MARSHMALLOWS

Marshmallows, although quite easy to make, introduce many confectionery skills to the food product manufacturer. No one recipe will satisfy everyone's requirements and for that reason the author is encouraging the would-be marshmallow producer to experiment. However, it is important to remember that the basic principles of food processing still apply, ie that the product is safe to eat over a time period which satisfies the marketing, transporting, storage, retailing and eating characteristics of the product. This is referred to as the shelf-life.

What is a marshmallow?
A marshmallow is a light, fluffy sweet made by beating air into a sugar solution containing **(**a type of) gum (eg gelatine), colour and flavour. This mixture is then poured into moulds and allowed to set. To explain some of the science behind the process: beating air into the gelatine solution produces a structure not unlike that of bread, although with smaller air bubbles. The gelatine will eventually harden and in so doing will trap the air that has been added to the mixture. The resulting product is spongy and slightly rubbery.

Although the reason for making marshmallows may be that they are not already available in your area, and therefore have a good market potential, it would be a good idea to try and identify an existing supplier, if one exists, and take a good look at the product. Can you match or improve the quality at a competitive price?

How to make marshmallows
Originally 'marshmallows' were used for medicinal purposes and contained the root of the marshmallow plant, sugar, gum and egg-white. Since those times the basic ingredients have remained unchanged with the exception that marshmallow root is no longer used.

The basic ingredients and approximate proportions are as follows:

Sugar	40-48%
Glucose	0-25%
Water	24-30%
Gelatine	2-3%
Flavours	minimum
Colours	minimum

Some recipes include the use of albumen (egg-white). However, perfectly good marshmallows can be made without egg-white and more importantly, marshmallows made without egg-white are more stable and less prone to spoilage and therefore, the risk of food poisoning from contaminated egg-whites.

Other ingredients sometimes used for marshmallows are cream of tartar and/or citric acid. Both these ingredients can assist the inversion of sugar which can improve the keeping quality of the product by minimising the chance for the sugar to form crystals. Crystal formation will give the marshmallows an unsatisfactory texture. In addition, cream of tartar gives a mild acid taste to the product which some consumers prefer. The use of these ingredients may allow the amount of glucose, added in its pure form, to be reduced because the inversion process increases the overall amount of glucose in the recipe. (*See end note). Glucose is a hygroscopic substance ie it attracts moisture. Therefore, it is important to use the minimum quantity of glucose necessary to prevent crystallisation of the sucrose. This will minimise the tendency for the glucose to attract water thus increasing the storage life.

If glucose is difficult to obtain in your area, then an alternative is to use cream of tartar to produce the invert sugar instead of adding pure glucose. The sugar is dissolved in the water with the cream of tartar. The whole mixture is then boiled until 116°C is achieved and then

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used as per the marshmallow recipe. This method cannot guarantee the amount of glucose produced during the inversion. For this reason once an acceptable procedure has been found the conditions of processing should be adhered to.

It is up to the producer to carry out the necessary product development to ascertain the most popular and optimum mix of ingredients.

Marshmallows contain a high proportion of water and therefore there is a danger of spoilage. To minimise this, it is important to use the correct amount of water in the recipe and also ensure, as with all food processing operations, that the ingredients are in a good condition and that a very high level of cleanliness is maintained throughout the entire processing operation. Packaging is also a very important factor with regard to the shelf-life. In summary, packaging acts as a barrier to dust and dirt and insect contamination. In addition, certain types of packaging such as plastics are a good barrier against water and water vapour. Keeping the product free from excess moisture will extend the shelf-life. Polythene is a good barrier for most products. However, as a barrier against water vapour (significant in countries with humid climates) polythene is inferior to polypropylene or cellophane. In the case of marshmallows produced under tropical conditions, polypropylene and cellophane are the recommended packaging materials.

Typical method for making marshmallows at small-scale

Most of the equipment used for making marshmallows at small-scale is normal domestic equipment likely to be found in most households. However, there are some items of equipment for which special purchases may have to be made**:**

Electric whisk
Confectionery thermometer
Moulds
Packing materials
Essences and colours.
Very large icing bag and nozzle

As previously indicated, marshmallows need to have air beaten into them. Although this can be done using a hand whisk it is time-consuming, hard work and the quality of the product is often low. Furthermore, referring back to the section on water content, improved beating results in a drier product because the water particles are better dispersed on the inner surfaces of the marshmallow structure. Therefore for all these reasons, an electric whisk is recommended.

Confectionery thermometer

In the manufacture of sweets the temperature used in processing is very important. Generally speaking, the higher the temperature the harder the final product. Table 1 gives an indication of the different temperatures used and the type of sweet made. A sugar thermometer is a useful piece of equipment because these temperatures are clearly marked. In the case of marshmallow production the temperature of the sugar solution should be raised to 116°C.

Temperature °C	**Term**	**Use**
110-113	Thread	Liqueurs
115-118	Feather, soft ball	Fondant, marshmallow
121-124	Ball	Candies, fudge
126-129	Hard ball	Caramels
130-132	Stiff ball	Soft toffees, caramels
135-138	Low crack	Drops, rock
168-177	Caramel	Burnt sugar

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Table 1: Temperatures used for different types of sweets

Moulds

With regard to moulds there are two options. The first is the easiest but can result in fairly unimaginative marshmallows. It involves simply pouring the beaten marshmallow mixture into a tray which has been lightly covered with butter/margarine and lightly dusted with a cornstarch/powdered sugar mixture. The dimensions of the tray relate to the amount of mixture and the final size of the marshmallow pieces desired. When the marshmallow mixture has set, it is turned out of the tray and cut into cubes using a blade or scissors. The pieces are then dusted with a cornstarch/powdered sugar mixture.

The other type of mould is known as a starch mould. Basically the mould is formed by preparing a tray of cornstarch - not packing it too tightly. Impressions are then made in the starch using shapes. Commonly the moulds are made from wood and more adventurous marshmallow producers have even made animal shaped moulds. The mixture is boiled and poured into the impressions in the starch. Once the technique is perfected many interesting marshmallow shapes can be made. Using starch moulding the marshmallow pieces set much more quickly and also the starch has a drying effect which prolongs the shelf-life.

Essences and colours

These ingredients are used to give the marshmallows a satisfactory appearance and taste. They are available in powdered or liquid form. Powdered flavours/colours should be mixed with the gelatine prior to adding it to the very hot water. Liquid flavour/colours can be added during beating. It is most important to use food grade quality essences and colours and if these are not available in your local shops you could try at your local bakery if they are making various cakes and sweets. Otherwise it may necessitate a trip to your nearest large town or city.

The most commonly used essences are rose water and vanilla. However, you could experiment with any essence you wanted to.

Any food grade colour could be experimented with according to local preferences and local regulations.

Other equipment

The other equipment required includes:

Electric or gas hotplate
Saucepans (preferably aluminium or stainless steel)
Measuring scales (0-100g and 0-1kg)
Wooden spoons

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Two recipes used in Peru

Recipe A

Sugar (600g)	Gelatine (50g)
Glucose (400g)	Very hot water (5x50=250ml)
Water (250ml)	Flavourings/colourings (powder form)
Heat to 116°C	Citric acid (5g)
	Dissolve

Addition of 1 tablespoon lemon juice if not using citric acid

Beat for 10-15 minutes (if using liquid colour/flavour add now)

Pour into prepared moulds

Leave to set ½-1 hour

Dust pieces with icing sugar/cornflour mixture

Pack

Recipe B

Sugar	1000g
Cream of tartar	10g
Water	500ml (250ml for Gelatine, 250ml (minimum) for sugar)
Gelatine	50g
Citric acid (or lemon juice)	5g
Colourings/flavourings	The minimum

Notes on method

Using the following ingredients follow the same procedure as for recipe A. Recipe B is significantly cheaper than recipe A but can have a shorter shelf life.

Dissolve the gelatine by adding it to very hot water and transfer to mixing bowl. Boil the sugar and glucose, with at least 250ml of water, to 116°C. The quantity of water is not critical provided that the minimum has been added. More water will result in a longer time to reach 116°C. Using more water is useful for the cream of tartar recipe because the longer heating time will cause more inversion of the sugar. Pour this slowly in a thin stream into the gelatine solution beating all the time. Continue to beat until the maximum volume is attained (approximately 5-10 minutes).

- If using the starch moulding technique transfer the bowl containing the mixture to a boiling water bath and heat sufficiently to allow the batch to be poured into the starch mould. A large icing bag is very useful. Allow pieces to set. Pack in polypropylene. Polythene is okay but the shelf-life is shorter.
- If using the oiled and floured tray technique the additional heating method using a water bath may not be necessary. Therefore, pour mixture in the prepared tray. When set, process as in the flow diagram.

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As can be seen from these two recipes there is no blueprint recipe for making very good quality marshmallows. Different climates, different equipment and different qualities of raw materials in different countries around the world are reasons for this. Hence, it is emphasised that although the above recipes will produce acceptable marshmallows, the small business person or group should continually strive to improve their products. Although an element of this will come through increased familiarisation with the ingredients and process over-time, making deliberate small changes to the recipe and recording these changes and the quality of the final product will result in positive steps towards the development of a product with optimum quality characteristics.

*** A note on invert sugar**

The normal sugar which you can buy in the shops has the chemical name of sucrose and is composed of two different sugars: one unit of glucose joined to one unit of fructose. The inversion of sugar is the chemical breaking of the link between the glucose and fructose units which results in a mixture of: sucrose units, glucose units and fructose units. This mixture is known as invert sugar. (Complete inversion to glucose and fructose has special applications in the food industry.)

In certain food processing activities this inversion process is very important. For example in the case of marshmallow the inversion process is necessary to increase the storage life of the jam by minimising the chance of the sucrose going back to its crystalline form which is unsatisfactory for good quality marshmallows.

References and Further Reading

- Marshmallows y Gomitas Enriqucidos Uña de Gato, ITDG Latin America, 2002-03-21 ISBN 9972 47 082 2
- Food Chain Journal No 22 –Jan 1998, ITDG

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