SCI LECTURE PAPERS SERIES

THE VIEW FROM JAPAN

I Nakamura[1] and H Kida[2]
1. Fuji Oil Europe, Kuhlmannlaan 36, B-9042 Gent, Belgium
2. Fuji Oil Co., Ltd., 1 Sumiyoshi-cho, Izumisano-shi, Osaka, Japan

ISSN 1353-114X
LPS 128/2003

Key words *Japan, Chocolate, Vegetable fats, Chocolate standards*

Introduction

The chocolate market in Japan is growing steadily. A lot of new products are launched every year, which stimulates the chocolate market greatly. The chocolate vegetable fats play an important role in this field, supporting the development works of chocolate producers.

Chocolate market in Japan

In the Japanese confectionery market, the Japanese traditional confectionery is the largest in production volume, and chocolate is in the second group increasing its volume (Fig 1). A lot of new products are launched in the market every year; each major chocolate producer launches 5-7 new products in spring and in autumn. These new products attract consumers by their new texture, appearance, and flavours, and then stimulate the chocolate market to grow. Vegetable fats are important ingredients of chocolate in order to enlarge its application possibilities for new products development.

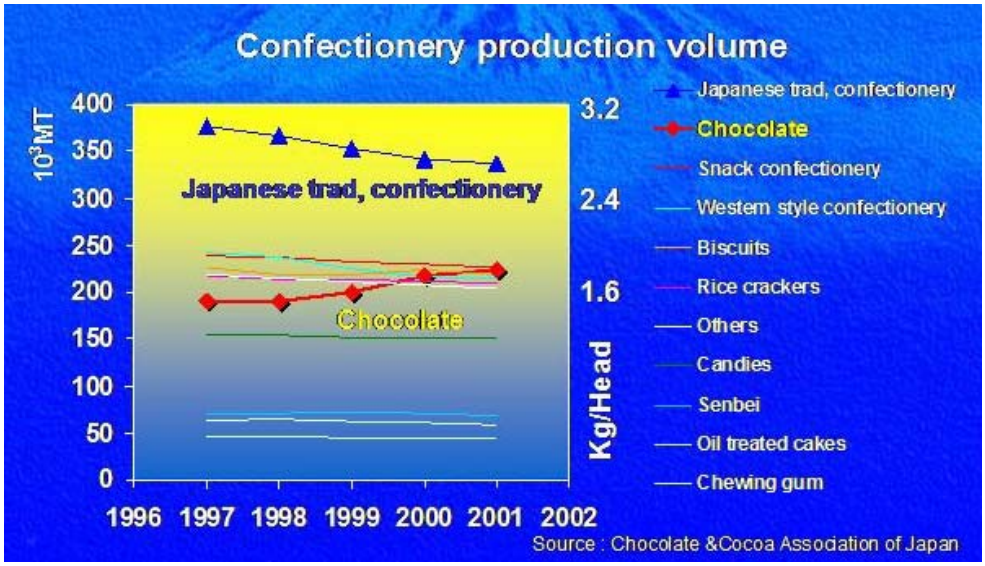

Figure 1: Confectionary market in Japan

Chocolate standards of Japan

The chocolate standards of Japan are based on a very simple principle. For example, chocolate needs to contain minimum 35% of total cocoa solids, including minimum 18% of cocoa butter (Fig 2). The rest part may be composed of other ingredients, such as sugar, vegetable fat, milk product, flavour, and so on. Milk chocolate needs to contain minimum 21% of total cocoa solids, including minimum 18% of cocoa butter, and minimum 14% of total milk solids, including minimum 3% of milk fat.

The comparison of the two different standards may give a clearer view of the chocolate standards of Japan (Fig 3). As for the use of vegetable fats in chocolate, there is no specific point required by the chocolate standards of Japan, while the EU directive requires vegetable fats to fulfill some physical, chemical and botanical requirements. The Japanese Standards leave larger possibilities for chocolate producers of utilizing the functions of vegetable fats in chocolate. As a result, chocolate could evolve in order to gain a certain market share in Japan.

Figure 2: Chocolate Standards of Japan

Chocolate products	EU 2000/36/EC	Japan
Cocoa butter	≧ 18%	≧ 18%
Fat-free cocoa solids	≧ 14%	
Total cocoa solids	≧ 35%	≧ 35%
Vegetable fats	≦ 5% Limitation -chemical characteristics -physial characteristics -production process -botanical origine	

Figure 3: Comparison of chocolate standards in Japan and EU

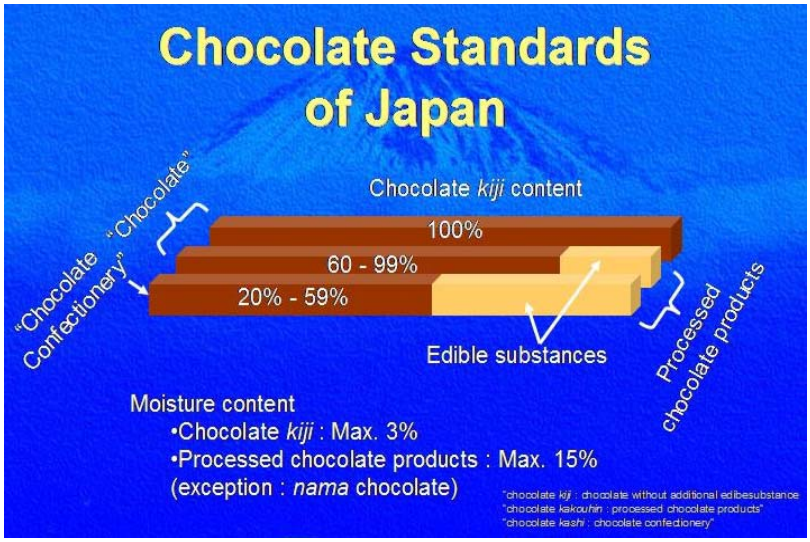

Figure 4: Chocolate products categories

The product labeling is also regulated by the Standards based on the chocolate *kiji* content in products. The chocolate *kiji* is defined in Figure 4. It is chocolate without the additional edible substances, such as nuts or fruits. When the chocolate *kiji* is combined with additional edible substances in a product, it is called “processed chocolate product”. When the content of chocolate *kiji* in the product is minimum 60%, the product can be labeled as “chocolate”. In the case of a processed chocolate product containing less than 60% and minimum 20% of chocolate *kiji*, it is labeled as chocolate confectionery. As for the moisture content, chocolate kiji is allowed to contain maximum 3%, and processed chocolate products are allowed to contain maximum 15% of moisture in the product. In 2002, there was an amendment to the standards, mainly concerning the *nama* chocolate, which is a new type of product in the market. In order to avoid any confusion among consumers with this new product type, the standards were therefore amended.

Chocolate application examples

Some application examples of chocolate with vegetable fats are given below, in order to understand how the vegetable fats are actually used in chocolate products in Japan.

Winter seasonal chocolate

This product has been in the market place for 10 years already. It is characterized by its quick melting profile in the mouth. The vegetable fat used in this product has specific melting profile as shown by the solid fat content (SFC) profile (Fig 5). It has the same steep SFC profile as cocoa butter, but at a lower temperature range. Thanks to this, this chocolate melts smoothly in the mouth even in the cold winter season.

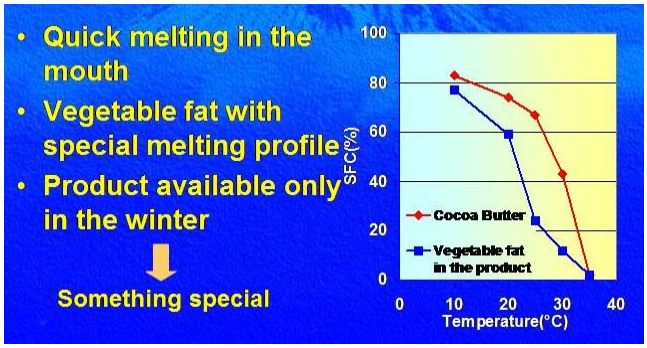

Figure 5: Winter Seasonal Chocolate

Figure 6 shows a recipe example of the winter seasonal chocolate with 23% of vegetable fat. Although the fat content of the chocolate is rather high, it does not have a fatty taste because of its good melting. The picture shows the typical appearance of this type of product. They are shaped into a small cube shape, often covered by cocoa powder.

Recipe		% Composition		Japan standards
Ingredients	%	Composition	%	Milk chocolate
Cocoa mass	20	Total cocoa solids	32.0	min,21
Cocoa butter	12	Non-fat cocoa solids	9.0	
		Cocoa butter	23.0	min,18
Whole milk powder	12	Total milk solids	15.0	min,14
Skimmed milk powder	3	Non-fat milk solids	11.9	
Milk fat	0	Milk fat	3.1	min,3
Sugar	30	Sugar	30.0	
Vegetable fat	23	Vegetable fat	23.0	
Total	100	Total fat content	49.1	

Figure 6: Example of the winter seasonal chocolate recipe

Chocolate combined with baked confections

When chocolate and baked confections are combined in a product, the chocolate viscosity is one of the crucial parameters influencing production efficiency. In addition to this, the lower viscosity of the chocolate is able to enlarge the chocolate application possibilities for the new products development.

The graph in Figure 7 shows one of the methods to get a lower viscosity of tempered chocolate. The red line indicates the increasing viscosity of dark chocolate when tempered at 30°C by Chocoseed A, which is a seeding agent based on the cocoa butter type triglyceride. The blue line indicates the viscosity of dark chocolate tempered by Chocoseed B, which is another type of the seeding agent based on 1,3-dibehenoyl-2oleoylglycerol (BOB) produced by enzymatic interesterification. Chocoseed B is able to temper chocolate at 35°C, while the chocolate viscosity can be kept at lower level over a longer period of time.

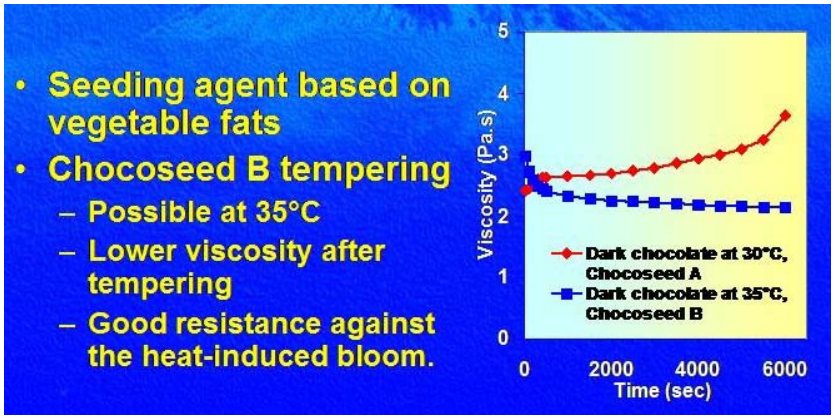

Figure 7: Tempering by Chocoseed B

Chocoseed B tempering has another advantage in chocolate. The chocolate tempered by this functional seeding agent has strong resistance against heat-induced bloom. Figure 8 shows the anti-bloom effect. When the chocolate is exposed to high temperatures, such as 35°C, normally the cocoa butter in the chocolate melts and looses its proper crystal form. But the BOB survives in the appropriate crystal form even under this severe condition. When the chocolate is cooled down to ambient temperature, the traditionally tempered chocolate shows strong bloom, while the one tempered with Chocoseed B keeps good appearance.

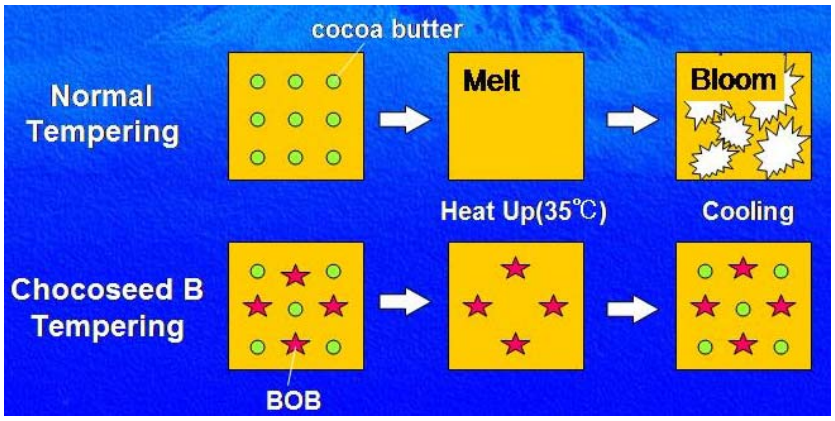

Figure 8: Mechanism of Chocoseed B anti-bloom effect

Aerated chocolate

Aerated chocolate has been very popular in Japan for several years. When it was launched into the market, its special melting property in the mouth was appreciated very much by the consumers. The aerated chocolate has been applied to many kinds of products. Some of the application examples (Fig 9) are pretzels coated by aerated chocolate, aerated chocolate filling in the baked confections and moulded aerated chocolate.

Figure 9: Aerated chocolate products

The texture of aerated chocolate can be arranged by changing the size of air cells. Changing the type of vegetable fats used is another way to give texture variety to aerated chocolate. One of the recipe examples is shown in Figure 10. The suitable aeration process may vary, depending on the application. For example, a specific equipment, may be suitable to make air cells bigger size, creating a pressure drop to expand the air cells in the chocolate. The chocolate with bigger air cells can have very low density and melts very quickly in the mouth. Another example is the aeration of chocolate tempered by Chocoseed B (see previous example). The aerated chocolate with a lower viscosity, obtained by this method, is suitable for coating applications. The aeration of chocolate using a paste fat is another possibility. This fat is designed to have functional fat crystals as a paste. Aeration is easily done by simple equipment, such as a vertical mixer, and the chocolate can hold fine air cells very well.

Recipe		% Composition		Japan standards
Ingredients	%	Composition	%	Milk chocolate
Cocoa mass	12	Total cocoa solids	27.0	min,21
Cocoa butter	15	Non-fat cocoa solids	5.4	
		Cocoa butter	21.6	min,18
Whole milk powder	18	Total milk solids	18.0	min,14
Skimmed milk powder	0	Non-fat milk solids	13.3	
Milk fat	0	Milk fat	4.7	min,3
Sugar	35	Sugar	35.0	
Vegetable fat	20	Vegetable fat	20.0	
Total	100	Total fat content	46.3	

Figure 10: Example recipe of aerated chocolate

Nama chocolate (“Fresh” chocolate)

Nama chocolate, which could be translated to “fresh” chocolate in English, is rather new in the Japanese chocolate marketplace. It is a kind of ganache, containing cream as an additional edible substance. It may be in O/W emulsion system or in W/O emulsion system. It has a very nice melting property and fresh mouth-feel.

What we call *nama* chocolate is classified in Table 1, according to the Chocolate Standards of Japan.

Table 1 *Nama* chocolate according to the chocolate standards of Japan

		% based on the total product weight				
		Chocolate *kiji*	Cream	Moisture	*Nama* chocolate (narrow sense)	Product Category
1	**Chocolate *kiji* to which edible substances containing moisture, including cream, is mixed**	**Min. 60%**	**Min. 10%**	**Min. 10%**	**-**	**Chocolate**
2	*Nama* chocolate (narrow sense) covered by cocoa powder, sugar powder, green tea powder, etc.	Min. 60%	-	-	Min. 60%	Chocolate
		Min. 40% and less than 60%			Min. 60%	Chocolate confectionery
3	Shell of chocolate products filled with *Nama* chocolate (narrow sense)	Min. 60%	-	-	Min. 60%	Chocolate
		Min. 40% and less than 60%			Min. 60%	Chocolate confectionery

Chocolate containing minimum 60% of chocolate *kiji* and minimum 10% cream resulting in the moisture content of minimum 10% is called *nama* chocolate in the narrow sense. It can be labeled as chocolate, and is called *nama* chocolate. When this *nama* chocolate (in narrow sense) is combined with other edible substances, the nama chocolate (in narrow sense) content should be minimum 60% to be *called* nama chocolate.

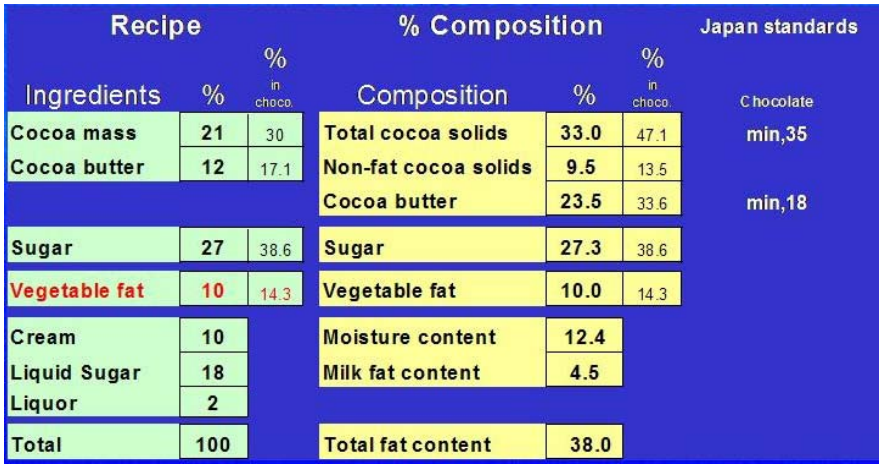

Figure 11: Example of recipe of W/O type *nama* chocolate recipe

There are some characteristic differences between the products in O/W and W/O systems. Products in O/W systems are the traditional type. They have a very fresh mouth feel, but most of them need the refrigerated delivery chain because of their higher water activity. On the other hand, products in W/O systems do not need the cold delivery chain, when the water activity is kept lower by the continuous fat phase. The characteristics of vegetable fat in chocolate affects a lot of the product characteristics in

this system. Figure 11 shows the example recipe of *nama* chocolate with 70 % chocolate *kiji* content and 10% cream content.

Chocolate with anti-bloom properties

Various types of anti-bloom fats have been developed by vegetable fat modification techniques, and are applied in chocolate products in Japan. These speciality vegetable fats are useful to equip chocolate with good anti-bloom properties that may be needed in the severe climate conditions in Japan, and also in chocolate applications susceptible to blooming.

Table 2 shows types of chocolate bloom, and example solutions to the problem by adding anti-bloom fats. According to the Chocolate Standards of Japan, all of these vegetable fats are allowed for use in chocolate.

Table 2 Type of chocolate bloom and solutions by specialty vegetable fats.

Types of bloom	Storage condition	Key points of prevention	Specialty vegetable fats
Crystal growth of Form VI	20-32° C	·Retardation of a) transformation V to VI b) crystal growth of form VI	Anti-bloom CBE
Re-crystallization after melting	20-36° C	·Increase heat resistance ·Remaining seed crystal	CBI, "Chocoseed B"
Re-crystallization due to fat migration	10-25° C	·Restraint of fat migration	Anti-migration fat (by SFC balancing)

Chocolate fats produced by enzymatic interesterification

1,3-distearoyl-2-oleoylglycerol (StOSt)is one of the major components of chocolate vegetable fats. Although it may be obtained from wild tropical plants, such as shea and sal, Enzymatic interesterification is another way to obtain the StOSt fat with stable quality and stable availability that might have advantages over the traditional sources.
The enzymatic interesterification is also a useful tool for speciality vegetable fat developments.

According to the Chocolate Standards of Japan, vegetable fats produced by this enzymatic process are allowed for use in chocolate.

Conclusion

Vegetable fats are not only cocoa butter alternative fats, but are also an indispensable functional ingredient of chocolate in Japan.

 ISSN 1353-114X