (dissolution)	cold water, leave over night; add salt after complete hydration
pH	2-13
Setting	gels when heated to 50-60 °C
Melting	melts below the setting temperature
Promoter	alcohol rises setting temperature
Inhibitor	salt lowers setting temperature
Tolerates	acids, bases
Viscosity of solution	low when cold, high when hot
Typical concentration	1-2% for gels; [0.26-3.4%]
Synergies	
Syneresis	yes

### Cream cheese noodles

370 mL cream cheese  
160 mL water  
1.3 g methyl cellulose (0.26%)

In saucepan, heat water to 85 °C and vigorously whisk in methyl cellulose. Add mixture to cream cheese and stir well to combine. Place mixture over ice bath and whisk until cooled to 10 °C. Store at or below 10 °C for 2 hours to allow complete hydration. Transfer to squeeze bottle. Bring two liters of water to simmer and pipe in cream cheese mixture to form noodles. Drain noodles as soon as they become firm (takes about 30 seconds).

*Wylie Dufresne in Art Culinaire, spring 2006*

### Olive oil soba noodles

2 g methyl cellulose (0.63%)  
80 mL water (room tempered)  
1 g salt  
240 mL olive oil (room tempered)

Dissolve methyl cellulose in water. Leave over night so air bubbles can escape. Add salt and olive oil slowly, like when making mayonnaise. Use a good olive oil – preferably a mild, fruity one rather than a bitter one (Valerrama Hojiblanca). Use a whisk rather than an immersion blender when mixing. Transfer mixture to syringe (or equivalent) and extrude into hot, clear liquids/soups.

*Joachim Eisenberger via <http://www.bosfood.de>*

### Tender broad bean balls

*Methyl cellulose mix*  
100 g water  
3 g methyl cellulose

*For broad bean balls*  
65 g shelled tender broad beans  
20 g methyl cellulose mix (0.7% in final comp.)

Mix the two ingredients at room temperature in the blender to obtain a lump-free mixture. Strain and leave to sit in the refrigerator for 24 h. Mix the shelled tender broad beans with the methyl cellulose mixture. Make 8 balls of 8.5 g each. Keep in the refrigerator. Put the balls in salted water which has been kept hot at 90 °C and leave to cook for 1 min.

*<http://www.texturaselbulli.com>*

### Cellulose stabilized foam

100 mL broth or juice  
1-1.5 g methyl cellulose (1-1.5%)

Disperse methyl cellulose and chill over night. Whisk at high speed or foam with a siphon.

*<http://www.inicon.net>*

### Hot mozzarella sheets

*Mozzarella base*  
560 g buffalo mozzarella  
70 g mozzarella water  
15 g olive oil  
1 g salt

*Mozzarella sheets*  
646 g mozzarella base  
161.5 g water  
10.1 g methyl cellulose (1.25%), *Methocel A15C*

Base: Blend ingredients until smooth to make a mozzarella base.

Sheets: Bring water to a boil and disperse the methyl cellulose in the simmering water. When the methyl cellulose is incorporated add the water mixture to the mozzarella base and shear until the mixture is smooth and shiny. Place the mozzarella mixture in a bowl over an ice bath and chill till cold. Spread the mozzarella base in thin sheets on a non-stick surface and bake in a low oven until the mixture gels. Remove the hot mozzarella and use sheets for draping.

*Kamozawa and Talbot via <http://ideasinfood.typepad.com>*

### Marshmallow

230 g water  
90 g sugar  
4.5 g methyl cellulose (1.4%), *E15*  
1/2 t vanilla  
confectioners sugar

Bring water and sugar to a boil. Let cool. Add methylcellulose and vanilla. Blend with immersion blender. Cover and chill for 2 hours or until thickened. Transfer to a mixing bowl and beat at high speed until fluffy, 2-3 minutes. Spread out on a silpat or mold and bake at 150 °C for 5-8 minutes or until set. Unmold or cut into desired shape. Sprinkle with confectioners sugar and apply a blowtorch or place under broiler until browned. Serve hot. Notice that these marshmallows will melt when cooled!

*<http://www.playingwithfireandwater.com>*

### Corn pudding

400 g corn juice, extracted with a juicer  
160 g cream cheese  
20 g cheddar powder

8.5 g methyl cellulose (1.4%), *Methocel SGA150*  
salt, to taste

Place 1/2 of the corn juice and the cream cheese in a saucepan and heat over medium heat until cream cheese is melted. Remove from heat and add the remaining juice, the cheddar powder and methyl cellulose. Blend well with an immersion blender, cover and chill for at least 4 hours to hydrate. When ready to bake, preheat the oven to 120 °C. and stir in the salt. Fill molds and bake for 10-20 minutes, depending on the capacity of molds. Unmold and serve immediately or hold in a 90 °C oven for up to 20 minutes.

<http://www.playingwithfireandwater.com/foodplay/2008/06/corn-pudding.html>

### Reconstructed potato

160 g hot potato puree  
75 g milk, cream, or buttermilk  
15 g butter  
salt  
100 g water  
5 g methyl cellulose (1.4%), *Methocel SGA150*

To make potato puree: Peel potatoes and cut into chunks. Drop into boiling, salted water and cook until very tender. Drain and pass through a ricer, tamis or sieve 2-3 times or until a very smooth texture is achieved. This is best made just before proceeding with recipe, while still hot.

Combine hot potato puree with milk, butter, and salt, stirring vigorously until butter melts.

Add methocel to water and blend it in with an immersion blender. Combine gel with potato mixture, stirring until well blended. Cover and chill overnight in refrigerator. The next day, preheat oven to 120 °C. Fill molds with potato mixture and bake for 8-10 minutes, or until firm. Remove from oven and unmold. If desired, proceed as described in the reference to coat potatoes with raclette cheese.

<http://www.playingwithfireandwater.com/foodplay/2008/08/raclette-potato.html>

### Hot vanilla ice cream

306 g whole milk yogurt  
230 g cream cheese  
80 g agave nectar  
154 g water  
1 Bourbon vanilla bean scraped  
pinch of sea salt  
11.55 g methyl cellulose (1.5 %), *Methocel SGA 150*

Blend yogurt, cream cheese, agave nectar, vanilla seeds and salt until smooth, but do not aerate. Disperse methyl cellulose in boiling hot water while whisking. Once dispersed, add it to the blender and purée until mixture is homogenized, again avoid aeration. Pour into bowl over an ice bath to chill and leave to rest for at least an hour, preferably over night.

Heat a pot of water and shut off the heat when it boils. Scoop the ice cream base, wipe the edges of the ice cream scoop, and immerse the scoop and its contents into the hot water. When the ice cream sets, dislodge it from the scoop. The ice cream should poach for about one minute for small scoops and longer for larger scoops. You may have to turn the heat back on to keep the water hot. Once the ice cream is set, remove the scoops, drain briefly on a paper towel and place into serving dishes and garnish. As the mixture chills the ice cream will “melt”, blending with the garnishes like an actual cold ice cream sundae.

*Kamozawa and Talbot via <http://ideasinfood.typepad.com>*

### Thin film (brittle, melting)

100 g water  
1.5 g sugar  
1.5 g methyl cellulose (1.5%)

Mix the powder of methyl cellulose with sugar. Heat up 1/3 of the water until the first bubble of boiling. Pour the powder of methyl cellulose and sugar in rain while moving. Put it in a mixer or in a blender to homogenize the solution. Add the remaining water in the mixture, continue to mix the solution for 30 min. Take 10 g of solution, pour it in a Petri dish (flat dish with diameter of 10 cm). Let the solution dry at room temperature for 48 hours. The thickness of the film is approximately 0.1 mm.

*Adapted from <http://www.inicon.net>*

### Thick film (like plastic/leather)

100 g water (or broth, juice etc.)  
2 g methyl cellulose (2%)  
3 g glycerol

Disperse methyl cellulose in water and chill over night. On the next day add glycerol and stir carefully to avoid foaming. Pour 1 to 1.5 mm high on a silicon mat, mold or tray and leave to dry at room temperature for 2 days. Remove and cut/shape as desired.

*Adapted from <http://www.inicon.net>*

### Basic recipe for hot melting jelly

2 g methyl cellulose (2%)

100 mL water (or flavored liquid)

Disperse methyl cellulose in cold water. Leave in fridge over night for hydration. Portion out and heat in a water bath or in a microwave oven to set. The gel melts upon cooling.

<http://www.inicon.net>

### Soya burgers

soy protein 21%  
vegetable fat 15%  
starch 2%  
potato flour 2%  
methyl cellulose 2%, *Benece*l M043  
dried onion 1.5%  
salt 1%  
seasonings and flavors 0.5%  
water to 100%

Methyl cellulose gels when heated. This gives shape retention. Since the gelling is thermoreversible, it is not noticed in the final product.

*CRC handbook of hydrocolloids*

### Crispy carrot foam

250 g carrot juice  
50 g water  
50 g sugar  
8 g methyl cellulose (2.2%), *Methocel F50*

Bring carrot juice, water and sugar to a boil. Remove from heat, pour into bowl and refrigerate until chilled. Add methyl cellulose to 250 g of the chilled carrot juice and blend with immersion blender. Transfer to stand mixer with whisk attachment. Whip on high speed for 10 min or until stiff peaks form. Pour onto silicone mat and spread out evenly. Transfer mat to dehydrator and dry at 55 °C for 5 h or until crisp. Reserve in airtight container.

*Grant Achatz in Alinea*

### Hot Bailey's ice cream

100 g espresso, cold  
50 g milk  
50 g Bailey's  
10 g sugar  
7 g methyl cellulose (3.2%)

Mix all ingredients together and leave in fridge overnight for proper hydration. Fill an ice cube freezing bag with the coffee mix. Heat the bag in water at 40-60 °C for 8 min. Cut out "ice cream" cubes and serve immediately.

*Rolf Caviezel in Molekulare Küche*

### Parsley spaghetti with porcini soup

*For the spaghetti*

parsley  
400 mL water  
1 pinch of salt  
30 mL olive oil  
15 g methyl cellulose (3.4%), *Metil from Texturas* was used

*For the soup*

500 mL beef stock  
150 g porcini  
100 g lean meat for clarification  
70 g cubed root vegetables  
1 egg white  
1 sprig rosemary and thyme  
1 T soy sauce

Blitz parsley with water with an immersion blender. Add methyl cellulose at slow speed (to avoid incorporation of bubbles). Add salt and olive oil while still blending at slow speed. Leave over night in fridge. For serving: fill syringe and inject into hot soup at the table.

*Heiko Antoniewicz*

Further recipes with methyl cellulose can be found in the section "Multi-hydrocolloid recipes" on page 62.



# Pectin

## Tips and tricks

- Pectin is very sensitive to pH, sugar content and cations. Furthermore a range of pectins with varying degrees of methoxylation are available. Please refer to textbooks for more details.
- Consider that the natural pectin content of fruit varies. Low pectin fruit include strawberry, peach, raspberry, pineapple. Medium pectin fruit: blackberry, apricot. High pectin fruit: apple, gooseberry, plum, quince, redcurrant, blackcurrant.
- I've decided not to include recipes where one relies on the pectin which is naturally present such as membrillo, fruit cheese, jellies, jams, marmalades.
- Low methoxyl pectin gels in presence of calcium ions and can be used for spherification just like sodium alginate.

Name	<i>pectin (E440) low methoxyl (LM)</i>	<i>pectin (E440) high methoxyl (HM)</i>
Origin	polysaccharide derived from citrus peel and apple pomace.	polysaccharide derived from citrus peel and apple pomace.
Texture	thermoreversible gels	<i>thermoirreversible</i> gels
Clarity	clear, transparent	clear, transparent
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x)
Hydration (dissolution)	cold or hot water	cold or hot water; will not dissolve if > 25% sugar
pH	2.5-5.5	2.5-4
Setting		40-85 °C (depending on pH and degree of methoxylation)
Melting	yes	no
Promoter	requires calcium ions for gelling; can gel in presence of milk (0.6-0.9% pectin required)	requires acidity (pH < 3.5) and high sugar contents for gelling (60-80% soluble solids, mainly sugar)
Inhibitor	high sugar concentrations, low pH	
Tolerates		
Viscosity of solution	low	low
Typical concentration	[0.15-3.1%]	[0.15-3.1%]
Synergies		
Syneresis	yes	yes



### Soft set orange marmalade

1.0 g high methoxyl pectin, rapid set (0.1%)  
0.5 g low methoxyl pectin (0.05%)  
10 g sugar  
100 g water  
200 g orange pulp and peel  
640 g sugar  
150 g water  
1.5 mL citric acid monohydrate (50% w/v)

Dry mix pectin and 10 g sugar and disperse in 50 g water with high speed mixer. Brings raspberries with remaining water and sugar to boil. Add pectin solution and boil down to 1015 g. Cool to 85 °C and deposit into jars. Keep pH in the range 3.0-3.2. Add citric acid if necessary.

*CRC handbook of hydrocolloids*

### Traditional raspberry jam

2.2 g high methoxyl pectin, rapid set (0.2%)  
10 g sugar  
50 g water  
450 g raspberries  
610 g sugar  
50 g water

Dry mix pectin and 10 g sugar and disperse in 50 g water with high speed mixer. Brings raspberries with remaining water and sugar to boil. Add pectin solution and boil down to 1015 g. Cool to 85 °C and deposit into jars. Keep pH in the range 3.0-3.2. Add citric acid if necessary.

*CRC handbook of hydrocolloids*

### Tuile craquante

150 g confectioner's sugar  
2 g pectin (0.53%)  
8 g all purpose flour  
120 g unsalted butter  
50 g glucose syrup  
50 g water

Sift together sugar, pectin, and flour. In a saucepan, combine butter and glucose and melt over low heat. Whisk in sifted ingredients, then water. Increase heat to medium. Stirring constantly, bring just to a boil. Remove from heat and allow to cool. After an ample resting period, spread onto a Silpat lined sheet pan and bake in a convection oven until golden at 180 °C. Remove from oven, allow to rest a moment, and shape as desired. Store in airtight container with desiccant.

*Michael Laiskonis via  
<http://michaellaiskonis.typepad.com/main/2008/04/transitions.html>,  
adapted from Frederic Bau*

### Paté fruit

250 g fruit purée  
6 g apple pectin (1.0%)  
25 g sugar  
80 g glucose  
2 g invert sugar (trimoline)  
230 g sugar

Boil purée. Add glucose and invert sugar, boil again. Add pectin and 25 g sugar, boil again. Add remaining sugar and cook to 108 °C. Pour into molds with a silt pad. Cut or unmold and dip in sugar.

*Ian Kleinman via <http://food102.blogspot.com>*

### Green tea sour mousse

2000 mL water  
375 g fresh lime juice  
350 g sugar  
32 g pectin (1.1%)  
60 g green tea  
50 g egg white  
25 g vodka  
2.5 g malic acid

Mix together water and lime juice. Mix the sugar and pectin together dry, then blend into the water and lime juice. Bring this solution to a boil and simmer for five minutes. Let cool completely. Infuse the green tea in the cold solution for two hours and then strain through fine muslin.

Take this base mix and combine with the egg white, vodka, and malic acid. Pour into a whipper and charge with nitrous oxide.

To serve, spray a small amount of foam into a soup spoon, knock the foam off the spoon into a Dewar filled with liquid nitrogen. Turn the mousse over in the liquid nitrogen for around 10 to 15 seconds until the entire surface has been frozen. Serve.

*Heston Blumenthal via <http://www.rsc.org>*

### Apple candy

500 g apple cider  
200 g glucose  
600 g sugar  
15 g high methoxyl pectin (1.1%)  
7 g citric acid

Warm cider and glucose over medium heat to dissolve glucose. In a bowl, whisk together 50 g of sugar, pectin and citric acid. Add to saucepan and bring to boil, whisking constantly. Add remaining 550 g sugar and heat to 107 °C. Pour into pan sprayed with nonstick cooking spray. Let cool until set and cut into 6 mm dice.

*Grant Achatz in Alinea*

### Liquorice candy (wheat flour based)

#### *Liquorice and anise extract*

20 cm liquorice root, crushed  
2 T anise, whole  
1000 mL water

#### *For candy*

350 mL extract  
260 g blackstrap molasses  
50 g oil  
10.3 g pectin or gelatin (1.2%)  
190 g flour

Extract: Boil down to 400-500 mL. Strain.

Candy: Bring extract, molasses and oil to boil. Add pectin. Boil hard for at least 1 min. Then add flour all at once. Lower heat and stir constantly until batter forms a mass and pulls away from the sides of the pot. Extrude the dough through a pastry bag or pat/roll the dough and cut to shape. Leave licorice to dry and cure, turning every few hours to let it dry evenly. It takes at least a day to firm up.

*E.J. Martin via <http://www.liquorice.org>*

### Raspberry sheets

500 g raspberry juice  
15 g rose water  
7 g amidated LM pectin (1.3%)

Combine raspberry juice and rose water in saucepan and blend in pectin with immersion blender. Bring to boil, stirring constantly and boil for 30 s. Remove from heat, let rest for 5-10 min and skim away foam. Reheat, stirring constantly, until just liquid. Pour onto acetate sheet sprayed with nonstick cooking spray. Raise acetate sheet into a U and raise and lower ends until mixture coats evenly. Place sheet in dehydrator and dehydrate at 40 °C for 4 hours or until sheet can be removed from acetate in one piece. If desired, rip sheets into random sized pieces, transfer to second acetate sheet sprayed with nonstick cooking spray. Dehydrate at 50 °C for 4 h or until crisp. Remove from tray to cold surface to harden.

*Grant Achatz in Alinea*

### Blackberry yogurt ravioli

greek yogurt  
150 g clear blackberry juice  
35 g sugar  
3 g amidated LM pectin (1.6%)

*Note: Blackberries contain 29 mg calcium/100 g fruit which is sufficient to gel amidated LM pectin.*

Pack yogurt into small, silicone hemisphere molds and freeze just until firm.

Combine sugar with pectin in a bowl and mix thoroughly. Place juice (preferably clarified/strained) in a pan and bring to boil. Add sugar-pectin and stir vigorously 1-2 minutes while cooking to dissolve. Return to boil and remove from heat. Keep a pan of simmering water on the stove to keep the pectin warm and fluid. Drop Tablespoonfuls of hot pectin solution onto a ceramic or glass plate, forming discs, and allow to gel. Set pan in simmering water while proceeding. When discs are firm, unmold yogurt hemispheres and place one on each of the discs. Pour the remaining warm pectin evenly over the yogurt to completely encase. When gelled, cut away the excess gel with a round cutter that is slightly larger than the hemisphere. Chill.

*<http://www.playingwithfireandwater.com/foodplay/2008/08/blackberry-rose-cashew.html>*

### Cold sauce with green cardamom

1000 mL water  
50 g glucose  
12 capsules of cardamom  
3-4 cm fresh ginger, peeled and minced  
zest of 1 lime

#### *For thickening use one of the following*

4 g agar (0.38%)  
20 g pectin (1.9%)  
10 g gelatin (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

*<http://www.chefsimon.com>*

### Sliced Chocolate

435 g water  
250 g dark chocolate  
135 g milk chocolate  
2 g salt  
8.2 g calcium gluconate (1%)  
16.4 g amidated LM pectin (2%)

Place water, chocolate, salt and calcium gluconate in a pot and bring to simmer. When temperature reaches 90°C, pour into a blender. Turn it on low, then increase speed to form vortex. With the blender running, carefully remove the lid and sprinkle in the pectin. Run the machine for about five minutes, and then pour the mixture into a plastic-lined dish. Let it cool, undisturbed, at room temperature for 30 minutes. Place in the refrigerator and chill for at least four more hours until completely cool and set. Once the chocolate is cold you

can slice it and serve immediately, or cover it with plastic wrap and keep refrigerated until you're ready to serve it.

*Aki Kamozawa and H. Alexander Talbot via  
<http://www.popsci.com/diy/article/2008-07/pectin-not-just-jelly>*

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### **Fruit Terrine**

1 honeydew melon  
1 pineapple

#### *Calcium solution for impregnation*

500 g water  
2.5 g calcium lactate or calcium gluconate (0.5%)

#### *Pectin solution for glueing fruit together*

500 g water  
15 g low methoxyl pectin (3.0%)

Cut fruit into thick squares of equal size, each about 1.5 cm thick. Dissolve calcium salt in water. Vacuum-seal fruit with calcium solution in a bag. Leave fruit to impregnate for 5 min. Open bag and pat fruit dry. Disperse pectin in water heated to 95 °C with blender/immersion blender. Let cool. Brush pectin solution on one piece of fruit and lay another piece on top. Vacuum-seal to hold pieces together. Leave to rest in fridge overnight over night. Open bag and slice fruit terrine to desired size/shape and serve.

*Aki Kamozawa and H. Alexander Talbot via  
<http://www.popsci.com/diy/article/2008-07/pectin-not-just-jelly>*

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### **Wine jelly**

850 g wine (red or white)  
120 mL fresh lemon juice  
56 g high methoxyl pectin (3.1%)  
850 g white sugar

Combine wine, lemon juice, and pectin in a large saucepot. Bring to a boil, stirring frequently. Add sugar, stirring until dissolved. Return to a rolling boil. Boil hard 1 minute, stirring constantly. Remove from heat. Skim foam off top, if necessary. Ladle hot jelly into hot, sterilized jars.

*<http://allrecipes.com>*

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Further recipes with pectin can be found in the section "Multi-hydrocolloid recipes" on page 62 .



# Sodium alginate

## Tips and tricks

- To get rid of air bubbles after dispersion and hydration, leave alginate solution in fridge over night, pour it through a fine meshed sieve or subject the solution to a vacuum.
- To avoid precipitation of alginic acid (occurs if pH < 3.65), adjust the pH as follows to reach pH 5:

Starting pH	Tri sodium citrate to add, g/L
2	2.7
2.5	0.85
3	0.27
3.5	0.082

- Lemon juice is around pH 2.4; Orange juice, apple juice, red wine etc. are all about pH 3.5. An extensive table of food pH is available from <http://vm.cfsan.fda.gov/~comm/lac-phs.html>
- For fluorescent spheres when exposed to UV light, use tonic water (which contains quinine) or riboflavin (Vitamin B2)
- Calcium rich foods such as dairy products are well suited for reverse spherification
- Consider that ion induced spherification is also possible with gellan, kappa carrageenan, iota carrageenan and pectin. Spherification with frozen oil can be done using agar, gelatin and gellan.
- For internal gelling it is necessary to slow down the gelling. To achieve this an insoluble calcium source such as calcium sulphate or calcium carbonate is used. These allow a controlled release of the calcium upon lowering of pH. Consult specialized texts or manufacturer for further details.
- Calcium alginate gels are heat stable up to more than 150 °C

<b>Name</b>	<b>sodium alginate (E401)</b>
Origin	polysaccharide extracted from brown algae.
Texture	thermoirreversible gel in presence of calcium ions; shear-thinning thickener in absence of calcium
Clarity	clear, transparent
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x); add. of acidic liquids may cause precipitation of alginic acid
Hydration (dissolution)	cold or hot water; if cold, allow to hydrate for a couple of hours
pH	2.8-10
Setting	independant of temp.
Melting	no (but prolonged heating at low/high pH will destabilize gel)
Promoter	requires calcium for gelling
Inhibitor	pH < 4 (is corrected by addition of sodium citrate); gels at too high ion/salt concentrations
Tolerates	up to ~50% ethanol (d. and hydrate in water before addition of alcohol)
Viscosity of solution	low in neutral water, high at lower pH
Typical concentration	0.5-1% for normal spherification; [0.3-5%]
Synergies	
Syneresis	yes

### Spherical tea ravioli

475 g water  
16 g Earl Grey tea  
25 g sugar  
50 g lemon juice  
1.5 g sodium alginate (0.3%)

#### Setting bath

500 g water  
3.25 g calcium chloride (0.65%)

Mix 400 g of water, the tea and 20 g of sugar while cold and steep in the refrigerator for 24 hours. Strain. Combine the lemon juice with 5 g of sugar and freeze in an ice tray. Blend the sodium alginate with 75 g water. Dilute the calcium chloride in 500 g water. Mix the tea infusion with the sodium alginate base and allow to rest. Place in the freezer to chill but do not allow it to freeze.

Place a lemon cube in a 3 cm dosing spoon and fill the rest of it with the tea base. Place in the calcium chloride bath for 30 seconds. Rinse the ravioli in cold water.

<http://www.texturasebulli.com>

### Spherical mango ravioli

250 g water  
1.3 g sodium citrate  
1.8 g sodium alginate (0.36%)  
250 g mango purée

#### Setting bath

1000 g water  
5 g calcium chloride (0.5%)

Blend the sodium citrate with 250 g of water, add the sodium alginate and blend once more. Bring to a boil, allow to cool and mix with the mango purée. Blend 1000 g of water with calcium chloride. Pour the contents of a dosing spoon full of the mango and sodium alginate mixture into this calcium chloride bath, leave for 2 minutes and wash in cold water. Repeat until all of the ravioli are made.

<http://www.texturasebulli.com>

### Liquid pea ravioli

260 g frozen peas  
325 g water  
5 large mint leaves  
3 g sodium alginate (0.5%)

#### Setting bath

1500 g cold water  
10 g calcium chloride (0.67%)

In a bowl, dissolve calcium chloride in water. Store bowl in the fridge.

Cook frozen peas in a small amount of water for four minutes, adding mint leaves for the last five seconds of cooking. Drain, then shock immediately in a cold water bath for three minutes.

Mix water and sodium alginate with immersion blender until the sodium alginate has dissolved. Bring to a boil over high heat, stirring constantly. Remove from heat and allow to cool to room temperature. When cooled, blend with pea mixture using an immersion blender until the mixture is smooth.

Remove chilled calcium chloride solution from fridge. Scoop pea mixture into a tablespoon measure in the shape of a half-sphere. Set the bottom of the tablespoon measure against the surface of the calcium chloride mixture, then pour the mixture in with a gentle turn of the wrist. Leave ravioli in the calcium chloride mixture for two minutes. Gently remove the ravioli from the calcium chloride bath using fingers or a slotted spoon. Place in another bowl filled with cold water or rinse gently under running water. Top with a couple of grains of sea salt and serve immediately.

<http://hungryinhogtown.typepad.com>

### Mozzarella spheres (reverse spherification)

250 g buffalo mozzarella  
150 g heavy cream  
5 g calcium lactate (~1%)  
2 tamarillos or tomatos, juiced

#### Setting bath

1 L water  
5 g sodium alginate (0.5%)

Mix mozzarella with cream and calcium lactate. Fill bowl with water and add sodium alginate. Stir until dissolved. Transfer mozzarella mix to alginate bath. Allow 2 min for setting. Inject spheres with tamarillo/tomato juice. Serve.

Dietmar Hölscher via <http://www.eispreis.de>

### Yoghurt beads (reverse spherification)

200 g yoghurt  
90 g double cream  
30 g sugar  
2 drops of pine extract

#### Setting bath

1000 mL water  
5 g sodium alginate (0.5%)

For the yoghurt beads; mix all the ingredients. Make a sodium alginate bath (reverse spherification) by mixing the water with the

sodium alginate. Fill syringes with the yoghurt mixtures. Inject the mixture into the sodium alginate bath so you get beads (2 cm diameter). Leave the beads into the bath for 2 minutes. Rinse in water and leave into the water until use.

*Sang Hoon Degeimbre via <http://foodfordesign.blogspot.com>*

### **Spherical olives (reverse spherification)**

400 g olive juice  
2.5 g calcium chloride (0.625%)  
1.5 g xanthan (0.375%)  
olive oil  
garlic  
thyme  
orange/lemon peel  
pepper

#### *Setting bath*

7.5 g sodium alginate (0.5%)  
1.5 L water

Mix sodium alginate and water. Keep in fridge over night to allow bubbles to escape.

Prepare olive juice by filtering puréed olives through a chinois cloth. Mix with calcium chloride. Sprinkle xanthan and mix with a hand held mixer (not an immersion blender) until desired consistency.

Gently head olive oil with garlic, thyme, citrus peel and pepper. Cool and store in tight container.

With a small spoon, transfer the thickened olive juice to the sodium alginate bath for setting. Rinse with water, let drip of and transfer to aromatized olive oil.

*Paco Roncero via <http://www.chefkoch.de>*

### **Spherical croquettes (reverse spherification)**

250 g croquette base without flour  
6 g calcium gluconate/calcium lactate (2.4%)  
0.8 g xanthan (0.32%)

#### *Setting bath*

1000 g water  
5 g sodium alginate (0.5%)

Blend the sodium alginate into the water until it dissolves. Leave in the fridge 12 h to eliminate excess air.

Dilute the calcium gluconate/calcium lactate mix in the croquette base, then mix in the xanthan with a hand blender to avoid lumps. Reserve in the fridge. Heat the croquette base until it regains a more liquid texture. Fill a 2.5

cm-diameter dosing spoon with the croquette base and pour it into the sodium alginate and water solution. Give the resulting sphere an elongated shape with the aid of 2 spoons so that it looks like a traditional croquette. Leave the croquettes in the sodium alginate solution for 3 min, turn them over and cook for a further 1 min. Once this time has elapsed, strain with a draining spoon and place them in hot water (60 °C) for 3 min. Remove from the water taking care not to break them. Dry the croquettes thoroughly and coat them in fried breadcrumb powder. Serve hot.

*<http://www.texturasebulli.com>*

### **Spherical mussels (reverse spherification)**

100 g mussel water  
0.5 g xanthan (0.5%)  
2.5 g calcium gluconate/calcium lactate (2.5%)  
20 clean rock mussels

#### *Setting bath*

1000 g water  
5 g sodium alginate (0.5%)

#### *For storage*

200 g seawater  
200 g water

Completely dissolve the sodium alginate in the water using a blender. Leave in the fridge for 12 h to eliminate excess air.

Dilute the calcium gluconate/calcium lactate in the mussel water with the aid of a hand blender. Add the xanthan and blend again until obtaining a fine texture. Vacuum pack mussel mixture to remove excess air and reserve in the fridge.

Place a mussel into a 2.5 cm-diameter dosing spoon together with 4 g of the spherical mussel base. Pour the contents of the spoon into the sodium alginate solution. It is extremely important that the spheres do not touch, as they will stick together. Cook the spherical mussels in the sodium alginate solution for 5 min. Strain the spheres with a draining spoon without breaking them and rinse in cold water. Drain the spherical mussels and keep them covered with the water and seawater mixture in the fridge.

Place the spherical mussels in hot water (60 °C) for 3 min. Remove them from the water taking care not to break them and place them in a spoon or on the corresponding plate. Serve hot.

*<http://www.texturasebulli.com>*

### Veal bone marrow (reverse spherification)

20 g reduced red wine  
200 g meat stock  
0.4 g xanthan (0.33%)  
4.5 g calcium gluconate/lactate (3.75%)  
salt

#### Setting bath

1000 g water  
5 g sodium alginate (0.5%)

Mix 100 g of the meat stock with the reduced red wine and add salt to taste. Dissolve the calcium gluconate/calcium lactate into the mixture. Use a hand blender to dissolve the xanthan and vacuum pack the solution to eliminate excess air. Set aside.

Completely dissolve the sodium alginate in the water using a blender. Reserve in the fridge for 12 h to eliminate excess air.

Fill a 2 cm-diameter dosing spoon with the mixture of the meat stock, reduction and calcium gluconate/calcium lactate.

Pour the contents of the spoon into the sodium alginate bath, forming spheres. It is extremely important that they do not touch, as they will stick together. Cook the spheres in the sodium alginate mixture for 5 min.

Strain the spheres without breaking them using a draining spoon and rinse them in cold water. Strain again and keep them covered with the other 100 g of meat stock. This inverted sphere is perfect as a sauce to accompany meat, in this case veal marrow.

<http://www.texturasebulli.com>

### Spheric green olives (reverse spherification)

500 g green olives, depitted

#### Olive mix

200 g green olive juice (see below)  
0.75 g xanthan (0.38%)  
1.25 g calcium chloride (0.63%)

#### Setting bath

1500 g water  
7.5 g sodium alginate (0.5%)

Crush olive pulp with immersion blender. Strain through a superbag pressing with the hands. Disperse sodium alginate in water with immersion blender and leave over night to hydrate and allow air bubbles to escape. Dissolve calcium chloride in olive juice. Sprinkle xanthan on surface and disperse with immersion blender.

To prepare olive spheres, fill 5 mL spherical spoon with olive mix and carefully pour the content into the sodium alginate solution to form spheric olive. Leave for 2-3 min, remove and rinse with water. Leave to drain and submerge them in aromatized olive oil (garlic, lemon peel, orange peel, thyme, rosemary, pepper).

<http://souschef.co.nz/Spherification.pdf>

### Melon cantaloupe caviar

250 g cantaloupe juice  
2 g sodium alginate (0.8%)

#### Setting bath

500 g water  
2.5 g calcium chloride (0.5%)

Mix sodium alginate with 1/3 of the melon juice and blend. Mix in remaining 2/3, strain and set aside. Dissolve the calcium chloride in the water. Fill syringe with the melon and sodium alginate mixture. Expel it drop by drop into the calcium chloride solution. Remove after 1 minute, strain and rinse the resulting caviar in cold water.

<http://www.texturasebulli.com>

### Kir moleculaire

80 mL black currant juice  
20 mL crème de cassis  
20 mL lemon syrup  
1 g sodium alginate (0.8%)  
champagne

#### Setting bath

2.5 g calcium chloride (0.5%)  
500 mL water

Mix fruit juices and sodium alginate. Leave over night to get rid of air bubbles. Use plastic syringe and drip alginate solution into setting bath. Leave in setting bath at least 30 seconds. Rinse spheres with water, transfer them to a champagne glass and fill glass with champagne.

*Adapted from recipe by H. Antoniewicz & A. Ariens-Derix*

### Restructured onions

40 g onion  
1.1-1.3 g sodium alginate (~1%)  
14 g starch  
1 pinch salt  
12 g sugar, maltitol or glucose syrup  
50-80 g water (low in calcium)  
0.2 g sodium citrate

### *Setting bath*

16 g calcium chloride (8%)  
200 g water

Blend the onion under water adding starch and sodium alginate. If tap water is rich in calcium, add some sodium citrate before you add the sodium alginate.

Use a ice cream scooper or a syringe to transfer mix to setting bath. You might also try filling a tray after spraying some setting bath solution. Collect restructured shapes from the setting bath in a strainer or with special spoon

Rinse well under running water and place in a tray to dry off. For firm shapes rest samples in the setting bath at least 10 minutes.

<http://www.gastronomie.kalys.com>

### **Cola caviar**

1 g sodium alginate (1.0%)  
100 g cola or other soda drink  
(konjac or xanthan)

#### *For setting bath*

8-10 g calcium chloride/calcium lactate (8-10%)  
100 g water

Heat soda to boil. Turn heat down. Mix the sodium alginate in. Stir well, turn heat off. Once at room temperature let the solution drip into the setting bath. The dripping speed depends on the viscosity of the solution. For a more viscous solution, use some thickener, e.g. 0.1-0.3% konjac or xanthan. Collect the spheres with a tea strainer, a sieve or a perforated spoon. Rinse with water.

<http://www.gastronomie.kalys.com>

### **Thin film**

100 g water or fruit juice  
1 g sodium alginate (1.0%)

#### *Setting solution for spraying*

100 g water  
5 g calcium lactate (5%)

Prepare 1% sodium alginate solution with water or fruit juice. Pour onto flat dish, baking platter or similar. Prepare calcium lactate solution and spray onto alginate film. Allow several minutes for setting. Small/thin films can be turned around and sprayed from the other side for faster setting. Short heating in the microwave after spraying (to evaporate calcium solution) gives greater flexibility and strength.

Adapted from <http://www.inicon.net>

### **Sodium alginate cubes**

20 g sugar or maltitol  
10 g dextrin  
170 g fruit juice  
3 g sodium alginate (1.5%)  
1 t lemon juice  
1-2 g calcium citrate, calcium lactate or calcium chloride (0.5-1.0%)

#### *For coating*

50 g baking cooking chocolate  
10 g butter or double cream

#### *Optional*

1 egg white  
1 pinch of xanthan

Blend half of the fruit juice with the lemon juice, dextrin and calcium source. Blend sodium alginate with remaining juice. Pour the first mix into the other and blend a few seconds. Leave to set for half an hour (setting should be almost immediate and visible within minutes). Cut into cubes.

The cubes are heat stable and resist cooling and heating. They may be used in an ice cream if cut into small pieces or to top mousse and drinks

Coating the cubes: Melt the chocolate over a hot pan (or in a double boiler) and blend in with the butter or double cream

Pick up the sodium alginate cubes on cocktail sticks and dip into melted chocolate sauce. Place on a grid rack (strainer) and leave to set in a cool place or the fridge

Variation: If you add an egg white and a pinch of xanthan to the calcium solution and then beat it before mixing into the sodium alginate solution, you will obtain a lighter gelled product.

<http://www.gastronomie.kalys.com>

### **Carbonated mojito spheres (reverse spherification)**

mojito  
alcohol  
xanthan gum  
calcium chloride (4-6%)

#### *Setting bath*

water  
sodium alginate (5%)  
sodium citrate (2%)

Leave spheres in setting bath. Transfer spheres to iSi bottle, cover spheres with small amount of mojito and charge with one charge of carbon dioxide. Leave for three hours and



serve immediately after opening. Garnish with lime zest and mint leaf.

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*ChefT, Cafe Atlantico via <http://forums.egullet.org>*

Further recipes with sodium alginate can be found in the section “Multi-hydrocolloid recipes” on page 62 .



# Xanthan

## Tips and tricks

- Add xanthan to reduce syneresis (water drainage), even in cold preparations
- Xanthan is shear thinning: liquids are viscous when at rest, but become more fluid when stirred or sprayed.
- The high at-rest viscosity gives excellent cling properties, for instance in tempura batters.
- Stabilizes emulsions.
- To keep water from leaking out of vegetable purées, add a touch of xanthan gum
- Often used to keep particles suspended (e.g. herbs, spices etc.)
- Xanthan reduces starch retrogradation in bread and baked products.
- In ice cream xanthan (~0.2%) prevents ice crystal formation during thawing cycles
- Xanthan can help stabilize whipped cream and mousses
- Xanthan added to gluten free products prevents crumbling and binds the product. For best effects use with guar gum in a 2:1 ratio (x:g).

Name	xanthan (E415)
Origin	polysaccharide obtained by fermentation of <i>Xanthomonas campestris</i>
Texture	high viscosity, shear-thinning; thermoreversible soft elastic gels w. locust bean gum or konjac
Clarity	clear, mostly transparent
Dispersion	cold or hot water; d. can be improved by mixing with sugar (10x) or glycerol, alcohol or vegetable oil.
Hydration (dissolution)	cold or hot water; does not hydrate at high sugar concentrations (>65%).
pH	1-13
Setting	
Melting	
Promoter	
Inhibitor	
Tolerates	acids/bases, salts, heating, enzymes, up to 60% ethanol
Viscosity of solution	high (independent of temperature)
Typical concentration	0.25% thin running sauce, 0.7-1.5% thick sauces, 0.5-0.8% foams; [0.08-0.85%]
Synergies	guar, locust bean gum, konjac
Syneresis	

### Banana milkshake

500 mL skimmed milk (0.1% fat)  
0.5 g xanthan (0.07%)  
10-15 g sugar  
1 banana  
vanilla  
5-10 ice cubes

Grind xanthan and sugar. In a blender, mix milk while adding xanthan and sugar. Add banana, vanilla and ice cubes. Xanthan gives a richer mouth feel.

*Martin Lersch*

### Fake cappuccino foam

500 mL cream liquor  
0.4 g xanthan (0.08%)

Blend, strain and transfer to whipper. Charge with nitrous oxide. Refrigerate.

Mix coffee liquor, ice and vodka/brandy in a shaker. Top with fake cappuccino foam and chocolate shavings.

*Adapted from recipe by H. Antoniewicz & A. Ariens-Derix*

### Tempura batter

1 egg  
100 g flour  
250 mL ice cold water  
0.35-0.5 g xanthan (0.1-0.15%)

Beat egg in a bowl. Add ice water in the bowl. Be sure to use very cold water. Add sifted flour and xanthan in the bowl and mix. Xanthan improves adhesion properties of batter, i.e. for onion rings and shrimps.

*<http://japanesefood.about.com> and CRC handbook of hydrocolloids*

### Piña colada espuma

600 mL pineapple juice  
350 mL coconut milk  
50 mL brown rum  
1 g xanthan (0.1%) **or** 10 g gelatin (1.0%)

Bloom gelatin. Heat a little of the pineapple juice and dissolve gelatin. Add remaining liquids. If using xanthan, it can be added directly to the liquids using a blender or immersion blender. Strain liquid, transfer to whipper and charge with nitrous oxide. Leave in fridge for some hours before serving.

*From Fizz magazine via <http://www.cuisine-concept.de>*

### Field poppy ice cream

800 mL plain yoghurt, stirred  
1 g xanthan (0.1%)  
10 g icing sugar

red color  
10 g poppy flavored cordial

#### *For cordial:*

100 g water  
100 g sugar  
1 pinch citric acid or 0.5 t lemon juice

Cordial: boil all ingredients and cool down

Ice cream: pour yoghurt into mixing bowl. Stir. Mix xanthan with icing sugar and add home made cordial. Disperse xanthan and sugar with blender. Pour the cordial into the yoghurt and whisk. Add color and flavoring to taste. Add some poppy seeds. Churn.

Variation: xanthan can be replaced by locust bean gum.

*Chef Simon via <http://www.gastronomie.kalys.com>*

### Orange ice cream

250 g reduced orange juice  
250 g cream  
100 g sugar  
8 g glucose  
1/2 vanilla pod  
1.5 g xanthan (0.16%)  
8 egg yolks  
200 g crème fraîche

Bring orange juice, cream, half of the sugar, glucose and the vanilla pod to boil. In a separate pan, whisk egg yolks with remaining sugar. Add orange juice mix and heat to 80 °C. Disperse xanthan into mixture and work in the crème fraîche. Cool and freeze, preferably with a pacojet.

*Heiko Antoniewicz and Klaus Dahlbeck in Verwegen kochen*

### Iberian ham cream

50 g Iberian ham broth  
30 g Iberian ham fat  
0.2 g xanthan (0.25%)

Mix the 3 ingredients with an immersion blender or a turmix to obtain a creamy emulsion with no lumps. Keep in the refrigerator. Serve with oyster.

*<http://www.texturasebulli.com>*

### White sangría in suspension

500 g white sangría mix  
1.4 g xanthan (0.28%)

Put the sangría in a bowl with xanthan and blend with a turmix. Strain and vacuum pack the whole mixture to extract the bubbles trapped in the interior.

The consistency obtained will enable us to maintain elements such as herbs, fruit or spherical caviar in suspension.

<http://www.texturaselbulli.com>

### Strawberry ice cream

500 mL unsweetened soymilk  
3.4 g xanthan (0.32%)  
230 g honey  
320 g strawberries

Add xanthan to 200 mL soymilk while mixing with immersion blender. Add remaining soymilk, honey and strawberries. Blend until smooth. Freeze in a flat metal pan. After 1 hour, return mixture to blender and process until creamy. Freeze again. Repeat again after 1 hour.

<http://dairyfreecooking.about.com>

### Coco cola

400 ml coconut juice  
60 g sugar  
160 g spray dried coconut  
2.5 g xanthan gum (0.4%)

Warm 100 mL coconut juice to dissolve sugar, followed by dried coconut, last xanthan. Bring to a boil, strain, allow to cool to 45-50 °C mix with remaining xanthan. Strain, fill soda siphon (or whipper) and charge with carbon dioxide.

<http://willpowder.net>

### Fruit purée mayonnaise

200 g fruit purée  
150 g olive oil  
2 g mono-/diglycerides (0.6%)  
1.5 g xanthan (0.4%)

Mix fruit purée, olive oil and mono/diglycerides well with immersion blender. Add xanthan and mix more.

*Adapted from Nova Kuirejo via <http://www.nova-kuirejo.de>*

### Gluten free flour mix

320 g rice flour, white  
100 g cornstarch  
35 g tapioca flour  
3.4 g xanthan (0.7%)

Blend and use in any recipe calling for flour.

<http://www.recipezaar.com/214986>

### Marshmallows with xanthan

60 mL water  
pinch of cream of tartar  
255 g sugar, granulated  
255 g light corn syrup

½ vanilla bean  
85 g egg whites (~3 egg whites)  
5 g xanthan (0.76%)

Ground xanthan with a tablespoon of sugar. Set aside. Heat water, cream of tartar, remaining sugar, corn syrup and vanilla to 120 °C. Discard vanilla bean. Whisk egg whites for about 2 min until still soft. Continue whipping egg whites at slow speed while adding syrup slowly. Sprinkle xanthan mix while still whipping. Turn speed up and continue mixing for 2-3 min or until meringue pulls away from sides. Sprinkle a pan or baking sheet generously with cornstarch and spread out the meringue. Sprinkle top with cornstarch, cover with plastic and leave to set for 4 hours in a refrigerator. Cut marshmallows into desired shapes and dip cut surfaces in cornstarch.

*Elizabeth Falkner in Demolition Desserts*

### Balsamic vinegar syrup

100 mL balsamic vinegar  
10 g sugar  
0.9 g xanthan (0.82%)

Grind sugar and xanthan. Add to vinegar while mixing with immersion blender. Avoid incorporation of air bubbles as these only slowly escape.

*Martin Lersch*

### Balsamic vinegar dressing

30 mL balsamic vinegar  
20 g honey  
0.85 g xanthan (0.85%)  
50 g extra virgin olive oil  
salt

Mix in blender until smooth.

<http://www.recipezaar.com/242717>

### Carrot pillow

80 g carrot juice  
120 g egg white  
70 g egg yolk  
20 g flour  
3 g xanthan (1.0%)  
salt  
pepper

Disperse xanthan in carrot juice and mix in egg white, egg yolk and flour. Add salt and pepper to taste. Strain and transfer to 0.5 L whipper. Charge twice with nitrous oxide. Leave to rest for 30 min. Butter plastic cups, cut two holes in the bottom and fill half way up with the carrot mix. Cook for ~30 s in a microwave.

Experiment with time and power setting until desired end result is achieved.

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*Rolf Caviezel in Molekulare Küche*

Further recipes with xanthan can be found in the section “Multi-hydrocolloid recipes” on page 62.



# Multi-hydrocolloid recipes

This section primarily contains recipes where hydrocolloid synergies play an important role or where the hydrocolloids are present in relatively high concentrations. All recipes however can be found through the texture index. A plus sign after the hydrocolloid name means it is used in combination with other hydrocolloids.

## Standard ice cream

water 64.4%  
sucrose 12%  
skimmed milk powder 12%  
butter fat 8%  
glucose syrup 3%  
mono-/diglycerides 0.3%  
locust bean gum (Carob) 0.15%  
vanilla flavor 0.1%  
color 0.05%  
kappa carrageenan 0.02%

Add all ingredients to cold water and heat with stirring to 85 °C. Melt butter fat in hot water. Cool. Freeze in an ice cream maker.

<http://www.cybercolloids.net>

## Freeform crème brûlée

360 g egg yolks  
180 g sugar  
3.3 g agar agar (0.2%)  
300 g milk (3.25% fat)  
750 g cream (36% fat)  
1 vanilla bean  
4 g gelatine mix (~0.75 g gelatin, corresponds to 0.05% gelatin in final mix)

*Gelatin mix*  
14 g gelatin powder  
60 g water

Bloom gelatin powder in water, melt and reserve. Combine agar with 50% of sugar, and remaining sugar with egg yolks. Bring milk, cream, vanilla bean and agar mix to the boil, and simmer for 5 min to ensure complete

hydration of the agar. Add yolks and remaining sugar, and cook to 80 °C, stirring with a rubber spatula to minimize incorporation of air. Remove from heat, add 4 g of reserved gelatin mix, strain and portion into molds. Refrigerate and caramelize to order. The added agar and gelatine prevent melting of the freeform creme brulee during caramelization.

Adam Chandler, <http://chocolateadventure.wordpress.com/>

### Mint jelly, sauce and foam

500 mL water  
mint (dried or fresh leaves)  
1 grain sea salt  
0.5 t sugar  
0.5 g konjac (0.1%)  
1 g carrageenan (0.2%)

Prepare a herbal tea or infusion of herbs. Add sugar and grain of salt. Infuse for 10-15 minutes. Add konjac and carrageenan. Bring to boil. Mix and keep on boil a couple of minutes. Strain into ramekins or bowls. Jelly can be used as it is. To make sauce (fluid gel), blitz the gel in a blender after cutting into smaller pieces.

Variation: Adding a pinch of xanthan to the gel with a glass of water helps whisk the jelly into a foamy solution.

<http://www.gastronomie.kalys.com>

### Soft chocolate gel

530 g cream  
500 g chocolate (64% cocoa), chopped  
120 g sugar  
600 mL water  
1.6 g locust bean gum (~0.1%)  
1.6 g carrageenan (~0.1%)

Scald the cream and pour it over the chocolate and sugar. Whisk to combine. Set aside. In another bowl, add the water, locust bean gum and carrageenan. Use a hand blender to combine thoroughly. Boil the mixture. Whisk the hot gel and chocolate mixture together. Pour it into an 20 x 20 cm pan lined with plastic. Refrigerate for at least two hours to set.

Sam Mason via <http://www.sugoodswets.com>

### Raspberry pearls (cold oil technique)

250 g raspberry purée (10% sugar)  
50 g granulated sugar  
1.0 g agar agar (0.25%)  
0.4 g locust bean gum (0.1%)  
100 g water

Gently warm raspberry purée and reserve. Combine sugar, agar agar and locust bean

gum, and disperse into water. Transfer to a small sauce pan. Bring this mixture just to a boil, reduce heat and simmer for 2-3 minutes. Remove from heat and incorporate into the warm raspberry base using an immersion blender. Drop the mixture into cold vegetable oil, allowing 5-10 minutes to fully set. Transfer pearls to cool water to rinse, and then drain.

Michael Laiskonis via  
[http://michaellaiskonis.typepad.com/main/files/raspberry\\_pearls.pdf](http://michaellaiskonis.typepad.com/main/files/raspberry_pearls.pdf)

### Chocolate ganache

260 g dark chocolate (70%), chopped  
310 g heavy cream  
200 g water  
1.5 g agar agar (0.19%)  
20 g glucose syrup  
1 g salt  
2 g (1 sheet) gelatin, bloomed (0.25%)

Add agar agar, glucose and salt to water and bring to boil while stirring. Leave to simmer for 2-3 min. In a separate pan carefully heat cream. Once it has boiled, remove from heat and gradually incorporate into the chocolate. Follow with the agar agar mixture. Add the gelatin and transfer to a flexible silicon mold. Freeze for at least 2 hours.

Michael Laiskonis via  
<http://michaellaiskonis.typepad.com/main/2008/03/bread-and-choco.html>

### Vinaigrette-style salad dressing

7% spirit vinegar 12.5%  
sugar 9.5%  
salt 3.2%  
iota carrageenan 0.3%  
xanthan 0.15%  
chopped spice pieces 1.0%  
color  
preservative  
water to 100%

Mix and serve.

*CRC Handbook of hydrocolloids*

### Dessert jelly

water 80%  
sugar 15%  
citric acid 2.5%  
tripotassium citrate 2%  
carrageenan 0.25%  
locust bean gum 0.25%  
color and flavor as required

Mix gums with sugar and disperse into hot water. Stir until fully dissolved. Cool to set.

<http://www.cybercolloids.net>

### Pliable chocolate ganache

375 g chocolate (72%)  
1.7 g gelatin; 1 sheet (0.12%), bloomed  
50 g water  
100 g sorbitol  
3 g agar (0.20%)  
50 g glucose  
900 g heavy cream  
2 g salt

Place chocolate in large bowl. In a medium saucepan, bring water, sorbitol and agar to boil, whisking constantly. Squeeze out water of bloomed gelatin sheet and add with glucose to saucepan. Bring to boil again. Add cream and salt and stir to combine. Strain half of hot mixture through chinois over chocolate and stir continuously until chocolate melts completely. Add remaining cream mixture and stir to combine. Pour ganache into sheet tray lined with acetate. Leave to set for 1 hour in fridge. Cut into strips of desired size, twist them and serve.

*Grant Achatz in Alinea*

### Loukoums chew (Turkish delight)

100 g sugar  
150 mL fruit juice  
75 mL glucose syrup  
15 mL lemon juice  
2 g of agar and tara in a 70:30 ratio (0.6%)

*For molds*  
2 T vegetable oil

*For coating*  
1 T glucose  
1 t gum arabic  
25 mL water

Disperse agar and tara in two thirds of fruit juice. Heat to boil and set aside to cool. Don't let the solution set!

Dry blend the remaining powders. Pour into a saucepan, add remaining juice and heat to boil while stirring well. Once all is blended, remove from fire and mix from time to time

Put agar and tara solution on heat to melt then pour onto other solution. Add lemon juice. Flavor or color may be added to taste. Mix well and pour into molds or onto mold's greased surface

Leave solution to dry for at least 4 hours or even overnight. Cut into pieces.

Dissolve the Gum Arabic in the water. Dip the pieces into the solution using a clean needle then sprinkle sugar onto them. Leave in a

warm and aerated place to dry off for a few days.

For variation, replace agar/tara by other combinations of gums :

1-2 g agar/tara, 70:30 ratio  
1-2.5 g carrageenan/tara, 70:30 ratio  
3-5 g xanthan/tara, 50:50 ratio  
0.5-1 g konjac/carrageenan, 20:80 ratio  
1-4 g konjac/carrageenan, 60:40 ratio

<http://www.gastronomie.kalys.com>

### Fig cylinders

*Caramelized fig purée*  
65 g granulated sugar  
200 g fig pulp  
25 g water  
zest of one orange  
50 g cinnamon jalapeño syrup

*Fig cylinders*  
50 g orange juice  
75 g water  
0.8 g high acyl gellan (0.21%)  
0.7 g low acyl gellan (0.19%)  
0.5 g tapioca maltodextrin (0.13%)  
250 g caramelized fig purée

Caramelized fig purée: In a non-reactive sauté pan, caramelize sugar over high heat. Just as sugar begins to color, add fig pulp, and water. Stir to combine. Lower heat to medium and continue cooking until liquid is absorbed. Stir in syrup and remove from heat. Purée with an immersion blender and reserve warm.

Fig cylinders: Combine orange juice, water, gellans, and maltodextrin and blend well with an immersion blender, about two minutes. Transfer mixture to a small sauce pan and heat just until boiling. Quickly combine with the reserved fig purée and once again mix with an immersion blender. Into five prepared cylinders (20 mm diameter by 145 mm length), pipe the mixture, tapping the forms to reduce the chance of air pockets. Allow to chill and set before removing from forms and slicing.

*Michael Laiskonis via*  
<http://michaellaiskonis.typepad.com/main/2008/07/reconfigure.html>

### Flexible foie gras

xanthan:konjac (30:70 ratio) 0.65%  
foie gras terrine  
egg yolk  
water

Melt foie gras terrine into liquefied fat, mix in xanthan and konjac, and then a small amount of water and an egg yolk. Spread the mixture



on a sheet, chill, cut into strands and tied into knots.

*Wylie Dufresne via <http://www.iht.com>*

### Hot transparent savory mousse

600 mL water  
4.2 g carrageenan (0.7%)  
0.4 g konjac (0.07%)  
3 g maltitol  
0.2 g xanthan (0.03%)  
1 soup cube or 80 g meat juices or juices  
from a meat dish with a bouquet garni

Mix all dry ingredients (except xanthan) and add liquids. Heat all ingredients to close to boiling point (80 °C) for a few minutes. Use power blender to avoid lumps. Strain if using herbs. Leave solution to set. Blitz the gel in a mixer with the pinch of xanthan. The gel will yield some water so you don't have to add any.

Strain through a mesh size suitable for the nozzle and pour into dispenser. Use 1 to 2 gas canisters following makers guidelines.

This mousse will be quite heat resistant and can be served hot or warm (40-50 °C max.).

By changing slightly the amounts of xanthan, you can easily modify viscosity and texture to get the best mousse.

*<http://www.gastronomie.kalys.com>*

### Passion fruit sabayon

350 g passion fruit purée  
160 g sugar  
vanilla pod, seeds  
2 g xanthan (0.36%)  
50 g water  
1.5 g methyl cellulose (0.27%)  
passion fruit seeds

Grind xanthan with some sugar and disperse together with methyl cellulose in water. Leave to hydrate over night. Blend passion fruit purée, sugar and hydrocolloid mix. Transfer to serving sized dish. Heat in microwave at 600 W for 20 s. Garnish with passion fruit seeds.

*Heiko Antoniewicz and Klaus Dahlbeck in [Verwegen kochen](#)*

### Soft gel noodles

flavored base, soup or broth  
agar (0.4%)  
locust bean gum (0.25%)  
xanthan (0.2%)

Disperse hydrocolloids in cold water with immersion blender. For easier dispersion the hydrocolloids can be grinded with some sugar in a mortar prior to dispersion. Bring to boil. Fill

straws or tubes with hot solution and leave to set in a cold water bath. Eject the noodles and heat under a lamp. The noodles are soft, palatable and heat resistant, but there is some syneresis.

*Chad Galliano via <http://chadzilla.typepad.com/chadzilla/2008/11/soft-gel-noodles.html>*

### Martini sorbet

240 mL vermouth  
3.5 g agar (0.7%)  
240 mL gin  
0.9 g xanthan (0.2%)

Place vermouth and agar in a pot on high heat. Stir until all of the agar has dissolved. Take off of heat. Add gin and xanthan and stir until completely dissolved. Place in freezer until frozen with the texture of a sorbet. Serve with olive caviar (see recipe in the "Gelatin" section).

*Jamie Boudreau via <http://spiritsandcocktails.wordpress.com>*

### Mint pudding

700 g water  
6 g agar (0.5%)  
200 g glucose  
200 g sugar  
100 g mint leaves  
6 g xanthan (0.5%)  
2 g calcium ascorbate

Bring water and agar to a boil, whisking constantly. Add glucose and sugar and return to boil. Transfer to blender, add mint and blend on high speed for 3 min. Strain through chinois and refrigerate for about 2 hours or until set. Transfer to blender and blend until broken up. With blender running on high speed, add xanthan and calcium ascorbate and blend until smooth and creamy. Transfer to squeeze bottle and refrigerate.

*Grant Achatz in [Alinea](#)*

### Caviar using cold oil technique

375 g vegetable or fruit juice, strained  
sugar to taste  
3.7 g agar (1%)  
0.4 g locust bean gum (0.1%)  
2 L bottle of rapeseed/canola oil

Put oil in freezer over night. Mix all the powders together and whisk into the juice as it comes to the boil. Remove from the heat. Pour cold oil into a narrow but deep bowl. Allow juice to cool slightly. Sieve to remove any gumminess, transfer to squeeze bottle and drip mix into oil. The droplets solidify upon contact with the cold oil, forming spheres that sink to the bottom. To collect spheres, pour oil through

sieve. Submerge in cold water to remove excess oil.

Sam Mason

### Sour mix with a twist

300 g water  
100 g lemon juice  
100 g lime juice  
3 g salt  
6.5 g methyl cellulose (1.0%), Methocel F150  
1.0 g xanthan (0.15%)  
150 g simple syrup

Combine water, lemon juice, lime juice and salt in a blender. Turn the blender on low and gradually increase the speed to medium. Sprinkle in the methyl cellulose and xanthan and shear in the blender for 30 seconds until the powders are full dispersed. Chill the mixture to 10 °C. Stir in the simple syrup. The sour mix can be whipped to soft peaks using a stand mixer fitted with a whisk or an immersion blender with a whisk attachment. Incorporate the whipped sour mix into your favorite drink recipe.

Aki Kamoza and H. Alexander Talbot via  
[http://www.ideasinfood.com/ideas\\_in\\_food/2008/07/sour-mix-with-a-twist.html](http://www.ideasinfood.com/ideas_in_food/2008/07/sour-mix-with-a-twist.html)

### Lemon whip

lemonade  
salt  
xanthan  
methyl cellulose (1.25%), SG A16

Weigh out fresh lemonade and add salt to taste. Thicken with xanthan to almost the consistency of heavy cream. Whisk in methyl cellulose. Whip at high speed for 15 min. There is a 4-fold increase in volume.

Chad Galliano via <http://chadzilla.typepad.com>

### Fluid gel (basic recipe)

185 g liquid flavor base  
2 g agar (1.1%)  
0.35 g xanthan (0.19%)

Blend agar and xanthan into base. Place in a saucepan and bring to a boil. Allow to cool until solidified. Place solid gel in a blender and blend until creamy.

<http://www.playingwithfireandwater.com>

### Flavored agar cream

1.5 g agar (0.7%)  
120 mL liquid cream (or full fat milk)  
30 mL milk  
1 t angelica liqueur

30 g absinthe cordial  
1 g xanthan (0.5%)  
40 g water

Heat dairy ingredients with agar till boiling then after a couple of minutes cut off the heat. Pour into a large bowl and leave to set in refrigerator for 1-2 hours. Turn gel out and cut in pieces. Fill blender and blitz into cream.

Add liqueur, cordial, pinch of xanthan and water (a teaspoon at a time to check texture). Whisk to beat in as much air as possible.

<http://www.gastronomie.kalys.com>

### Dessert jelly

500 g water  
90 g sugar  
10.2 g gelatin (1.7%), type B, 240 Bloom  
2.3 g citric acid anhydrous  
1.6 g tri sodium citrate dihydrate  
0.35 g low acyl gellan (0.06%)  
color and flavor as required

Blend all the dry ingredients. Heat the water to boiling and dissolve blend into the hot water by stirring for 1–2 minutes. Deposit and chill.

CRC Handbook of hydrocolloids

### Ravioli filled with mango mousse

1 ripe mango  
200 g mango purée  
3.5 g gelatin (~0.9%)  
2 shoots of a young pine (the very tender, fresh leaves)  
3.5 g of methyl cellulose (~0.9%)  
lemon juice  
rose leaves

Cut the mango into fine (maximum 1 mm) sheets. Mix the mango purée with the shoots of the pine (cut into fine pieces). Divide the mango purée into two parts. The first part is heated to 40 °C and mixed with the gelatin. The second part is kept cool and mixed with the methylcellulose. Beat the 2 parts together into a light foam. Fold the mango sheets into 4 to form like little cornets. Fill the cornets with the mango foam. Dress the cornets on a plate together with the yoghurt beads (see recipe in "Sodium alginate" section), some mango coulis, leaves of roses and shoots of pine.

Sang Hoon Degeimbre via <http://foodfordesign.blogspot.com>

### Hummus gnocchi

300 g smooth hummus, room tempered  
75 g water  
3.75 g methyl cellulose (1%) SGA150  
3.75 g gelatin (1%), bloomed

Bring the water to a boil, remove from the heat and whisk in the methocel to disperse it. Add the drained bloomed gelatin to the methocel water, then mix this mixture into the hummus. Once the two mixtures are fully combined, cool the mixture completely in an ice bath. When the mixture is ice cold, place it in a pastry bag with a one centimeter tip. Bring a pot of water to a boil, season with salt and turn down the heat so the water just simmers. Squeeze the hummus mixture into the water, cutting of two centimeter sections with a knife. The gnocchi will float and be firm to the touch when they are set. The gnocchi must be used warm.

*Kamozawa and Talbot via <http://ideasinfood.typepad.com>*

### Green tea noodles

120 g strong green tea  
1 g agar (0.8%)  
2 g gellan (1.6%)  
3 g sugar  
vegetable stock

Bring green tea to boil, whisk in agar, gellan and sugar. Bring to boil again. Pour onto silpat or tray laid out with plastic foil. Leave to set and cut into noodles. Heat noodles in vegetable stock and serve. The agar serves to make the noodles more elastic upon heating.

*Rolf Caviezel in Molekulare Küche*

### Gluten free flour

2.4 g xanthan (1.6%)  
1.2 g guar gum (0.8%)  
75 g soy flour  
75 g rice, potato or corn flour

Mix and use as normal flour.

*Adapted from The Kitchen Hand by Anthony Telford*

### Milk pudding

1000 mL milk  
100-200 g sugar  
2-3 g carrageenan (1.7-2.5%)  
1-2 g guar gum (0.8-1.7%)  
pinch of potassium salt  
flavor as desired (e.g. orange, limette)

Mix hydrocolloids with sugar. Add to milk and heat to 70 °C. Add flavor. Pour into mold or individual ramekins (lined with caramelized sugar if desired) and leave to set.

*<http://www.chefsimon.com>*

### Warm chocolate coffee mousse

*Methyl cellulose base*  
100 mL milk  
100 g muscovado sugar

100 g cocoa seeds, roasted  
100 g granulated coffee  
7 g methyl cellulose (1%)

#### *Gelatin base*

300 mL milk  
12 g gelatin (1.7%)

Methyl cellulose base: Bring 100 mL milk to boil with sugar and add cocoa seeds and coffee. Strain. Purée the infusion with methylcellulose following instructions for hydration. Bring to 80-90 °C, then rapidly chill to 4 °C.

Gelatin base: Warm the remaining 300 mL milk to dissolve gelatin and reserve at 35 °C.

Begin whipping methylcellulose base in mixer, slowly adding gelatin base and making a stable mousse. Freeze in molds, unmold, and warm to order in the salamander.

*Will Goldfarb via <http://www.starchefs.com>*

### Soft chocolate gel

240 mL water  
240 mL heavy cream  
120 g bittersweet chocolate (60% cocoa)  
50 g granulated sugar  
1 g iota carrageenan (0.15%)  
20 g low methoxyl pectin (3%)

Disperse carrageenan into cold water. Heat cream carefully in a pan and add sugar, stirring to dissolve. Pour the hot cream over chocolate to melt. Stir a little. Add dispersed carrageenan and whisk gently to avoid formation of bubbles. Bring the mixture to boil and whisk in the pectin. Let boil for about 30 seconds until it starts to thicken and immediately pour through a fine meshed sieve to get rid of bubbles. Pour into 20 x 20 cm pan lined with plastic wrap. Let cool a little and cover with plastic wrap. Allow to set in a fridge for a couple of hours. Slice in long thin strips, twist and place them on plates for serving.

*David Barzelay <http://www.eatfoo.com>, adapted from Alex Stupak*

### Chocolate flan

water 74.1%  
sugar 10%  
skimmed milk powder 10%  
cornstarch 3%  
10% alkalized cocoa 2.5%  
kappa carrageenan 0.4%

Mix all ingredients. Add chocolate flavor and color as required.

*<http://www.cybercolloids.net>*

### **Tortenguss (German cake glaze)**

water or fruit juice 91%  
sugar 5%  
starch 3%  
carrageenan 0.8%  
potassium citrate 0.2%

Mix all ingredients together, stir with heating until you reach a low simmer. Simmer for one minute. Add color and flavor as required.

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<http://www.cybercolloids.net>

### **Marshmallow foam**

250 mL bottled water  
1.5 g xanthan gum (0.2-0.3%)  
1.5 g methyl cellulose (0.2-0.3%), F50  
dash of vanilla  
dash of salt  
250-400 g confectioner's (powdered) sugar

Disperse methyl cellulose in 125 mL water and leave over night in refrigerator to allow complete hydration. Mix xanthan with some of the powdered sugar (to avoid lumping) and disperse in 125 mL with immersion blender. Combine methyl cellulose and xanthan mix in the bowl of a large mixer (7 L) with a whisk. Add vanilla and salt and turn speed to medium. Once soft peaks form, add sugar a little at a time. Notice how the foam becomes more dense and elastic (texture is something in between marshmallow fluff and canned vanilla frosting). Foam can be spooned out for serving. The foam can be caramelized just like "real" marshmallows.

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*Adapted from <http://chef531.wordpress.com/2008/03/10/marshmallows/>*

# Non-hydrocolloid foams

## Spinach espuma

500 g drained and pressed out spinach  
200 mL vegetable or poultry stock  
300 mL heavy cream (33%)  
salt  
nutmeg  
white pepper

Purée the cooled spinach with the cold vegetable or poultry stock very carefully in a mixer and pass through a fine sieve. Add the cream, season to taste and pour into a heat resistant whipper. Charge with nitrous oxide

Tip: Lightly brown 50 g of diced shallots and one chopped clove of garlic, add before puréeing the mixture. Refine with just a few squirts of lemon juice. Try warm spinach espuma: Pour in the ingredients when still hot or heat whipper to around 60 °C.

*iSi North America via <http://www.prairiemoon.biz>*

## Warm potato espuma

600 g boiled potatoes (boil until powdery)  
300 mL whole milk  
100 mL water in which potatoes were boiled  
50 g butter  
salt  
nutmeg

Boil potatoes in salt water until done and pass through a sieve. Mix with hot milk, water in which potatoes were boiled and butter. Season and pour into a heat resistant whipper while warm. Charge with nitrous oxide.

*iSi North America via <http://www.prairiemoon.biz>*

## Potato foam

250 g potatoes, peeled and cut into chunks  
125 mL single cream  
35 mL virgin olive oil, plus extra for drizzling

Place the potatoes in a pan of cold water, bring to the boil, and cook for about 20 minutes until soft. Drain, reserving 100 mL of the cooking water. Place the cooked potato and the water in a blender. Purée, adding the cream little by little. Follow the same procedure with the oil until you have a smooth emulsion. Season with salt. Strain, then fill the siphon using a funnel.

Charge with nitrous oxide, shake, and keep warm in a bain-marie at 70 °C.

*Ferran Adria via <http://www.chubbyhubby.net>*

## Vanilla yogurt parfait

250 mL plain yogurt  
250 mL heavy cream  
2 T vanilla syrup

Fill 0.5 mL whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

*<http://www.isinorthamerica.com>*

## Chocolate mousse

400 g heavy cream  
1-2 t instant coffee  
8 T instant cocoa  
2-3 T cognac/brandy  
confectioners' sugar to taste

Swirl to dissolve all ingredients. Fill 0.5 L whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

*<http://www.isinorthamerica.com>*

## Foamy hot ginger mayonnaise foam

60 g egg yolk (ca. 2 yolks)  
130 g eggs (ca. 2 eggs)  
150 g sunflower oil  
50 g olive oil  
50 g ginger oil  
7 g Dijon mustard  
7 g raspberry vinegar  
7 g salt

Mix all ingredients in a bowl. Pass through strainer and fill 0.5 L whipper. Charge with nitrous oxide. Heat in bain marie to 70 °C. Shake every 15 min to prevent egg from setting.

*Translated from <http://www.kochpiraten.de>*

## Chocolate chantilly

200 mL water  
150-200 g chocolate (> 50% cocoa)

Put the chocolate and water into a pan (or bowl of metal), and immerse it into a larger pan with

water which is gently heated. Stir the chocolate and water mixture occasionally until it forms a uniform mixture. Immerse the pan into a larger pan with cold water and some ice cubes. Whisk the chocolate water mixture until it thickens.

*Hervé This*

### Zabaglione

5 egg yolks  
grated zest of ½ lemon  
a pinch of powdered vanilla  
or a few drops of vanilla essence  
180 g sugar  
200 mL white wine  
100 mL Marsala

Whisk yolks, zest, vanilla and sugar in a basin until thick and pale. Place basin in a bain marie and continue whisking. Add white wine and Marsala, a little at a time. Remove basin from bain marie when the zabaglione is thick and frothy.

*Larousse Gastronomique*

### Vessel 75 with maple syrup foam

#### *Foam*

4 egg whites  
180 mL water  
120 mL maple syrup  
60 mL lemon juice

#### *Drink*

90 mL Bourbon  
3 healthy dashes Peychaud's bitters

Foam: Place all into a ISI canister, charge with nitrous oxide and refrigerate.

Drink: Stir in mixing glass, strain into rocks glass, top with maple syrup foam, garnish with orange zest.

*Jamie Boudreau via <http://www.smallscreennetwork.com>*

### Marshmallow fluff

3 egg whites  
2 cups light corn syrup  
1/2 teaspoon salt  
2 cups icing sugar (confectioner's)  
1 tablespoon vanilla extract

In a large bowl, combine egg whites, corn syrup and salt; beat with mixer in high speed for 10 minutes or until thick. Add in icing sugar; beat on low speed until blended. Beat in vanilla until blended. Use this in any recipe called for marshmallow creme. The fluff may be frozen for later use or kept in a refrigerator for 1 week.

Make sure to stir well with a spoon before use after freezing or refrigerating.

<http://www.recipezaar.com/75813>

### Egg white foam (Troll cream)

1 egg white  
80 g sugar  
200 mL berries (blueberries, cranberries, etc.)

Whisk egg white until soft peaks form. Add sugar while still whisking. Fold in berries and serve as dessert.

<http://peppernet.no>

### Vauquelin

1 egg white  
150 mL fruit syrup (e.g. blueberry)

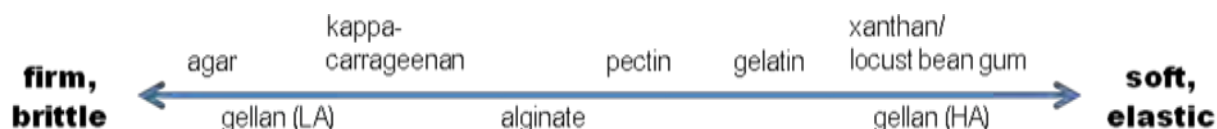
Whisk egg white, preferably in a metal or glass bowl. Slowly add syrup while still whisking. One egg white yields approximately 2 L of foam. Spoon out portions and set foam in microwave at 3-400 W for a couple of seconds.

*Adapted from Hervé This*

# Appendix

## Comparison of gel texture in common gelling agents

(adapted from "CRC Handbook of hydrocolloids")



## Volume-weight conversion of hydrocolloids

Name	Density (g/mL)	mL/g	g/teaspoon (5 mL)	g/tablespoon (15 mL)
Agar	0.48	2.1	2.4	7.2
Calcium gluconate	0.62	1.6	3.1	9.3
Calcium lactate				
Cornstarch	0.64	1.6	3.2	9.6
Gellan gum	0.39	2.6	1.9	5.8
Guar gum				
Iota carrageenan				
Kappa carrageenan				
Lecithin	0.46	2.2	2.3	6.9
Locust bean gum				
Maltodextrin	0.42	2.4	2.1	6.3
Methyl cellulose	0.27	3.7	1.3	4.0
Mono/diglyceride				
Pectin	0.68	1.4	3.4	10.3
Sodium alginate	0.69	1.4	3.5	10.4
Sodium citrate				
Sucrose esters of fatty acids				
Xanthan gum	0.69	1.4	3.5	10.4

You can help fill out the table by measuring the densities of hydrocolloids and reporting them back to [webmaster@khymos.org](mailto:webmaster@khymos.org). More info about this on <http://blog.khymos.org/2008/04/30/help-needed-with-densities-of-hydrocolloids>.

## texturePro measuring spoon-weight conversions

Name	texturePro name	1 texturePro measuring spoon equals approximately
Agar	Agazoon	0.1 g
Gellan	Gellazoon	0.9 g
Iota	lotazoon	0.3-0.4 g
Methyl cellulose	Celluzoon	0.5 g
Xanthan	Xanthazoon	0.5 g
Sodium alginate	Algizoon	0.8 g

Conversions are based on recipes found in *Verwegen kochen* by Heiko Antoniewicz and Klaus Dahlbeck.

## Synergies

Hydrocolloids (ratio or percentage)	Effect/texture
high methoxyl pectin + sodium alginate	gel formation at lower solid contents and pH < 3.8
iota carrageenan + starch	gives gels which are four times stronger than with starch alone
kappa carrageenan (0.6%) + konjac (0.4%)	strong, elastic gels (konjac interacts more strongly with kappa carrageenan than locust bean gum)
kappa carrageenan + locust bean gum (maximum gel strength at 65:35, lower syneresis at 20:80)	elastic gels with low syneresis when cooled below 50-60 °C
methyl cellulose + starches	increased viscosity, better water binding
xanthan (0.6%) + konjac (0.4%)	strong gel
xanthan (1%) + konjac (0.02-0.03%)	viscosity of xanthan is raised 2-3 times upon heating
xanthan + guar gum	increased viscosity, strong and elastic gel
xanthan + locust bean gum	increased viscosity, strong and elastic gel

## List of common chemicals

Popular name	Synonyms	Formula	CAS	E-number
calcium chloride	calcium(II) chloride, calcium dichloride	CaCl <sub>2</sub>	[10043-52-4]	E509
calcium gluconate	calcium (2 <i>R</i> ,3 <i>S</i> ,4 <i>R</i> ,5 <i>R</i> )- 2,3,4,5,6-pentahydroxyhexanoate	C <sub>12</sub> H <sub>22</sub> CaO <sub>14</sub>	[299-28-5]	E578
calcium lactate	calcium 2-hydroxypropanoate	C <sub>6</sub> H <sub>10</sub> CaO <sub>6</sub>	[814-80-2]	E327
carbon dioxide		CO <sub>2</sub>	[124-38-9]	E290
citric acid	2-hydroxypropane-1,2,3-tricarboxylic acid	C <sub>6</sub> H <sub>8</sub> O <sub>7</sub>	[77-92-9]	E330
cream of tartar	potassium bitartrate, potassium hydrogen tartrate	KC <sub>4</sub> H <sub>5</sub> O <sub>6</sub>	[868-14-4]	E336
glycerol	glycerine, glycerin, propane-1,2,3-triol	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	[56-81-5]	E422
isomalt		C <sub>12</sub> H <sub>24</sub> O <sub>11</sub>	[64519-82-0]	E953
lime	pickling lime, calcium hydroxide	Ca(OH) <sub>2</sub>	[1305-62-0]	E526
nitrous oxide	dinitrogen oxide	N <sub>2</sub> O	[10024-97-2]	E942
potassium citrate	tripotassium citrate	C <sub>6</sub> H <sub>5</sub> K <sub>3</sub> O <sub>7</sub>	[866-84-2]	E332
potassium phosphate	potassium dihydrogenphosphate	KH <sub>2</sub> PO <sub>4</sub>	[7778-77-0]	E340
sodium citrate	trisodium citrate, trisodium 2-hydroxypropane-1,2,3-tricarboxylate	Na <sub>3</sub> C <sub>6</sub> H <sub>5</sub> O <sub>7</sub>	[68-04-2]	E331
sorbitol	(2 <i>R</i> ,3 <i>S</i> ,4 <i>S</i> ,5 <i>S</i> )-hexane-1,2,3,4,5,6-hexol	C <sub>6</sub> H <sub>14</sub> O <sub>6</sub>	[50-70-4]	E420



### Conversion table for brand names

Name	Texturas	CP Kelco	texturePro <sup>d)</sup>	Sosa <sup>d)</sup>
Agar	Agar		Agazoon	
Calcium chloride	Calcic			Clorur/Gelesfera B
Calcium gluconate	Gluco <sup>a)</sup>			Gluconolactat <sup>a)</sup>
Calcium lactate			Calazoon	
Gellan gum		Kelcogel	Gellazoon	
- low acyl	Gellan	Kelcogel F		
- high acyl		Kelcogel LT 100		
Guar gum			Guarzoon	
Iota carrageenan	Iota	Genuvisco	lotazoon	
Kappa carrageenan	Kappa	Genu Texturizer		
Lambda carrageenan		Genuvisco		
Lecithin	Lecite			Soya lecithin Gelespuma <sup>b)</sup>
Locust bean gum		Genu Gum	Locuzoon	
Maltodextrin	Malto			Maltosec
Methyl cellulose	Metil	Cekol	Celluzoon	Metilgel
Mono/diglyceride	Glice			Emulsifying paste
Pectin		Genu		GelGras
Sodium alginate	Algin		Algizoon	Gelesfera A
Sodium citrate	Citras			Kit pH
Sucrose esters of fatty acids	Sucro			
Xanthan gum	Xantana	Keltrol	Xanthazoon	Gelespessa <sup>c)</sup>

a) A mixture of calcium gluconate and calcium lactate

b) A mixture of lecithin, glucose, potassium phosphate and silica

c) A mixture of xanthan and maltodextrin

d) It seems as if all texturePro and many of the Sosa products are blended with maltodextrin. This helps dispersion and may also allow the use of a measuring spoon as the volume increases. Measuring spoon-weight conversions for some of the texturePro products are presented in a separate table (page 71). Where the exact blending ratio is not known, these products can not be used with the recipes in this collection.

### Gelatin gels with alcohol

Alcohol in dish (%)	Suggested amount of gelatin (%) *
0	1
5	1.8
10	2
15	2.2
20	2.4
30	2.8

\* The experiment was conducted with a powdered, 180 bloom gelatin. The concentrations give gels of approximately the same gel strenght for the different ethanol/water mixtures. Notice that alcohol can influence the melting temperature. Added sugar will increase the gel strength. The range 5-15% has been tested. Values for 15-30% are extrapolated. For gels with > 30% alcohol it is recommended to check the gel properties before serving.

### Gelatin and bloom strength

<b>Name</b>	<b>Bloom strength</b>	<b>Grams pr. sheet</b>
Bronze	125-155	3.3
Silver	160	2.5
Gold	190-220	2.0
Platinum	235-265	1.7

### Formula for conversion of bloom strengths

The required mass of gelatin B can be calculated if the mass of A is known as well as the bloom strengths of gelatin A and B.

$$\text{massB} = \text{massA} \times \frac{\text{bloomstrengthA}}{\text{bloomstrengthB}}$$

Sources on the net (see <http://forums.egullet.org/index.php?showtopic=85599>) site a formula where mass A is multiplied with the square root of (bloom strength A/bloom strength B). However, the formula fits better with the data given for gelatin sheets in the table above when the square root is omitted.

### Miscellaneous

nitrous oxide = dinitrogen oxide = N<sub>2</sub>O = cream charger

carbon dioxide = CO<sub>2</sub> = soda charger

t = tea spoon = 5 mL

T = table spoon = 15 mL

1 egg ≈ 55 g

1 egg white ≈ 40 g ≈ 5 g egg white powder + 35 g water

1 egg yolk ≈ 15 g

### Comparison of hydrocolloid properties

Name	agar (E406)	carrageenan (E407) iota type	carrageenan (E407) kappa type	cornstarch	gelatin (E441)
Origin	polysaccharide obtained from red algae (several species)	polysaccharide obtained from red seaweed	polysaccharide obtained from red seaweed.	polysaccharide extracted from maize/corn	protein obtained from collagen in animals
Properties, texture	thermoreversible, heat resistant, brittle gel; high hysteresis	thermoreversible, soft, shear-thinning, elastic gel with calcium	thermoreversible, firm, brittle gel with potassium	thermoirreversible thickener	thermoreversible, soft, elastic gel; melts in mouth
Clarity	clear to semi-opaque		clear/slightly turbid	opaque	clear, transparent
Dispersion	in cold or hot water	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water	bloom in cold water.
Hydration (dissolution)	> 90 °C; heating to boil necessary for gelling.	> 70 °C; for high sugar concentrations: add sugar after hydration.	> 70 °C	62-72 °C	~50 °C
pH	2.5-10	4-10	4-10		4-10
Setting	35-45 °C, rapid (minutes)	40-70 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.	30-60 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.	thickens when heated > 70 °C	< 15 °C, slow (hours)
Melting	80-90 °C%	5-10 °C above setting temperature (unless mixed with starch)	10-20 °C above setting temperature (unless mixed with certain proteins)		25-40 °C
Promoter	sugar; sorbitol and glycerol improve elasticity.	calcium yields soft and elastic gels	potassium, milk protein		transglutaminase (1-3%), milk, sugar, low alcohol conc.
Inhibitor	tannic acid (counteracted by add. of glycerol); prolonged heating at pH outside the range 5.5-8	hydrolysis of solution at low pH with prolonged heating; gels are stable	salts; hydrolysis of solution at low pH with prolonged heating; gels are stable	pH around 2-3 lowers viscosity	salts; acids; prolonged heating; proteases in fresh kiwi, papaya, pineapple, peach, mango, guava, fig; high alcohol conc.; tannins can cause precipitation
Tolerates	salt, sugar, alcohol, acid, proteases	salt			alcohol up to ~40%
Viscosity of solution	low	medium	low	high once fully hydrated	low
Typical concentration	0.2% will set, 0.5% gives firm jelly, [0.24-3%] *	1-1.5% for gel [0.02-1.5%]	1.5% for gel [0.02-1.5%]	[0.4-10.4%]	0.5-1.5% for espumas; 0.6-1.7% for gels; [0.12-7.9%]
Synergies	locust bean gum (only with certain agar types)	starch	locust bean gum (increased elasticity, improves clarity, reduced syneresis), konjac, tara, milk protein		
Syneresis	yes (can be prevented by replacing 0.1-0.2% agar with locust bean gum)	no	yes		

\* Concentrations in [square brackets] show range exemplified in this collection.

Table continued on next page

<b>Name</b>	<b><i>gellan (E418) low acyl (LA)</i></b>	<b><i>gellan (E418) high acyl (HA)</i></b>	<b><i>guar gum (E412)</i></b>	<b><i>konjac glucomannan (E425)</i></b>	<b><i>locust (carob) bean gum (E410)</i></b>
Origin	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide extracted from the seeds of the legume <i>Cyamopsis tetragonolobus</i>	polysaccharide extracted from the tuber <i>Lasioideae Amorphophallus</i>	polysaccharide extracted from the seeds of the legume <i>Ceratonia siliqua</i>
Properties, texture	<i>thermoirreversible</i> , hard, brittle gel; sodium/potassium ions give <i>thermoreversible</i> gels	<i>thermoreversible</i> , soft, elastic gel; thickener if not heated	very stable, quick acting thickener, suitable for suspending particles	shear-thinning viscous sol. with fatty mouth feel; <i>thermoreversible</i> elastic gels w. xanthan/kappa carrageenan; <i>thermoirreversible</i> gels at pH 9-10	thickener, often used in ice cream; elastic gel in 1:1 ratio with xanthan
Clarity	transparent	opaque	transparent	transparent	
Dispersion	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water, d. is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water; d. can be improved by mixing with sugar or flour (3-5x).	cold water; d. can be improved by mixing with sugar (3-5x).
Hydration (dissolution)	90-95 °C; keep pH > 3.9; add sugar after hydration; inhibited in presence of sodium and calcium, but 0.1-0.3% sodium citrate helps	85-95 °C; can be hydrated at pH < 4; less sensitive to ions; add sugar after hydration	cold or hot water	cold water with continuous stirring for at least 2h	> 90 °C
pH	4-10	3-10	4-10	~3-10	
Setting	10-60 °C, rapid (minutes)	70-80 °C			
Melting	does not melt	70-80 °C		w. xanthan: yes, alkaline gels: no	
Promoter	gelling promoted by calcium, magnesium, sodium, potassium and acids	gelling is not sensitive to ions		xanthan, kappa carrageenan	will only gel in presence of agar, kappa carrageenan or xanthan
Inhibitor	will not hydrate at pH < 3.9 or with sodium/calcium salts present		low pH	viscosity decreases with decreasing pH; gelling occurs at higher pH.	
Tolerates		salts, acidic foods	salt and sugar	salt, acidic foods	
Viscosity of solution	low	high	high in cold low in hot	low temperature: high high temperature: lower	low temperature: high highest viscosity obtained > 60 °C
Typical concentration	0.4-0.7% for gels (self supporting from 0.05%); [0.03-2.6%]	0.4-0.7% for gels (self supporting from 0.2%); [0.03-2.6%]	0.2-0.5% (very sticky solutions above 1%)	0.1-0.3% for viscous solutions	0.1-1.0%
Synergies			locust bean gum, xanthan	xanthan, kappa carrageenan, locust bean gum	xanthan, kappa carrageenan
Syneresis	no (if left untouched)	no			

Table continued on next page

<b>Name</b>	<b>methyl cellulose (E461)</b>	<b>pectin (E440) low methoxyl (LM)</b>	<b>pectin (E440) high methoxyl (HM)</b>	<b>sodium alginate (E401)</b>	<b>xanthan (E415)</b>
Origin	a modified polysaccharide derived from cellulose rich plants.	polysaccharide derived from citrus peel and apple pomace.	polysaccharide derived from citrus peel and apple pomace.	polysaccharide extracted from brown algae.	polysaccharide obtained by fermentation of <i>Xanthomonas campestris</i>
Texture	thermoreversible soft elastic gel when heated; helps form and stabilize foams when cold	thermoreversible gels	thermoirreversible gels	thermoirreversible gel in presence of calcium ions; shear-thinning thickener in absence of calcium	high viscosity, shear-thinning; thermoreversible soft elastic gels w. locust bean gum or konjac
Clarity		clear, transparent	clear, transparent	clear, transparent	clear, mostly transparent
Dispersion	hot or cold water, use slow speed to avoid foaming; mix with small amount of hot water to avoid lumps and stir into the rest of the cold water	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x); add. of acidic liquids may cause precipitation of alginic acid	cold or hot water; d. can be improved by mixing with sugar (10x) or glycerol, alcohol or vegetable oil.
Hydration (dissolution)	cold water, leave over night; add salt after complete hydration	cold or hot water	cold or hot water; will not dissolve if > 25% sugar	cold or hot water; if cold, allow to hydrate for a couple of hours	cold or hot water; does not hydrate at high sugar concentrations (>65%).
pH	2-13	2.5-5.5	2.5-4	2.8-10	1-13
Setting	gels when heated to 50-60 °C		40-85 °C (depending on pH and degree of methoxylation)	independant of temp.	
Melting	melts below the setting temperature	yes	no	no (but prolonged heating at low/high pH will destabilize gel)	
Promoter	alcohol rises setting temperature	requires calcium ions for gelling; can gel in presence of milk (0.6-0.9% pectin required)	requires acidity (pH < 3.5) and high sugar contents for gelling (60-80% soluble solids, mainly sugar)	requires calcium for gelling	
Inhibitor	salt lowers setting temperature	high sugar concentrations, low pH		pH < 4 (is corrected by addition of sodium citrate); gels at too high ion/salt concentrations	
Tolerates	acids, bases			up to ~50% ethanol (d. and hydrate in water before addition of alcohol)	acids/bases, salts, heating, enzymes, up to 60% ethanol
Viscosity of solution	low when cold, high when hot	low	low	low in neutral water, high at lower pH	high (independent of temperature)
Typical concentration	1-2% for gels; [0.26-3.4%]	[0.15-3.1%]	[0.15-3.1%]	0.5-1% for normal spherification; [0.3-5%]	0.25% thin running sauce, 0.7-1.5% thick sauces, 0.5-0.8% foams; [0.08-0.85%]
Synergies					guar, locust bean gum, konjac
Syneresis	yes	yes	yes	yes	

# Glossary

**Dispersion** A mixture of two components that are non-miscible. For hydrocolloids in particular it is often the case that they do not hydrate (or dissolve) instantly, and that hydration is associated with swelling which easily causes lumping. It is therefore necessary to disperse hydrocolloids in water. This can be done with an immersion blender, a conventional blender or by grinding/mixing the hydrocolloid with a helping agent such as sugar, oil or alcohol prior to dispersion in water. Refer to table on page 75 for details.

**Emulsion** A mixture of two immiscible liquids where one (the dispersed phase) is dispersed in the other (the continuous phase). An example includes mayonnaise where oil droplets are dispersed in water which is the continuous phase. Oppositely, in butter water is dispersed in fat. An emulsion is stabilized by surface active components which have a water soluble and a fat soluble end. Lecithin is an example of a compound with such properties.

**Hydration** The process where a hydrocolloid binds to water and becomes fully dissolved. Proper hydration requires that the hydrocolloid first is dispersed, and depending on the hydrocolloid, hydration may occur at lower or higher temperature (see table on page 75 for details).

**Hydrocolloid** A substance that forms a gel in contact with water.

**pH** A measure of the acidity or basicity of a solution. The scale ranges from pH 1 to pH 14. Neutral solutions have pH 7, acidic solutions have pH below 7 and basic solutions have pH above 7. pH is easily measured with an electronic pH meter or special paper strips which are compared with color charts after wetting.

**Shear-thinning** A liquid or gel where stirring or agitation causes a decrease in viscosity. The viscosity is regained when the liquid or gel is left undisturbed.

**Syneresis** The process where liquid is expelled from a gel. This is typically not a desired feature for gels, whereas it is the main principle behind gel filtration (see examples with agar and gelatin in the recipe section).

**Thermoirreversible gel** A gel that does not melt upon heating. Excessive heating however may cause evaporation of the water and collapse of the gel.

**Thermoreversible gel** A gel that melts upon heating and sets upon cooling.

**Viscosity** A measure of the resistance of a fluid against flow. Water has low viscosity.

# References

In addition to the references given for each recipe, the following websites and books have been consulted in the compilation of the recipes and the appendix:

## **Websites**

<http://inicon.net>  
<http://en.gastronomie.kalys.com>  
<http://food.oregonstate.edu/gums>  
<http://www.cybercolloids.net>  
<http://en.wikipedia.org>  
<http://www.texturaselbulli.com>  
<http://www.sosa.cat>  
<http://forums.egullet.org>  
<http://www.cpkelco.com>  
<http://www.foodproductdesign.com>

## **Books**

Belitz, H. D.; Grosch, W.; Schieberle, P. Food chemistry (3<sup>rd</sup> ed.), 2004, Springer.  
Imeson, A. (ed.) Thickening and gelling agents for food, 1999, Aspen publishers.  
McGee, H. On food and cooking – The science and lore of the kitchen (2<sup>nd</sup> ed.), 2004, Scribner.  
Phillips, G. O.; Williams, P. A. (ed.) CRC handbook of hydrocolloids, 2000, Woodhead.

# Suppliers

## Europe

<http://www.bienmanger.com>  
<http://www.buchgourmet.de>  
<http://www.bos-food.de>  
<http://www.cuisine-innovation.fr>  
<http://www.infusions4chefs.co.uk>  
<http://www.jeloshop.de>  
<http://www.gastronomie.kalys.com>  
<http://www.mcc-metropolis.com>  
<http://www.phode.com>  
<http://www.texturaselbulli.com>  
<http://www.texturepro.de>

## Asia

<http://www.ajiusafood.com>

## Australia

<http://www.mfcd.net/depot>

## North America

<http://le-sanctuaire.com>  
<http://parisgourmet.com>  
<http://www.chefrubber.com>  
<http://www.dcduby.com/entertain>  
<http://www.lepicerie.com>  
<http://www.terraspice.com>  
<http://www.thechefstableathome.com>  
<http://www.ticgums.com>  
<http://www.willpowder.net>

## South America

<http://www.passionfoods.biz/>

Updated list available at <http://khymos.org/suppliers.php>.

To be added, please send a link to [webmaster@khymos.org](mailto:webmaster@khymos.org).



# Texture index

## Overview of texture-hydrocolloid combinations represented in recipe collection

X indicates use of single hydrocolloid + indicates use in combination with other hydrocolloids	Agar	Carrageenan	Cornstarch	Gelatin	Gellan	Guar gum	Gum arabic	Konjac	Lecithin	Locust bean gum	Maltodextrin	Methyl cellulose	Pectin	Sodium alginate	Xanthan
	Emulsion	X			X	X				X			X		
Film	X				X							X	X	X	
Fluid gel	+	X+			X			+							+
Foam	X+	X+	X	X+				+	X		X	X+	X		X+
Frozen	+	+	X	X		X			X	+					X+
Gel	X+	X+	X+	X+	X+	X+	X+	+	X	+	+	X+	X+	X	X+
Liquid	X	X+	X	X	X	X				X	X		X		X+
Noodle	X+				X+					+		X			+
Other use	X			X		+	X		X			X	X		X+
Solid			X		X						X		X		
Solid foam				X			X					X	X		X
Spherification	+	X		X	X					+				X	

Know a recipe that fills a "hole"? Let me know at [webmaster@khymos.org](mailto:webmaster@khymos.org).

## List of recipes according to texture and hydrocolloid used

<b>Category</b>	<b>Category includes *</b>
Emulsion	Liquids with a significant proportion of fat/oil
Film	Thin, flexible sheets
Fluid gel	Gels which have been sheared after gelling to yield a purée like texture
Foam	Airs, espumas, fluffed gels, soufflés, whipped cream, mousse, chantilly
Frozen	Ice creams, sorbets, frozen foams
Gel	Gels, jellies, jams, marmalades, lokums, spreads, icings
Liquid	Liquids and thickened liquids
Noodle	Noodles made by gelling in PVC tube, extrusion in setting liquid or cutting/shaping of films
Other use	All recipes not fitting into any of the remaining categories
Solid	Very hard (non-flexible) gels and solids
Solid foam	Marshmallows, frozen foams, meringues, tuiles
Spherification	Calcium and potassium induced gelling (normal/reverse), instant gelling in cold oil or liquid nitrogen

\* Note that the same recipe might appear in several categories

A plus sign (+) after a hydrocolloid means it is used in combination with other hydrocolloids in the listed recipes.

<b>Emulsion</b>	Thin film (brittle, melting)..... 46
<i>Agar</i>	<i>Pectin</i>
Vinaigraite sheets ..... 12	Blackberry yogurt ravioli..... 50
<i>Gelatin</i>	Raspberry sheets ..... 50
Kientzheim butter foam.....28	<i>Sodium alginate</i>
Olive oil gummy bears .....26	Thin film..... 56
<i>Gellan</i>	<b>Fluid gel</b>
Olive oil gelatin .....33	<i>Agar+</i>
<i>Lecithin</i>	Flavored agar cream..... 66
Emulsified vinaigrette .....39	Fluid gel (basic recipe)..... 66
Orange air with olive oil .....40	<i>Carrageenan</i>
<i>Methyl cellulose</i>	Chocolate foam, chantilly and dessert..... 14
Olive oil soba noodles .....45	<i>Carrageenan+</i>
<i>Xanthan</i>	Mint jelly, sauce and foam ..... 63
Balsamic vinegar dressing.....60	<i>Gellan</i>
Fruit pureé mayonnaise.....60	Almond fluid gel ..... 32
Iberian ham cream.....59	Fluid gel for beverages ..... 31
<b>Film</b>	Pomegranate and vodka fluid gel ..... 32
<i>Agar</i>	Pulp suspension beverage (fluid gel)..... 31
Cold cod-fish salad with agar wrapping..... 10	<i>Konjac+</i>
Dehydrated lime curd ..... 8	Mint jelly, sauce and foam ..... 63
Vinaigraite sheets ..... 12	<i>Xanthan+</i>
<i>Gellan</i>	Flavored agar cream..... 66
Consommé macaroni .....34	Fluid gel (basic recipe)..... 66
Saffron tagliatelle.....34	<b>Foam</b>
<i>Methyl cellulose</i>	<i>Agar</i>
Hot mozzarella sheets .....45	Chocolate mousse ..... 9
Thick film (like plastic/leather) .....46	Hot red berry chantilly ..... 11

Hot vegetable mousse.....	8	<i>Non-hydrocolloid</i>	
<i>Agar+</i>		Chocolate chantilly.....	69
Flavored agar cream .....	66	Chocolate mousse .....	69
<i>Carrageenan</i>		Egg white foam (Troll cream).....	70
Basic foam with carrageenan .....	14	Foamy hot ginger mayonnaise foam .....	69
Chocolate foam, chantilly and dessert .....	14	Marshmallow fluff .....	70
<i>Carrageenan+</i>		Potato foam.....	69
Hot transparent savory mousse .....	65	Spinach espuma .....	69
Mint jelly, sauce and foam .....	63	Vanilla yogurt parfait .....	69
<i>Cornstarch</i>		Vauquelin .....	70
Grapefruit souffles .....	18	Vessel 75 with maple syrup foam .....	70
Soft meringue for pie filling .....	18	Warm potato espuma.....	69
<i>Gelatin</i>		Zabaglione .....	70
Asparagus espuma.....	23	<i>Pectin</i>	
Bavarian cream .....	26	Green tea sour mousse .....	49
Citrus foam .....	22	<i>Xanthan</i>	
Cold coffee espuma.....	23	Fake cappuccino foam.....	59
Cucumber yoghurt espuma .....	24	Piña colada espuma .....	59
Filled mozzarella balloons .....	26	<i>Xanthan+</i>	
Fruit espuma.....	22	Flavored agar cream.....	66
Grape sponge.....	27	Hot transparent savory mousse.....	65
Heat stable gelatin gel and foam .....	27	Lemon whip.....	66
Key lime cloud .....	22	Marshmallow foam.....	68
Kientzheim butter foam.....	28	Passion fruit sabayon.....	65
Mango espuma.....	22	Sour mix with a twist .....	66
Piña colada espuma .....	25	<b>Frozen</b>	
Raspberry espuma .....	24	<i>Agar+</i>	
Red beet foam .....	25	Chocolate ganache .....	63
Saffron foam .....	23	Martini sorbet .....	65
Salmon mousse.....	25	<i>Carrageenan+</i>	
Stabilization of whipped cream.....	25	Standard ice cream.....	62
Sweet lemon foam.....	26	<i>Cornstarch</i>	
Watermelon foam .....	25	Cornstarch ice cream.....	18
<i>Gelatin+</i>		<i>Gelatin</i>	
Ravioli filled with mango mousse .....	66	Cranberry Ginger Sorbet.....	22
Warm chocolate coffee mousse .....	67	Frozen champagne.....	27
<i>Konjac+</i>		Gazpacho sorbet.....	23
Hot transparent savory mousse .....	65	Grape sponge .....	27
Mint jelly, sauce and foam .....	63	Rhubarb strawberry sorbet .....	22
<i>Lecithin</i>		<i>Gelatin+</i>	
Frozen parmesan air .....	39	Chocolate ganache .....	63
Lime air .....	39	<i>Guar gum</i>	
Orange air with olive oil .....	40	Applewood ice cream.....	36
Soy sauce air .....	40	Banana ice cream .....	36
Tea air.....	40	Tonka bean ice cream .....	36
<i>Maltodextrin</i>		<i>Konjac</i>	
Sour mix recipe.....	43	Konjac dondurma (chewy ice cream) .....	38
<i>Methyl cellulose</i>		<i>Lecithin</i>	
Cellulose stabilized foam.....	45	Peachy soy ice cream.....	40
<i>Methyl cellulose+</i>		<i>Locust bean gum</i>	
Lemon whip .....	66	Lemon sorbet.....	41
Marshmallow foam .....	68	<i>Locust bean gum+</i>	
Passion fruit sabayon .....	65	Standard ice cream.....	62
Ravioli filled with mango mousse .....	66	<i>Xanthan</i>	
Sour mix with a twist.....	66	Field poppy ice cream.....	59
Warm chocolate coffee mousse .....	67		

Orange ice cream .....	59	Liquorice candy .....	19
Strawberry ice cream.....	60	Turkish delight.....	19
<i>Xanthan+</i>		<i>Cornstarch+</i>	
Martini sorbet.....	65	Chocolate flan .....	67
		Tortenguss (German cake glaze) .....	68
<b>Gel</b>		<i>Gelatin</i>	
<i>Agar</i>		90 years of aviation .....	26
Agar drink with lime .....	11	Bavarian cream .....	26
Agar gel cubes.....	11	Carbonated yuzu jelly .....	24
Battered baby squids with agar noodles .....	10	Cheese cake with lemon.....	23
Chocolate flavored doughnut icing .....	12	Cranberry Ginger Sorbet.....	22
Coconut jelly with strawberry sauce .....	8	Fruit jelly.....	26
Cold cod-fish salad with agar wrapping.....	10	Gazpacho sorbet.....	23
Fruit jelly .....	9	Heat stable gelatin gel and foam .....	27
Fruity flan dessert .....	9	Jellied gin and tonic .....	28
Hot lobster gelatin.....	8	Olive caviar .....	27
Lemon curd with agar .....	9	Olive oil gummy bears .....	26
Orange marmelade.....	11	Orange and grapefruit consomme .....	25
Parmesan spaghetti.....	12	Panna cotta.....	24
Sweet potato jelly .....	11	Red wine jelly.....	27
Terrine of basil.....	9	Rhubarb strawberry sorbet .....	22
Turkish delight .....	8	Salmon mousse .....	25
Vinaigraitte sheets .....	12	Wine gum.....	28
Yokan.....	10	<i>Gelatin+</i>	
<i>Agar+</i>		Dessert jelly .....	66
Caviar using cold oil technique.....	65	Freeform crème brûlée .....	62
Freeform crème brûlée .....	62	Hummus gnocchi .....	66
Loukoums chew (Turkish delight).....	64	Pliable chocolate ganache.....	64
Martini sorbet.....	65	<i>Gellan</i>	
Mint pudding .....	65	Amaretto jelly .....	32
Pliable chocolate ganache.....	64	Apple noodles .....	33
Raspberry pearls (cold oil technique).....	63	Apple puree.....	32
<i>Carrageenan</i>		Bake-stable fruit preparation.....	31
Basic gel recipe with iota carrageenan.....	15	Banana-cocoa raviolis.....	31
Basic gel recipe with kappa carrageenan....	15	Bourbon whiskey gel.....	33
Beer gel .....	15	Consommé macaroni.....	34
Celery pudding .....	16	Fruit juice jelly .....	31
Chocolate foam, chantilly and dessert .....	14	Hot potatoe ice cubes .....	34
Fruit-flavored water dessert jelly .....	14	Jelly sweets.....	33
Gelatinated cucumbers in bloom.....	15	Maple gel.....	33
Kefir custard .....	15	Mint gel.....	32
Milk gel.....	14	Olive oil gelatin.....	33
Peanut butter panna cotta .....	15	Onion purée .....	32
Pineapple gel.....	14	Raisin gel .....	33
Porcini amber .....	16	Reduced sugar jam using HA/LA blend.....	31
<i>Carrageenan+</i>		Saffron tagliatelle .....	34
Chocolate flan.....	67	Warm tomato jelly .....	32
Dessert jelly .....	63	<i>Gellan+</i>	
Loukoums chew (Turkish delight).....	64	Dessert jelly .....	66
Milk pudding .....	67	Fig cylinders .....	64
Mint jelly, sauce and foam .....	63	<i>Guar gum</i>	
Soft chocolate gel .....	63, 67	Banana ice cream .....	36
Standard ice cream .....	62	Tonka bean ice cream .....	36
Tortenguss (German cake glaze).....	68	<i>Guar gum+</i>	
<i>Cornstarch</i>		Milk pudding.....	67
Chocolate Cornstarch Pudding .....	19	<i>Gum arabic</i>	
Cornstarch ice cream .....	18	Hard gums .....	37
Halva balls with feta cheese and pistachio..	18	Soft gums and pastilles.....	37

<i>Gum arabic</i> +		Loukoums chew (Turkish delight) .....	64
Loukoums chew (Turkish delight) .....	64	Martini sorbet .....	65
<i>Konjac</i>		Mint pudding .....	65
Alkaline konjac gel .....	38		
Konjac dondurma (chewy ice cream) .....	38		
<i>Konjac</i> +			
Flexible foie gras .....	64		
Loukoums chew (Turkish delight) .....	64		
Mint jelly, sauce and foam .....	63		
<i>Lecithin</i>			
Peachy soy ice cream .....	40		
<i>Locust bean gum</i> +			
Caviar using cold oil technique .....	65		
Dessert jelly .....	63		
Raspberry pearls (cold oil technique) .....	63		
Soft chocolate gel .....	63		
Standard ice cream .....	62		
<i>Maltodextrin</i> +			
Fig cylinders .....	64		
<i>Methyl cellulose</i>			
Basic recipe for hot melting jelly .....	46		
Corn pudding .....	45		
Cream cheese noodles .....	45		
Hot Bailey's ice cream .....	47		
Hot mozzarella sheets .....	45		
Hot vanilla ice cream .....	46		
Olive oil soba noodles .....	45		
Parsley spaghetti with porcini soup .....	47		
Reconstructed potato .....	46		
Tender broad bean balls .....	45		
Thick film (like plastic/leather) .....	46		
Thin film (brittle, melting) .....	46		
<i>Methyl cellulose</i> +			
Hummus gnocchi .....	66		
<i>Pectin</i>			
Blackberry yogurt ravioli .....	50		
Liquorice candy (wheat flour based) .....	50		
Paté fruit .....	49		
Sliced Chocolate .....	50		
Soft set orange marmalade .....	49		
Traditional raspberry jam .....	49		
Wine jelly .....	51		
<i>Pectin</i> +			
Soft chocolate gel .....	67		
<i>Sodium alginate</i>			
Restructured onions .....	55		
Sodium alginate cubes .....	56		
Thin film .....	56		
<i>Tara</i> +			
Loukoums chew (Turkish delight) .....	64		
<i>Xanthan</i>			
Balsamic vinegar dressing .....	60		
Fruit pureé mayonnaise .....	60		
Iberian ham cream .....	59		
<i>Xanthan</i> +			
Flexible foie gras .....	64		
		Loukoums chew (Turkish delight) .....	64
		Martini sorbet .....	65
		Mint pudding .....	65
		<b>Liquid</b>	
		<i>Agar</i>	
		Cold sauce with green cardamom .....	9
		<i>Carrageenan</i>	
		Dill custard .....	15
		Frappuccino .....	14
		<i>Carrageenan</i> +	
		Vinaigrette-style salad dressing .....	63
		<i>Cornstarch</i>	
		John Nott's wine chocolate .....	18
		Pastry creme .....	19
		Vanilla sauce (No-egg custard) .....	18
		<i>Gelatin</i>	
		Cold sauce with green cardamom .....	24
		<i>Gellan</i>	
		Fluid gel for beverages .....	31
		Pulp suspension beverage (fluid gel) .....	31
		<i>Guar gum</i>	
		Fruit sauce .....	36
		Red raspberry freeze drink .....	36
		<i>Lecithin</i>	
		Emulsified vinaigrette .....	39
		<i>Locust bean gum</i>	
		Super foamy milkshake .....	41
		<i>Maltodextrin</i>	
		Sour mix recipe .....	43
		<i>Methyl cellulose</i> +	
		Passion fruit sabayon .....	65
		<i>Pectin</i>	
		Cold sauce with green cardamom .....	50
		<i>Xanthan</i>	
		Balsamic vinegar dressing .....	60
		Banana milkshake .....	59
		Coco cola .....	60
		Tempura batter .....	59
		White sangría in suspension .....	59
		<i>Xanthan</i> +	
		Passion fruit sabayon .....	65
		Vinaigrette-style salad dressing .....	63
		<b>Noodle</b>	
		<i>Agar</i>	
		Battered baby squids with agar noodles .....	10
		Parmesan spaghetti .....	12
		<i>Agar</i> +	
		Green tea noodles .....	67
		Soft gel noodles .....	65
		<i>Gellan</i>	
		Apple noodles .....	33
		Consommé macaroni .....	34
		Saffron tagliatelle .....	34

<b>Gellan+</b>	
Green tea noodles .....	67
<b>Konjac</b>	
Alkaline konjac gel .....	38
<b>Locust bean gum+</b>	
Soft gel noodles .....	65
<b>Methyl cellulose</b>	
Cream cheese noodles .....	45
Olive oil soba noodles .....	45
Parsley spaghetti with porcini soup .....	47
<b>Xanthan+</b>	
Soft gel noodles .....	65
<b>Other use</b>	
<b>Agar</b>	
Clear liquid by agar filtration .....	8
<b>Gelatin</b>	
Clear liquid by gelatin filtration .....	22
unBloody Mary (gelatin filtration) .....	24
<b>Guar gum+</b>	
Gluten free flour .....	67
<b>Gum arabic</b>	
Candied rose petals .....	37
<b>Lecithin</b>	
Apple strudel .....	40
Bread machine dough enhancer .....	40
<b>Methyl cellulose</b>	
Soya burgers .....	47
<b>Pectin</b>	
Fruit Terrine .....	51
<b>Xanthan</b>	
Gluten free flour mix .....	60
<b>Xanthan+</b>	
Gluten free flour .....	67
<b>Solid</b>	
<b>Cornstarch</b>	
Liquorice candy .....	19
Turkish delight .....	19
<b>Gellan</b>	
Carrot lolly .....	33
Jelly sweets .....	33
<b>Konjac</b>	
Alkaline konjac gel .....	38
<b>Maltodextrin</b>	
Bacon powder .....	43
Bitter almond oil crumbs .....	43
Dry caramel .....	42
Nutella powder .....	42
Olive oil powder .....	42
Roasted flour nuggets .....	42
White chocolate powder .....	42
<b>Pectin</b>	
Apple candy .....	49

<b>Solid foam</b>	
<b>Gelatin</b>	
Frozen champagne .....	27
Fruit marshmallows .....	27
Grape sponge .....	27
Marshmallows .....	27
<b>Gum arabic</b>	
Marshmallows .....	37
<b>Methyl cellulose</b>	
Crispy carrot foam .....	47
Marshmallow .....	45
<b>Pectin</b>	
Green tea sour mousse .....	49
Tuile craquante .....	49
<b>Xanthan</b>	
Carrot pillow .....	60
Marshmallows with xanthan .....	60
<b>Solids foam</b>	
<b>Agar</b>	
Marshmallows with agar .....	10
<b>Spherification</b>	
<b>Agar+</b>	
Caviar using cold oil technique .....	65
Raspberry pearls (cold oil technique) .....	63
<b>Carrageenan</b>	
Spherification with iota carrageenan .....	15
Spherification with kappa carrageenan .....	16
<b>Gelatin</b>	
90 years of aviation .....	26
Olive caviar .....	27
<b>Gellan</b>	
Spherification with gellan .....	32
<b>Locust bean gum+</b>	
Caviar using cold oil technique .....	65
Raspberry pearls (cold oil technique) .....	63
<b>Sodium alginate</b>	
Carbonated mojito spheres (reverse spherification) .....	56
Cola caviar .....	56
Kir moleculaire .....	55
Liquid pea ravioli .....	53
Melon cantaloupe caviar .....	55
Mozzarella spheres (reverse spherification) .....	53
Restructured onions .....	55
Spheric green olives (reverse spherification) .....	55
Spherical croquettes (reverse spherification) .....	54
Spherical mango ravioli .....	53
Spherical mussels (reverse spherification) .....	54
Spherical olives (reverse spherification) .....	54
Spherical tea ravioli .....	53
Veal bone marrow (reverse spherification) .....	55
Yoghurt beads (reverse spherification) .....	53

# Index of alcoholic preparations

Most hydrocolloids are compatible with alcohol and specific information about this is included in the table on page 75. However, for illustrative purposes the recipes which include alcohol are listed in this separate index.

## Fluid gel

<i>Gellan</i>	
Pomegranate and vodka fluid gel .....	32

## Foam

<i>Pectin</i>	
Green tea sour mousse .....	49
<i>Xanthan</i>	
Piña colada espuma .....	59

## Frozen

<i>Agar+</i>	
Martini sorbet .....	65
<i>Gelatin</i>	
Frozen champagne .....	27
<i>Xanthan+</i>	
Martini sorbet .....	65

## Gel

<i>Agar+</i>	
Martini sorbet .....	65
<i>Carrageenan</i>	
Beer gel .....	15
<i>Gelatin</i>	
90 years of aviation .....	26
Jellied gin and tonic .....	28
Red wine jelly .....	27

## *Gellan*

Amaretto jelly .....	32
Bourbon whiskey gel .....	33

## *Methyl cellulose*

Hot Bailey's ice cream .....	47
------------------------------	----

## *Pectin*

Wine jelly .....	51
------------------	----

## *Xanthan+*

Martini sorbet .....	65
----------------------	----

## Liquid

### *Cornstarch*

John Nott's wine chocolate .....	18
----------------------------------	----

## Solid foam

### *Gelatin*

Frozen champagne .....	27
------------------------	----

### *Pectin*

Green tea sour mousse .....	49
-----------------------------	----

## Spherification

### *Gelatin*

90 years of aviation .....	26
----------------------------	----

### *Sodium alginate*

Carbonated mojito spheres (reverse spherification) .....	56
Kir moleculaire .....	55

# Keyword index

agar.....	2, 5, 7, 8, 9, 10, 11, 12, 14, 21, 24, 41, 50, 52, 62, 63, 64, 65, 66, 67, 75, 76, 78
agar filtration.....	8
calcium chloride.....	53, 54, 55, 56, 72
calcium gluconate.....	50, 51, 54, 55, 72, 73
calcium lactate.....	15, 31, 32, 51, 53, 54, 55, 56, 72, 73
carbon dioxide.....	24, 56, 60, 72, 74
carrageenan.....	13, 14, 15, 16, 38, 41, 52, 62, 63, 64, 65, 67, 68, 71, 72, 73, 75, 76
<i>iota carrageenan</i> .....	13, 14, 15, 16, 63, 67, 72
<i>kappa carrageenan</i> .....	15, 16, 38, 41, 52, 62, 67, 72, 76
carragenan.....	64
citric acid.....	10, 14, 26, 28, 31, 33, 37, 41, 43, 49, 59, 63, 66, 72
cornstarch.....	4, 5, 17, 18, 19, 20, 60, 67, 75
cream charger.....	23, 24, 25, 59, 69
cream of tartar.....	18, 19, 60, 72
dehydrator.....	8, 47, 50
dextrin.....	9, 56
<i>maltodextrin</i> .....	9, 32, 33, 42, 43, 64, 73
espuma.....	22, 24, 25, 59
ethanol.....	7, 13, 21, 30, 35, 44, 52, 56, 58, 73, 75, 76, 77, 78, 87
film.....	10, 46, 56, 82
filtration.....	8, 22, 24, 78
fluorescence.....	52
gelatin.....	4, 7, 8, 9, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 37, 50, 52, 59, 62, 63, 64, 66, 67, 73, 74, 75, 78
gelatin filtration.....	8, 22, 24
gellan.....	5, 21, 30, 31, 32, 33, 34, 52, 66, 67, 76
<i>high acyl gellan</i> .....	31, 32, 33, 64
<i>low acyl gellan</i> .....	31, 32, 33, 34, 64, 66
glucose.....	9, 15, 24, 26, 28, 31, 32, 33, 34, 36, 37, 41, 42, 49, 50, 55, 59, 62, 63, 64, 65, 73
glycerol.....	7, 10, 30, 37, 46, 58, 72, 75, 76, 77
guar.....	35, 36, 58, 67, 72, 76, 77
gum arabic.....	4, 37, 64
ice cream.....	18, 19, 21, 22, 23, 36, 38, 40, 41, 46, 47, 56, 58, 59, 60, 62, 76
inulin.....	41
invert sugar.....	36, 49



isomalt .....	26, 72
konjac .....	4, 13, 38, 56, 58, 63, 64, 65, 72, 75, 76, 77
lecithin.....	5, 14, 39, 40, 73
locust bean gum .....	4, 7, 13, 21, 35, 38, 41, 58, 59, 62, 63, 65, 72, 75, 76, 77
low acyl gellan .....	33
maltitol .....	9, 55, 56, 65
maltodextrin .....	9, 32, 33, 42, 43, 73
methyl cellulose .....	44, 45, 46, 47, 65, 66, 67, 68, 72, 77
microwave.....	19, 32, 47, 56, 60, 65, 70
mono-/diglycerides .....	33, 60, 62
nitrous oxide .....	8, 11, 14, 22, 23, 24, 25, 26, 27, 49, 59, 60, 69, 70, 72, 74
noodle .....	2, 10, 11, 33, 34, 38, 45, 65, 67
pectin .....	7, 9, 21, 24, 48, 49, 50, 51, 52, 67, 72, 77
<i>amidated low methoxyl pectin</i> .....	50
<i>high methoxyl pectin</i> .....	49, 51, 72
<i>low methoxyl pectin</i> .....	49, 51, 67
potassium citrate .....	14, 15, 31, 68, 72
potassium phosphate .....	16, 72, 73
reverse spherification .....	52, 53, 54, 55, 56
shear-thinning.....	13, 38, 52, 58, 75, 76, 77
sodium alginate .....	9, 14, 48, 52, 53, 54, 55, 56, 57, 72, 77
sodium citrate .....	30, 31, 33, 52, 53, 55, 56, 66, 72, 76, 77
sorbitol .....	7, 64, 72, 75
spherification.....	5, 48, 52, 53, 54, 55, 56, 65, 77
syringe .....	2, 11, 12, 34, 45, 47, 55, 56
transglutaminase .....	21, 27, 75
whipper .....	8, 9, 11, 14, 22, 23, 24, 25, 26, 27, 49, 59, 60, 69
xanthan .....	5, 8, 25, 35, 36, 38, 39, 41, 54, 55, 56, 58, 59, 60, 61, 63, 64, 65, 66, 67, 68, 72, 73, 76, 77