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Non-Traditional Soyproducts in Asia

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Abstract

Soybeans provide both protein and edible oil as their main components. Culture and geography are the main determinants of the end uses for soybeans. In addition to traditional soyfoods which have been produced in many countries in Asia for several millennia, several non-traditional soyproducts have recently been produced in these countries. These are baked/roasted whole seeds and soymeal, products from full-fat soyflour, roasted soyproducts, soyproducts from defatted soybeans (including animal feed products and other animal soyproducts), isolated soyprotein products, soyflour, concentrates and grits products (bakery ingredients, meat products), special diet foods, soyproducts from crude soyoil, soyflour, etc.

Keywords: *Non-tradtional soyfoods, soyproducts, soyflour, soymeal, de-oiled meal, defatted soybeans, isolated soyprotein, soyoil.*

Introduction

FAO (1999) statistics indicates the soybean production figure in 1998 at around 22.80 mill.t for the Asia-Pacific Region, against a global figure of some 158.33 mill.t. People's Republic of China was the largest producer in the Region, with 13.76 mill.t, followed by India (6.10 mill.t), Indonesia (1.31 mill.t), Democratic Republic of Korea (0.42 mill.t) Thailand (0.37 mill.t), Republic of Korea (0.16 mill.t), and Iran, Japan and Vietnam (0.14 mill.t). Other producers are Australia, Myanmar and Cambodia which produced less than 100,000 t.. Countries such as Nepal, Pakistan and the Philippines produced smaller quantities of soybeans. The average annual growth rate in the Region has risen to 4.7% between 1988-98, with individual country growth rates as high as 25.4% in Pakistan, 14.4% in India, 12.3% in Myanmar, and 10.4% in Cambodia. Thailand registered a decline of 4.8% during this same period.

Strong potential for processing exists, as soybean provides both protein and edible oil, as its main components. Culture and geography are the main determinants of the end uses for soybeans. In South Asian countries, the priority use is as an oilseed, with the de-oiled meal often being exported for animal (mainly cattle) feed. In Southeast and East Asian countries (including Japan), on the other hand, soybeans are generally consumed directly or in formulated products, as they are an excellent source of dietary protein in human food. An excellent review of soybean processing and utilization appears in Chomchalow (1990), while that of traditional soyfoods in Asia in Chomchalow (1998).

If one examines the post-harvest flow of soybeans in, for example, South Asia, typical post-harvest losses may be as high as 10-15% through poor drying, or grain shattering on harvest. Food uses of 0.5-1% will be applied as soymilk, soyflour, soydhal and other products. Seed for planting can take up around 18% of the harvest. Then, the major part of the crop, around 66%, is utilized for edible oil production, normally by solvent extraction. Of the remaining soymeal, around 20% is used as livestock feed whilst the remainder may be exported (Singh 1989).

Soyproducts from Whole Bean

If the whole soybean containing its natural oils is used for soybean products, then the range of derived products is quite wide. Nutritious food products can be developed from the whole soybean and, as a result, soybeans have been a staple food in the oriental diet for several thousands of years. The protein content of the soybean ranges from between 30-40%, the oil content ranges from 12-18% or higher; the amounts of these components have an inverse relationship. The fiber content of the soybean, including the hull, is over 5%, and the carbohydrates content is around 40% (Bhumiratana 1978).

Baked / Roasted Seeds and Soymeal

Soybean seeds can be presented in edible form after a baking or roasting process. Stockfeeds derived from soymeal have been subjected to an extrusion process.

Products from Full-Fat Soyflour

The full-fat soyflour can take several forms, whether enzyme-active or not, and whether it includes the hulls or not. The functional properties of the full-fat soyflour make it a very versatile ingredient which can be used in bread, candy, doughnut mix, frozen desserts, pancake flour, pan grease extender, pie crust, sweet goods, low-cost gruels and soymilk powder drinks.

Roasted Soyproducts

Using roasted soybeans, the applications range from candies, cookies, and cracker toppings and ingredients, to confectionery, fountain topping, soycoffee, soynut butter, dietary snacks, and spice base.

Soyproducts from Defatted Soybeans

Products made from defatted soybeans include animal feeds, isolated soyproteins, soyflours, concentrates and grits products.

Animal Feed Products

Animal feed products made from defatted soybeans include soymeal and other animal soyproducts.

Soymeal: Soymeal has a major role in animal feed formulations, for livestock and poultry production. The complementarity of the amino-acid profile of soybean and maize allows a protein source of high biological quality in feed formulae. Compared to corn or maize, dehulled, solvent extracted, soybean meal contains higher amounts of the limiting amino acids for poultry and livestock, i.e. the lysine level is about 6.6% (approximately 2.7% in maize), and the tryptophan level is about 1.2% (against 0.7% in maize). Isoleucine is at about 5.8% (against 4% in maize) and arginine is about 7.0% (against 4% in maize) (Bray 1980).

Other animal soyproducts: In addition to this conventional use of soybean meal, other applications are as significant, e.g. a carrier for vitamins, antibiotics and medicinal products as well as a high-fiber livestock feed, and also as an ingredient in other pet foods.

Isolated Soyproteins

Isolated soyproteins (ISP) have many edible and commercial uses as food and non-food ingredients with specific functional properties.

ISP: These ISP can be found improving protein content and nutritive value, as well as texture and appearance in a range of foods. These include examples such as simulated meat products, textured vegetable protein (TVP), spun protein fibers for imitation meats, dehydrated 'meat' bits. ISP can be further used as aerating agents in marshmallows, *frappes* and *fondues*; also in beverages such as soymilks, food and sports drinks, infant food formulations and dietary drinks.

Industrial soyprotein: The industrial (non-food) uses of isolated soyproteins include

applications in the manufacture of adhesives, plywoods, wallboards, insecticidal sprays, particle boards, tape joints, cements, linoleum backing and textured paints. The ISPs are also used as nutrients in yeast production, antibiotics, beer and ale brewing.

Soyflour, Concentrates and Grits Products

Under this group of products are bakery ingredients, meat products, special diet foods, soyoil, and food products.

Bakery ingredients: In this form, defatted soyflour can be used as an ingredient in high-protein bread and baked goods, high-protein cookies, crackers and doughnuts. In alimentary pastes and noodles, the flour is used as an ingredient. Ready-to-eat cereals and prepared mixes, such as pancake and waffle, also contain soyflour.

Meat products: Meat products can often contain soyflour or protein concentrate in meat patties, speciality sausages, chili *con carne*, etc.; similarly, soyflour is used in textured vegetable protein (TVP), formulated meats, fruits and nut products.

Special diet foods: In general, special diet foods are used for diabetic, allergenic and/or high-protein applications, as well as canned baby foods and dry powder weaning foods in particular, contain soyflour; other examples are dry food concentrates for camping or space food, hypo-allergenic soymilk for lactose intolerance.

Soyoil: One of the primary uses of soybeans is edible oil extraction; once this oil has been refined by neutralizing and deodorizing, then a number of products and by-products can be derived.

Food products: These are derived from the refining process include cooking and salad oils, mayonnaise, margarine, salad dressings, sandwich spreads, vegetable shortening.

By-products from Soyoil

Soyoil contains by-products which are of considerable importance. They can be separated under two groups, viz. (i) sterols, fatty acids, glycerol; and (ii) technical or isolated products.

Sterols, fatty acids and glycerol: The extraction and refining process of edible oils leads to several by-products including sterols, fatty acids and glycerol. Tocopherol, for example, has many food, feed, pharmaceutical, consumer, and industrial uses. Soybean lecithin is used as an edible emulsifying agent, in bakery and candy products, as a surface active agent in beverage powders, chocolate coatings and pharmaceuticals, nutritional use in medicinal and dietary applications. Lecithin can also be used as an anti-spattering agent in margarine and a stabilizing agent in several foods. Additional products include pharmaceuticals and antibiotic manufacture, mellorine and medicinal products.

Technical or industrial products: These include caulking compounds, core oils, disinfectants, electrical insulation, insecticides, linoleum backing, oiled fabrics, printing inks, protective coatings, plasticizers, waterproof cement and weather-board. Further technical and industrial uses for these by-products include applications as an antifoam agent in yeast and alcohol production; as a dispersing agent in paint, ink, insecticides and rubber goods; as a wetting agent in cosmetics, paints, calf milk replacement, and powdered metals.

Constraints

Solvent extraction plants for soyoil are well described in the technical literature. In several countries, however, solvent extraction raises some challenges and has some constraints. The raw material quality can be quite variable, even poor, caused by poor post-harvest practices, storage, handling and the incidence of high moisture content. In addition the non-availability of solvent due to import restrictions can produce delays in processing.

Prospects

Other less tangible but no less important advantages for soyfoods are that, apart from offering vegetarian alternatives to regular foods, there are nutritional benefits such as no cholesterol content and the presence of essential and polyunsaturated fatty acids in soybean oil. Soyfoods are readily digestible and the protein is of high biological value, close to that of dairy protein. They are very versatile as have been elaborated, and new foods such as soy ice cream and soyburgers are making inroads into the traditional dairy and a livestock foods arena. Soybeans can therefore be positioned as low-cost, high-quality protein and oil-food legumes. They can be considered for supplementation of wheat flour to provide a more balanced nutritional profile at low cost in countries where popular diets may be marginal.

The production of extruded and textured foods using extrusion technology with soyflour in combination with e.g. rice, plus supplementary minerals and amino acids, can be used to provide low-cost, nutritious snack foods, as well as supplementary food for weaning infants, lactating mothers and other vulnerable groups.

Environmental concerns can be addressed by the use of products such as 'biodiesel'; an alternative fuel derived from soyoil. Through the process of esterification, methyl soyate is formed after removing the glycerine from soyoil. The methyl soyate is then used in diesel engines, at up to 100%, but usually at 20-30%, blended with petroleum diesel. Particulate and carbon monoxide, sulfur dioxide emissions are reduced.

In soybean-based newspaper inks, the petroleum solvent is replaced, reducing volatile organic compounds (VOC) and polycyclic aromatic compounds (PAC) which are harmful to health. Soybean oil can substitute for petroleum oils in existing formulations, though at a slightly higher cost. Having similar resin solubility characteristics, the oil oxidizes on the paper and lower the "rub-off" effect, by encapsulating the pigment on the newsprint. Disposal of waste ink is easier, cleaner and has less environmental impact (Erhan 1992).

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