

# Utilization of Oil Palm Products in the Formulation of Cheese Powder

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## INTRODUCTION

Cheese is a food made from coagulated curds that are pressed together to form a solid that is usually allowed to ripen. The main milk components (protein, fat and minerals) are concentrated and protected from rapid deterioration by spoilage micro-organisms. Many industrial food applications are dependant on the delivery of an authentic cheese flavour; however, food manufacturers have continually sought for alternatives due to the requirement to refrigerate fresh cheese. By far, the most efficient way to incorporate the natural goodness of cheese has been through the use of cheese powders.

Cheese powders are a convenient and economical alternative to block cheese. They offer the entire flavour, functional and nutritional attributes associated with natural cheese. Savings from reduced raw materials, shipping and storage costs can also be considerable. Up to a year in product shelf-life and significant blending advantages make cheese powder a logical choice for many food processors and in other applications. The potential application for cheese powders extends far beyond traditional snack seasonings and dry boxed convenience dinners where low moisture and long shelf-life without refrigeration demand their use. Cheese powder systems also deliver exceptional combinations of cheese and dairy flavours while maintaining a label-friendly identity. Kerry, an Irish-based company, is one of the leading suppliers of spray-dried cheese and dairy flavourings.

In recent years, producers have seen remarkable growth in the cheese powder industry as a result of flavour trends and complex innovative products. Cheese flavour is one of the fastest growing flavours in the Asian region and the Pacific Rim. The compatibility of cheese flavours in a wide variety of snack substrates has contributed in making cheese among the top

snack flavours globally, while the snack food industry is also the largest user of cheese powders.

## CHEESE POWDER FORMULATION

Due to the varying demands from the many segments of the food industry, most cheese powder manufacturers make custom-designed products to meet specific application requirements that provide economy of operation for end-users. Ability to provide unique and distinct cheese powder flavours to

ensure brand recognition and image of the finished products present more challenges to cheese powder suppliers as well. Delivery of cost-efficient products particularly in the snack food sector makes the usage of enzymatically derived flavours and other flavouring components compulsory. Virtually, all powdered cheese in the market consists of natural cheese solids combined with other food ingredients that provide the best value and a competitive end-product. Substitution of milk fat from cheese with a good quality vegetable fat is a feasible alternative in cheese powder formulation.

In 1999, as part of its Asia Pacific expansion strategy, Kerry took a lead in establishing the very first cheese powder spray-drying plant in Southeast Asia, in the southern city of Johor Bahru in Peninsular Malaysia. With Malaysia being the largest producer of palm oil in the world, it was only logical that Kerry looked into the use of palm oil in the products manufactured there. It was during localization of the process of cheese powder manufacturing that Kerry ventured into the use of palm oil as a substitute for milk fat and other seed oils.

## ATTRIBUTES OF PALM OIL

Apart from local availability and supply considerations in cheese powder formulation, palm oil was also chosen for being a highly

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functional ingredient used in the food industry, e.g. for margarines, shortenings, specialty fats, as well as other fat-based products. The key attributes that make palm oil attractive for use in cheese powder formulation are:

- heat stability;
- high resistance to oxidation;
- superior sensory attributes;
- price competitiveness;
- mouth-feel;
- health consciousness;
- low crystallization temperatures; and
- melting properties.

Use of palm oil as the major frying oil in the snack food industry and other processed foods also provides labelling advantages to manufacturers as palm oil would be the single source of vegetable fat present in a particular finished product.

#### USE OF PALM OIL IN CHEESE POWDERS

During the developmental stage of making cheese powder with palm fat, partially hydrogenated palm oil is the closest alternative and the best substitute for the other vegetable fat that was already incorporated in the cheese powder industry.

The in-house testing done at Kerry to utilize palm fat in cheese powder had very encouraging results. Findings suggest that stability and shelf-life of partially hydrogenated palm oil is superior to other hydrogenated seed oils in overall flavour, functionality, and it also has the added advantage of a much lower *trans* fat content. Typically, soya oil has been used as a fat in cheese powder. *Table 1* compares hydrogenated palm oil and hydrogenated soya oil. It may be seen that palm oil is as good as soya

oil in terms of mouth-feel and flavour, but superior to soya oil in cost competitiveness, oxidative stability and shelf-life as well as being more healthy in having less *trans* fat.

#### Spray-Drying and Oil Encapsulation

Spray-drying is the most common method used for dehydration of products that contain water. The very first step in a spray-drying cycle is wet processing or batching. During wet processing, all the powdered and liquid raw materials/ingredients are diluted in water and mixed to achieve an emulsion at a pre-determined solid content. In the batching tank, the emulsion is heated to a temperature of 60°C-70°C and homogenized. From the homogenizer, the emulsion is transferred to the high-pressure pump. The high-pressure pump then pumps the emulsion to the atomizer, which is located at the top of the chamber. At the atomizer, the feed stock is converted into small droplets and mixed with heated air at temperatures in excess of 170°C. The hot air supplies the heat required for evaporation of the water from the spray of fine droplets.

Upon evaporation of the liquid from the atomized droplets, the dried bulk powder is recovered in the chamber. From the chamber, the powder is further removed from the exhaust air and collected at the base of the cyclone (*Figure 1*). Freshly spray-dried powders are cooled down to room temperature, and a free-flowing agent is added. Addition of the free-flowing agent helps to prevent the spray-dried powders from caking during storage.

The cheese powder manufacturing process is shown in *Figure 2*, in which spray-drying features

prominently.

Spray-drying is probably the most effective means of encapsulating fats and oils. During the spray-drying process, the fat globules/droplets are encapsulated with non-fat components like complex protein (caseinate), starch, gums and several other modified food components to achieve a dry and free-flowing powder. This non-fat component forms a film around the fat droplet and provides primary protection against oxidation and polymerization. This greatly helps to improve the stability of fats and oils that are less stable and more prone to oxidation in their original form. In addition to this, encapsulation of oil greatly helps to reduce product odours and to improve flavour delivery for convenient, ready-to-use food products.

For cheese powder spray-drying, the inclusion of palm fat and its derivatives contributes to the ease of operation and the handling of the powders. The melting behaviour facilitates the cooling process and helps in maintaining the flowability of the powders during storage.

Currently, the usage of palm fat-based cheese powder spans across many segments of the food industry in the Asia Pacific region. It is mainly used in snack foods, fillings, bakery products, biscuits, dressings, dips, sauces and soups, desserts and convenience meals, and is also added directly on other hot dishes, e.g. pasta and fried items, for flavour enhancement.

#### *Trans* Fat and Palm Oil

Small amounts of *trans* fat occur naturally in dairy products and meat, but it is the non-natural form that faces extensive debate. *Trans* fatty acids (TFAs) are artificially formed when liquid oils or

TABLE 1. TYPICAL COMPARISON BETWEEN HYDROGENATED PALM OIL AND HYDROGENATED SOYA OIL

Cheese powder with 35% fat	Palm oil	Soya oil
Mouth-feel	Good	Good
Flavour	Comparable	Comparable
Cost	Competitive	Less competitive
Oxidative stability and shelf-life	Superior	Good
Healthy	10% <i>trans</i> fat	40% <i>trans</i> fat

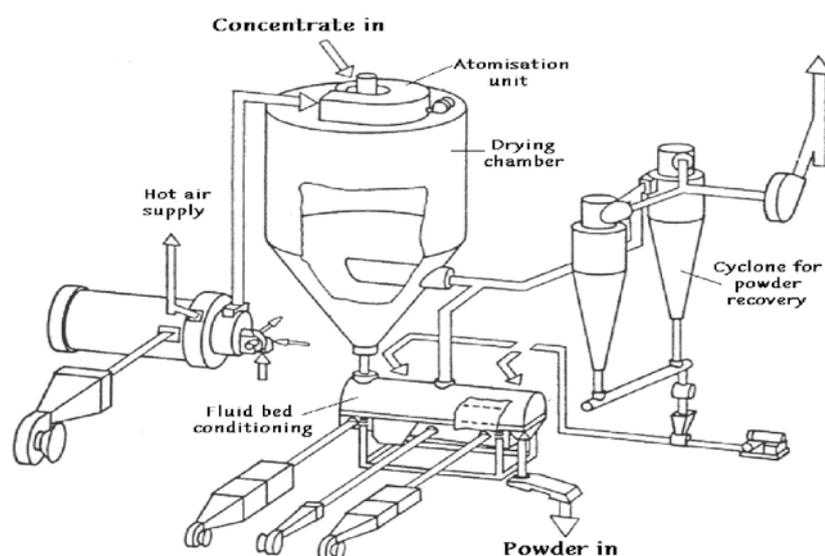


Figure 1. Spray-drying – process diagram.

fat go through a chemical process called hydrogenation. Common in a range of food products – biscuits, chips, doughnuts, crackers, etc. – the hydrogenated vegetable fat is used by food processors because its solid form at room temperature facilitates handling and primarily extends the shelf-life of the products. However, *trans* fat is deemed unhealthy by medical professionals, and research scientists have found that *trans* fats raise LDL (bad) cholesterol levels, causing the arteries to become more rigid and clogged, thereby promoting heart disease. Hence, the move away from *trans* fat becomes vital as more consumers look for alternative products, switching to healthier food options.

Replacing the role of a partially hydrogenated fat in terms of functionality, e.g. aerating, emulsifying, lubricating and providing textural, structural and flavour characteristics is a challenge for food developers. Increasing numbers of ingredient suppliers are rolling out replacements for the TFAs to meet the market demand. Probably, thousands of products are being reformulated.

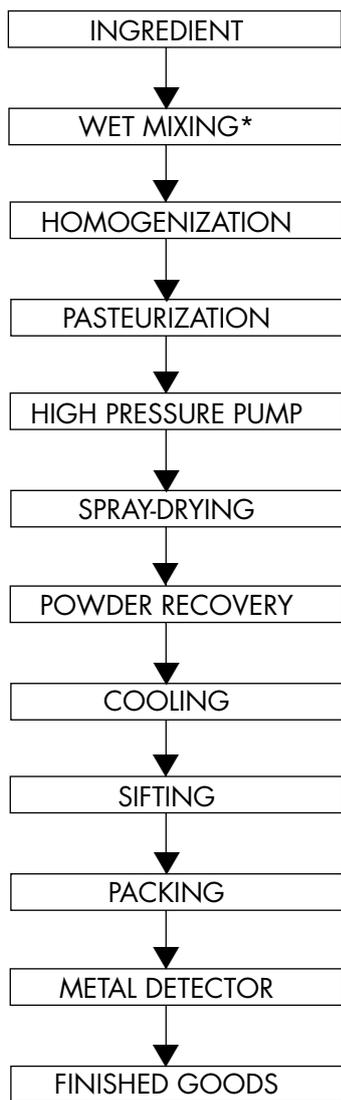
Non-*trans* fat, traditional seed oils without hydrogenation are not considered suitable alternatives due to their short shelf-life and poor stability or flavour reversion – which is a concern for companies. The urgent need for resolution and the search for options have shifted the focus to palm oil.

Palm oil, coming from the world's most productive oil-producing plant (oil palm), is an ideal choice to achieve low *trans* or *trans*-free products. Palm oil and palm oil fractions with their natural source of solid fat and balance in saturated and unsaturated fatty acid profiles are alternatives to hydrogenated fats in food processing applications.

### Emerging Trend – *Trans*-free/ Low *Trans* Cheese Powder

In line with the trend for healthier food, Kerry Ingredients, being a major supplier to the food industry, has taken the step to reduce the usage of hydrogenated fat in cheese powder. It is rather challenging to develop a low *trans* or *trans*-free cheese powder due to the fact that hydrogenated fats have high oxidative stability which provides extended shelf-life and stability, rather critical criteria for food items in a tropical climate.

Kerry's in-house tests and shelf-life studies have shown that cheese powder produced via co-drying a blend of cheese and dairy solids with palm fractions fat exhibits comparable shelf-life stability. The organoleptic attributes of cheese powders using low *trans* or *trans*-free palm fat are similar to cheese powders using hydrogenated palm fat. Cheese powders using



Note: \*Cheese blocks are dissolved using emulsifying salts (e.g. phosphates) during wet mixing.

Figure 2. Cheese powder manufacturing process.

low *trans* or *trans*-free palm oil and its derivatives are suitable for most applications when compared to the original blend of dairy fat and the hydrogenated fat.

Figure 3 exhibits a summary of a sensory evaluation conducted by Kerry in-house trained panel. The organoleptic scores are generated based on the intensity of the key flavour attributes for a specific cheese powder sample throughout the shelf-life period.

**CONCLUSION**

Palm-based products have been successfully incorporated into the formulation of cheese powder as a substitute for the milk fat from natural cheese. This has helped to maximize the use of palm-based products and the development of tailor-made products that suit the

requirements of customers and/or manufacturers.

Kerry Ingredients, being a leading ingredient supplier to the food industry with success in developing palm fat-based cheese powders, can definitely help food companies in tapping into the current trend for healthier foods with the development of its new low *trans* or *trans*-free cheese powder. This unique combination of performance (functionality) with health benefits will gain consumer food companies a real competitive edge in a market that caters for health conscious consumers.

Looking into the future, the current global trend will further contribute to the increasing demand for palm oil and palm derivatives, and will extend the use of palm oil in more innovative, trendy and healthier food products.

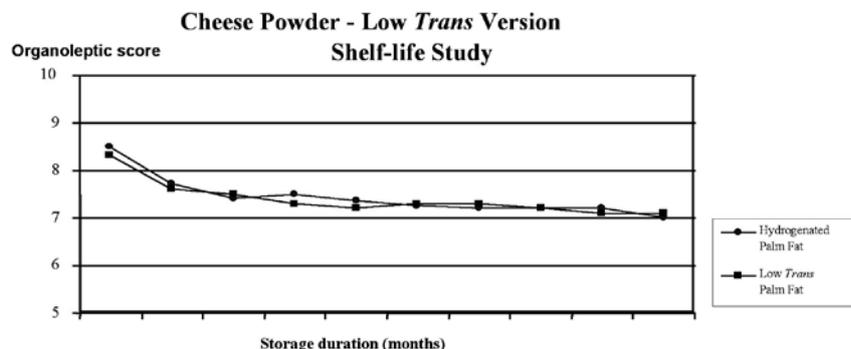


Figure 3. Summary of sensory evaluation following storage of a low trans version of cheese powder.