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HYDROGENATED FATS FOR CONFECTIONERY AND ICE CREAM USE

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Introduction

The use of hydrogenated fats in confectionery and ice cream applications is widespread; for the purposes of this paper it is intended to concentrate on their use as Cocoa Butter Alternatives, as filling fats in both Fat and Sugar based confectionery fillings and to briefly cover their use in various ice cream applications.

Cocoa butter alternatives

Cocoa Butter Alternatives can be split into three groups based upon their raw materials and the processes involved.

Cocoa butter alternatives

	Tempering fats	**Non-tempering fats**	
	CB/CBE	CBR	CBS
Crystal form	β	β´	β´
Main fatty acids	C16/C18	C16/C18	C12
Process	fractionation	fractionation, hydrogenation	fractionation, hydrogenation
Compatibility with cocoa butter	0–100%	0-20%	0–5%

Cocoa Butter Equivalents are produced by blending exotic fats and usually fractionated Palm Oil, the hydrogenation process as such is not involved in their manufacture; it is however a key processing technique in the manufacture of Cocoa Butter Replacers and Cocoa Butter Substitutes.

Cocoa butter replacers

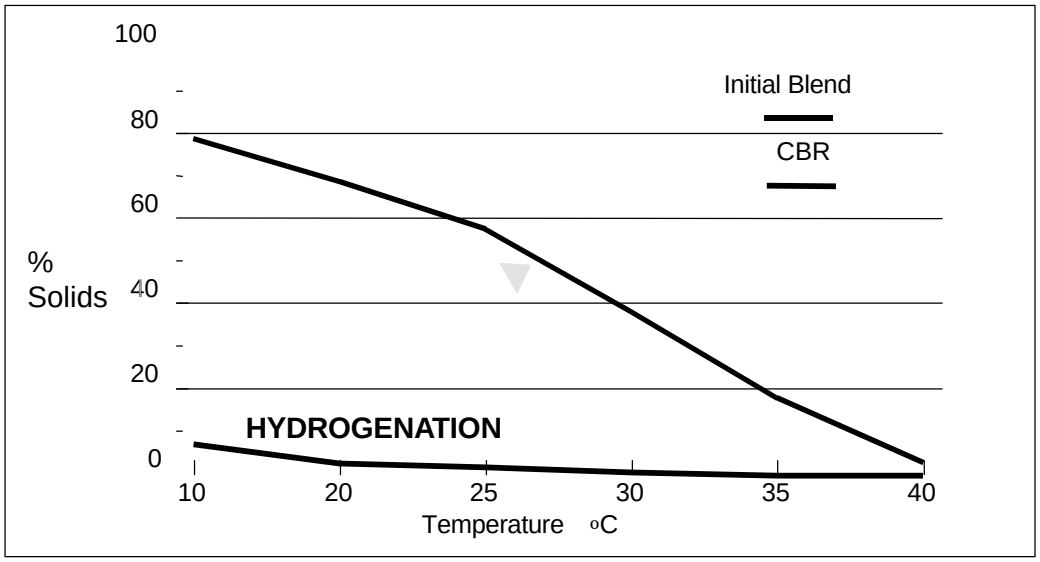
CBRs are based upon hydrogenated non lauric fat systems, Soya, Palm, Rape blends, premium grade products being subsequently subjected to a fractionation process. In the production of economy CBRs the role of the hydrogenation process is to ‘steep harden’ for example a rape/palm blend by promoting the formation of *trans* fatty acids and changing the fatty acid composition from comprising predominantly C18:2*cis* and C18:1*cis* to mainly C18:1*trans*.

Processing rape-palm oil economy CBRs
Changes in fatty acid composition

	Initial blend		CBR
C16:0	20.0		20.0
C18:0	2.8		6.0
C18:1 *cis*	52.5		15.0
C18:1 *trans*	0.0	hydrogenation	55.0
C18:2 *cis*	16.0	→	1.0
C18:2 *trans*	0.0		2.0
C18:3	6.0		0.5
C20:0	0.6		0.6
C22:0	0.2		0.2

The result of this on the melting profile of the fat blend is shown in the comparison of the melting profiles of the two blends.

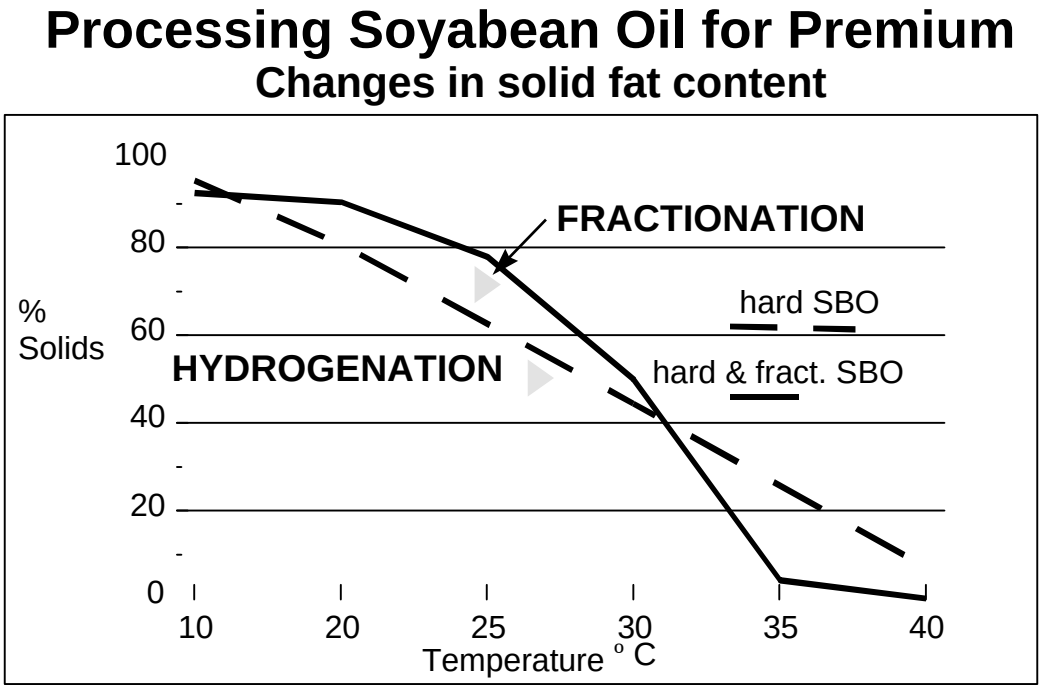
Processing rape/palm oil economy CBRs
Changes in solid fat content



A premium grade CBR would be created by a subsequent fractionation of the hydrogenated product to further increase the relative concentration of C18:1trans fatty acids, resulting in an altogether harder and more steeply melting fat.

Processing soyabean oil for premium CBRs
Changes in fatty acid composition

	Soya oil				CBR
C16:0	11.2		11.0		11.0
C18:0	4.1		16.0		12.0
C18:1 *cis*	21.7		17.0		–
C18:1 *trans*	–	hydrogenation →	53.0	fractionation →	70.0
C18:2 *cis*	53.9		–		–
C18:2 *trans*	–		1.1		5.0
C18:3 *cis*	7.5		–		–
C20:0	0.4		0.4		0.3
C22:0	0.5		0.4		0.4



Cocoa butter substitutes

In contrast to CBRs, Cocoa Butter Substitutes are based upon lauric fat systems normally Palm Kernel Oil. Again the economy products are produced via a straight hydrogenation in which this time the objective is not the creation of trans isomers but rather the saturation of C18:1 and C18:2 fatty acids to C18:0.

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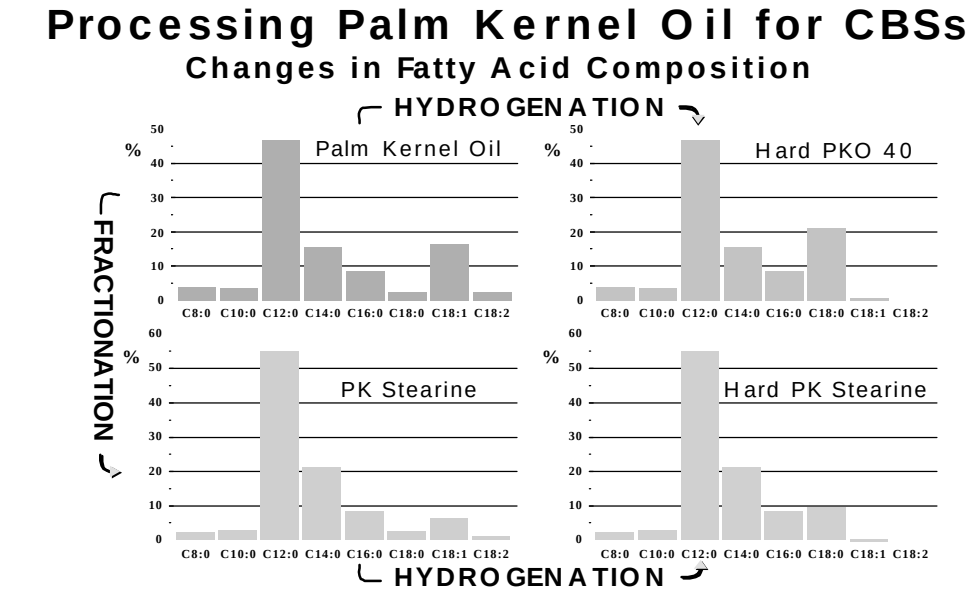
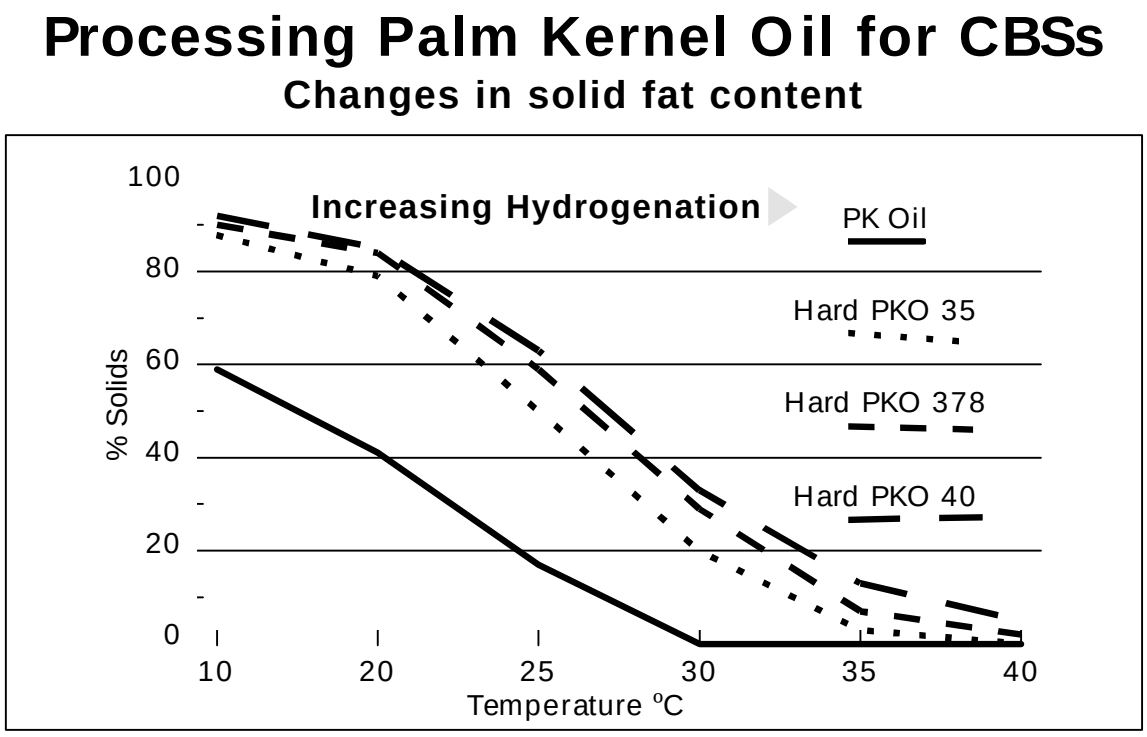


The resulting CBSs can be produced with melting points anywhere between 32°C and 40°C depending upon the degree of hydrogenation.

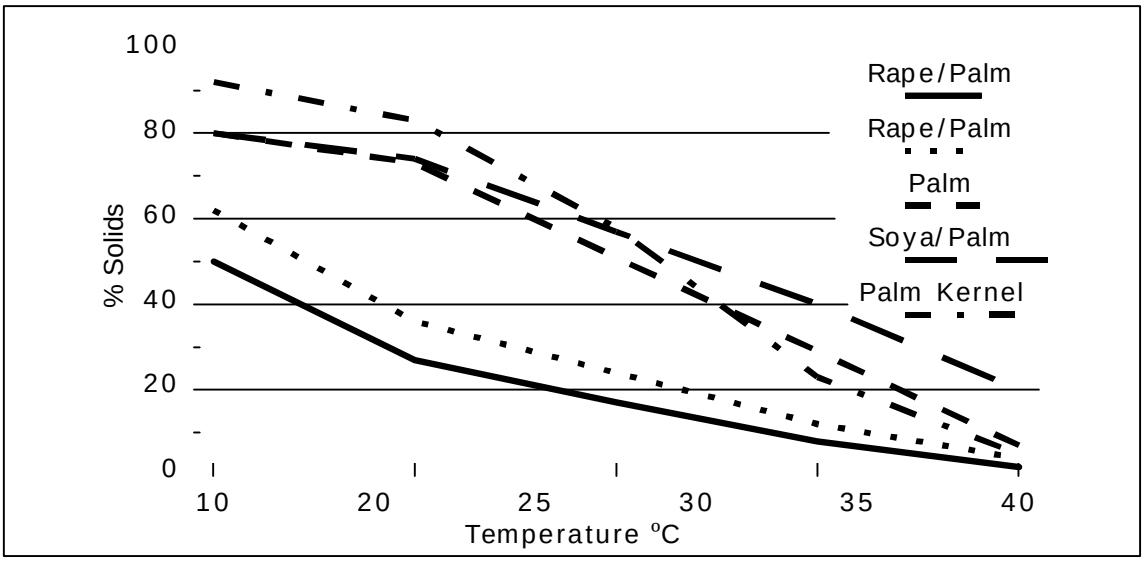


In the production of premium grade CBSs the Palm Kernel Oil is first fractionated and then hydrogenated resulting in a very hard, steeply melting fat system with excellent mouthfeel and melting properties.

Confectionery fillings

For fat based confectionery fillings the both physical and sensoric properties are determined by the fat phase, hydrogenation of both lauric and non-lauric systems results in a wide variety of products with the physical characteristics to meet most requirements.

Solid fat content of hydrogenated fats for fat based confectionery fillings



In sugar based fillings, e.g toffees, caramels etc the fat has more impact on the structure rather than the hardness of the product; flavour, oxidation, and rancidity stability are its key requiremnts. Again hydrogenation is a key process in the development of these characteristics.

Ice cream fats

Hydrogenated fats can be used to replace expensive milk fat in ice cream manufacture, palm/hardened palm blends could be used in economy products whilst blends of hardened laurics and non-laurics would be appropriate for more premium quality products.
In ice cream coatings hydrogenated lauric non-lauric blends can produce a fat system which combines the necessary low melting point, rapid melting and elasticity with rapid crystallisation and ‘good snap’.

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The primary objective of barrier fats is to prevent moisture migration, they re required to be fast setting, flexible, and of low melting point - steep hardened non-laurics can successfully meet these criteria.