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THE FORMULATION OF CHOCOLATE VEGETABLE FATS

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Introduction

The confectionery industry should appreciate the opportunities that the new legislation, permitting the use of chocolate vegetable fat , offers them.

Chocolate, differences and uses

The obvious differences are that you can have milk or plain chocolate. The manufacturer can also make chocolate in a variety of ways, for instance using milk crumb or milk powder. The manufacturer has a variety of processes that can be used, enrobing, moulding, extruding for example. This results in solid bars of chocolate, chocolate with wafers, biscuits, nuts and sugar centres, the variety is really quite large.

Chocolate, what the manufacturer wants

In general , a consistent chocolate as regards flavour, texture and processing properties is required, as well as minimum manufacturing costs. If a new ingredient can extend the range of chocolates currently available this gives more opportunity for innovation.

The new opportunity

The only fat in plain chocolate is cocoa butter, although sometimes a little milk fat, about 2% may be added as an anti-bloom agent. Milk chocolate contains cocoa butter and milk fat. Now there is the opportunity to add up to 5% of a chocolate vegetable fat to all types of chocolate.

Chocolate texture

One way to determine the texture of chocolate is to use a texture analyser. The sample of chocolate is placed in a thermal cabinet which can be varied over the temperature ranges that are of interest. The force needed to push a needle into the chocolate to a depth of 5mm is measured. So the larger the force needed, the harder the chocolate. An informal taste panel has supported all the results given in this paper.

Texture analysis results measured at 20°C

Plain chocolate with no milk fat required 988g force

Milk chocolate with 7% milk fat required 571g force

These results confirm that plain chocolate is harder than milk chocolate and it could be argued that the range of 988g force to 571g force represents the full range of chocolates that can be made without the use of vegetable fats.

The manufacture of chocolate vegetable fats

The legislation prevents hydrogenation and interesterification but it does permit blending and fractionation of the permitted raw materials. As an example, palm oil can be fractionated into stearine and olein. This olein can itself be fractionated into what is known as the palm mid-fraction and the palm double olein. It is this palm mid-fraction that is extensively used to make chocolate vegetable fats.

In general manufacturers use illipe and kokum as it is. Palm is fractionated twice or even three times, whilst for sal, shea and mango one fractionation is carried out, the stearine component being used in each case. In Figure 1, the trigyceride contents of these raw materials are tabulated. The contents are typical figures.

It can be seen that by blending these raw materials a fat can be produced which has a similar content of POP, POSt and StOSt to that of cocoa butter. Such a fat will possess similar properties to cocoa butter.

	Cocoa butter	Palm mid-fraction	Shea stearine	Illipe	Sal stearine	Mango kernel stearine	Kokum
POP	17	65	1	7	1	1	0
POSt	34	10	8	34	13	12	5
StOSt	26	1	68	47	60	56	75

P=palmitic acid, O = oleic acid, St = stearic acid

Figure 1: Trigyceride contents of the raw materials

It can also be seen that there are many possible blends which might approximate to that of cocoa butter. Which of these blends is the most appropriate will depend upon the application, the cost and the availability of the raw materials.

How to choose the appropriate chocolate vegetable fat

Texture

The texture of the chocolate is critical. Below are the results for two milk chocolates containing 5% of two very different vegetable fats. Both of these milk chocolates contain 7% milk fat. Therefore using different vegetable fats gives the opportunity to make either harder or softer chocolates.

Texture analysis results on milk chocolates measured at 20°C

Milk chocolate with 7% milk fat and 5% hard vegetable fat required 652g force
Milk chocolate with 7% milk fat and no vegetable fat required 571g force
Milk chocolate with 7% milk fat and 5% soft vegetable fat required 428g force

Flavour

The confectionery manufacturer will want to ensure that the flavour of the chocolate is not adversely affected. External sensory tests have been carried out by our company (Aarhus Olie) using trained tasters, which shows that these fats can be used at a 5% level without adversely affecting the flavour or meltdown of the chocolate.

Tempering properties

The best way to test for the tempering properties is to make up pilot scale samples of the standard and test chocolates and temper them on a pilot scale temperer, noting the temperatures needed in each of the tempering zones to give the required level of temper. Chocolate vegetable fats can be used which behave the same as cocoa butter in the tempering process.

Solidification properties

The solidification time is extremely important, any increase in solidification time results in reduced output or often processing problems. This attribute can be measured in many ways, such as the Jensen or Shukoff cooling methods, Differential Scanning Calorimetry or measuring the viscosity of tempered chocolate against time. Chocolate vegetable fats can be used which speed up, slow down or have the same solidification time as chocolate without vegetable fat.

Heat resistance

For chocolate to be suitable for eating at temperatures of around 28°C, heat resistance is needed. This can be achieved by a number of physical processes, which are not directly fat related. The milk fat can also be reduced, a harder cocoa butter incorporated into the recipe or harder vegetable fats used . These harder vegetable fats are usually referred to as cocoa butter improvers.

It can be seen from the results below that the hardness of plain chocolate can be increased from 222g force to 264g force, milk chocolate can be increased from 54g force

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to 103g force. So these fats can improve the heat resistance of both plain and milk chocolates.

Texture analysis results on chocolates measured at 28°C

Plain chocolate with no milk fat required 222g force
Plain chocolate with no milk fat and 5% cocoa butter improver required 264g force
Milk chocolate with 7% milk fat required 54g force
Milk chocolate with 7% milk fat and 5% cocoa butter improver required 103g force

Conclusion

The use of chocolate vegetable fat in chocolate gives the chocolate manufacturer greater flexibility in terms of texture, processing characteristics and cost.