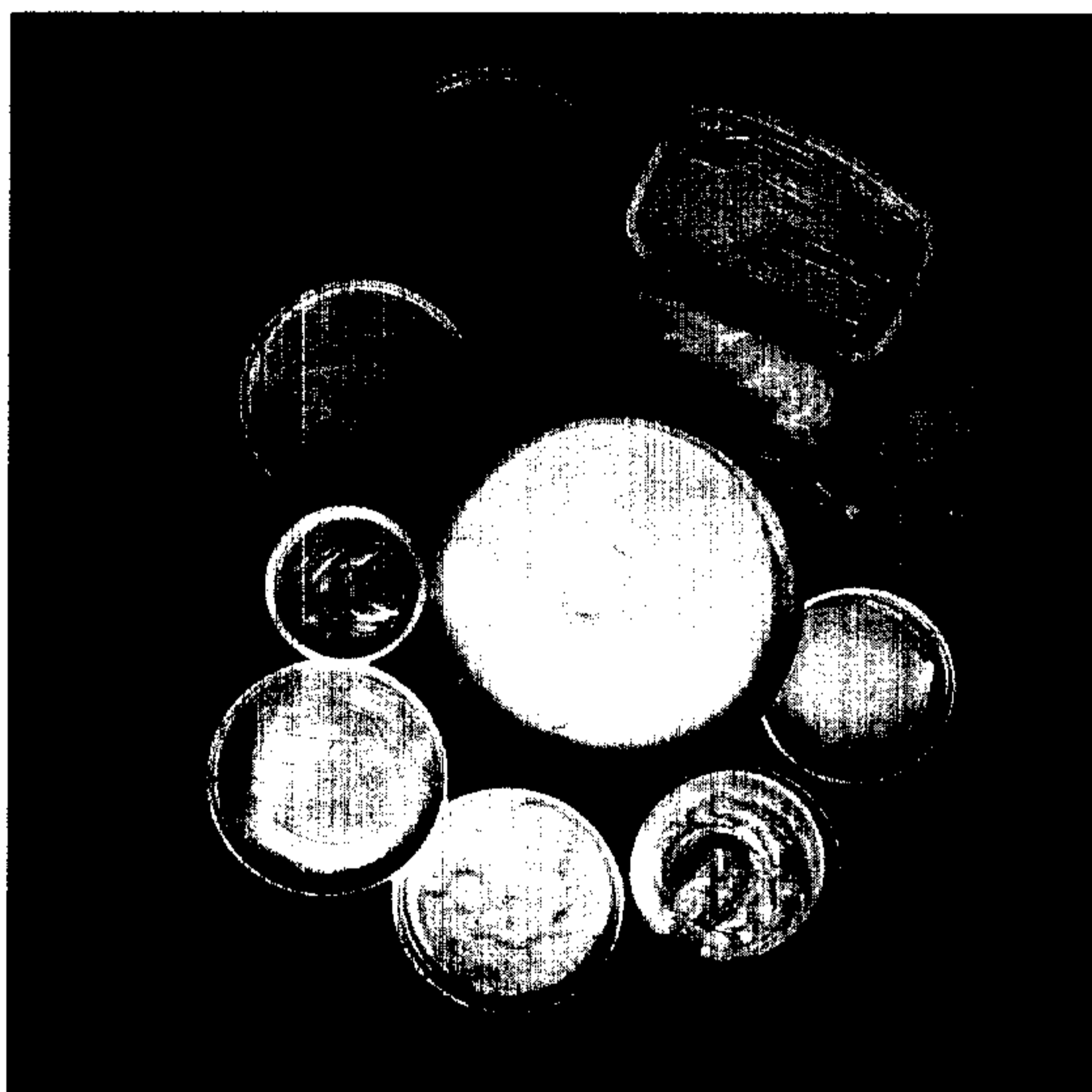


Oleochemical Products in Food Applications

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INTRODUCTION

About 90% of all the palm and palm kernel oil produced is used for edible purposes while the remaining 10% is used for non-edible applications. However, the non-edible or technical applications are increasing. With Malaysia currently the world's largest producer of palm and palm kernel oils, she is in a particularly favourable position to become a supplier of raw materials for oleochemicals.

Malaysia has five plants producing fatty acids at present. Fatty acids are the most important of the basic oleochemical and are regarded as the gateway to other derivatives. In general, fatty acids are produced from natural oils or fats by high pressure and high temperature hydrolysis, which is also known as fat-splitting. The by-product of the process is glycerine.

Crude fatty acids obtained from the fat-splitting process contain a substantial amount of impurities, which impart colour and odour, e.g. to crude palm fatty acids. Therefore it is necessary for the crude acids to be purified by distillation before being

further processed or sold.

Fatty acids and their derivatives are used for various applications such as in the production of toilet soap, in rubber compounding, emulsion polymerization, and for making dimer and trimer acids, lubricating greases, specialty household products, plastic additives, cosmetics, surface coatings and various types of food additives.

THE FOOD INDUSTRY APPLICATIONS OF FATTY ACID DERIVATIVES

The food industry utilizes a wide range of chemical additives such as colouring materials, flavouring compounds, sweeteners, antioxidants, preservatives and emulsifiers. There is a substantial usage of fatty acid derivatives in a wide variety of food products. Essentially, these derivatives are added because of their surface active properties and their principal role is to maintain proper quality in food systems under modern conditions where food products are transported over a long distances and stored for long periods of time in various environments. In most cases, additives have to

conform to national food legislation in respect of the types that can be incorporated and the quantities allowed.

The emulsifiers that are added during food processing are mainly esters such as mono- and diglycerides, propylene glycerol stearates, monostearate and other reaction products from esters such as citrate, succinate, lactylate and acetyl tartrate esters of glycerol monostearate. It is not the intention here to describe the manufacture of these products but instead to describe briefly the application of some of these emulsifiers in some major food products. Their main usage is in margarine, shortenings, baked goods, ice cream and confectionery products.

The products used in the largest volume, by far, are the monoglycerides. 'Monoglycerides' are in practice usually mixtures of mono-, di- and triglycerides. They are prepared either by transesterifying an oil or fat with glycerol or by esterifying fatty acids with glycerol. The reaction temperature is normally below 200° C and transesterification processes will produce about 40 - 60% monoglyceride, the rest being diglycerides and triglycerides. To produce monoglycerides of specific chain length for specialized applications, the esterification process is used. The consumption of monoglycerides is either in the form of mixtures of mono and diglycerides or as 90 - 97% pure monoglyceride (distilled monoglyceride).

MARGARINE

Margarine is a water-in-oil emulsion and the maximum water content specified in most countries is 16 percent. Low calorie spreads, which may not be called margarine, contain less fat and more water.

The emulsifying esters – mono and diglycerides – being oil-soluble are added to the oil together with another emulsifier, lecithin at the beginning of the manufacturing process. Emulsifier are multifunctional in margarine – reducing surface tension between the aqueous and oil phases so that the emulsion forms with minimal work, and stabilizing the finished product during storage to prevent leakage or coalescence of the aqueous phase. They also act as antispattering agents by preventing coalescence and violent eruption of steam during frying (Bailey, 1985). Modern margarine manufacturing is now invariably by continuous emulsification and chilling.

An example of the usage of emulsifiers in a general industrial margarine formulation in Malaysia is as follows:

SHORTENING AND BAKING FAT

Shortening and baking fats are not emulsion and are made of practically 100% fat blended to specification. They are characterized by their wide plastic range over a wide range of temperatures; this depends largely on the fat composition, which varies from country to country

The emulsifiers added to shortening serve a different purpose as compared with margarine. They promote the dispersion of the fat throughout the dough during the process of cake-making or bread-making. At the same time, the emulsifiers, also help to promote the incorporation of air thus resulting in baked goods of greater volume.

A good formulation for a baking fat(shortening) for cake is also as follows (Teah, 1989):

Fat:	%
Palm olein	55
Palm stearin	10
Hydrogenated soya bean oil (36°C) (Melting point) of the mixture: 36-38°C	35
Distilled monoglyceride	0.1
Lactic acid ester	0.25

CONFECTIONERY PRODUCTS

A great deal of research and development has been carried out to produce confectioner's coating fats which will resemble chocolate but in which most if not all of the cocoa fat has been replaced with another edible fat. Emulsifiers are added to some of the cocoa butter substitutes to inhibit bloom in confectioner's coatings. (Bloom is a process whereby fat migrates to the surface, of the chocolate, discolouring it and causing it to lose its gloss). The most widely used emulsifier for this purpose is sorbitan tristearate.

ICE-CREAM

Ice-cream can be made from either dairy products or from vegetable fats (non-dairy ice-cream). Emulsifiers are used in non-

dairy ice-cream, which normally contains about 10% vegetable fat (*e.g.* palm oil), non-fat milk solids, sugar and other additives besides emulsifiers.

The emulsifiers used in ice-cream are to ensure smooth dispersion and stabilization of fat globules formed through agglomeration. They also help to entrap air, leading to the dryness and stiffness of the ice-cream. The emulsifiers normally used are mono-diglycerides, sorbitan esters or mixtures.

OTHER FOOD PRODUCTS

Emulsifiers are also used in a wide variety of other products such as coffee whiteners, peanut butter, mousse and other desserts, whipping cream, mayonnaise and salad dressings. Some emulsifiers, *e.g.* polyglycerol esters, may be added to cooking oil to inhibit cloudiness due to crystallization.

GENERAL MARGARINE FORMULATION IN MALAYSIA

Fat Phase*	%
Fat blend (melting point 39-40°C) (Palm oil, palm kernel oil and palm stearin)	83
Monoglyceride	0.25
Lecithin	0.08
Beta-carotene	0.07
Flavour	0.06
Aqueous phase	
Water (milk free)	14.6
Sodium chloride	2.0
Sodium benzoate	160 ppm
Citric acid	160 ppm

*Yee Lee Oils and Foodstuffs, 1990

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