

Food By-products based Food Powders for Functional Nutrition and as Anticancer Agents

Ozlem Tokusoglu

Abstract

Food by-products in the food industry is characterized by a high ratio of product specific waste not only does this mean that the generation of this waste is unavoidable, but also that the level and the kind of by-product which consists primarily of the organic residue of processed raw materials, can scarcely be changed if the finished product quality is to remain consistent. Using and disposal of the merchandise specific waste is difficult due to its inadequate biological stability, potential pathogenic structure, high water content, potential auto oxidation tendency and high amount of enzymatic activity.

In the food industry, the diverse types of by-products can be evaluated by various branches of industry due to the selected desired properties of food by-products. The pulps, dregs, and wasted in food processing depends on the quality of by-product management, while ensuring environmental protection and sustainability in by-production monitoring. Food by-products or food industry shelf-stable co-products such as liquid, pomace, or powder forms can be obtained from fruits, vegetables, meats, seafoods, milk and dairy, cereals, nuts, fats and oils processing; drying by-products and converting them into powder offers a way to preserve them as useful and valuable products. Those above-mentioned by-products may be evaluated as a source of dietary phytochemicals including phenolic antioxidants, carotenoids, bioactive other polyphenols, dietary fibers; as a source of proteins, peptides and amino acids, may be evaluated as extruded products as sources of collagen, gelatine, and as sources of various food additive materials and they may be evaluated as extruded products. However, some of the by-products can be utilized as compost for plants, can be used as animal feed and can be utilized as industrial materials. Today, the potential utilization of these major components has been the focus of attention.

The Epidemiological studies have pointed out that fruits and vegetable consumption imparts health benefits including certain types of cancer, reduced risk of coronary heart diseases. Chemoprevention is an active cancer preventive strategy to inhibit, delay, or reverse human carcinogenesis, especially using naturally occurring chemical agents. Dietary Supplements and/or food fortification based on food by-products may be an alternative to the above mentioned healthy constituents. The health benefits of fruits and vegetables are majorly attributed to bioactive nutrients as phytochemicals, carotenoids, vitamins (ascorbic acid, tocopherol etc.), also to dietary fiber of these products.

Due to the high consumption and industrial processing of the edible parts of fruit, wastes such as the peels and seeds of fruit (apple, pear, orange, pomegranate, and tomato) residues, citrus fruit skins, mango residues, pineapple residues, residues of other exotic tropical fruits (avocado, banana, guava, jackfruit, and longan fruit), chestnut residues, olive residues and sugarcane bagasse are generated in large quantities in big cities. Moreover, the peel, leaf, or stem fractions of cabbage, cauliflower, celery, Chinese cabbage, coriander, cucumber, eggplant, endive lettuce, fennel, potato, rape, scallion and spinach can be evaluated as dietary phytochemicals and can be used extruded product, and the dietary fiber is also used in manufactures powder forms. The current methods for further utilization of product-specific waste of fruits and vegetables have been developed along traditional lines and these utilizations are closely bound to the agricultural origins of the raw materials. The majority of by-products in the meat industry are produced during slaughtering. Slaughterhouse waste consists of the portion of a slaughtered animal that cannot be sold as meat or used in meat products. Such meat by-products include internal organs, fats or lard, skin, feet, abdominal contents of the gastrointestinal tract, blood, bones, tendons, and the powder produced from these by-products.

Meat by-products are made by slaughterhouses, meat processors, wholesalers, and rendering plants.

The by-products of meat containing ash biomass include phosphorous. It is known that some high phosphorous ash can be in sludge ash and meat and bone meal, and phosphorous from biomass energy, biomass ash disposal, and as a phosphorous source.

By-products of fruits and vegetables are sources of these healthy compounds and it has been considered that these are the highly desired constituents of by-products of fruits and vegetables. Seafood product processing discard account for about three-quarters of the total weight of catch. Seafood processing is used as a probable waste utilization. It is known that the major components of seafood discard products are tongue, cheeks, stomach, liver of fish, protein bioactives from residual fish, marine bioactive lipid components (omega 3,6, DHA,EPA), fish skin, carotenoid bioactives and chitinous materials from shellfish products, gut enzymes, flavour products, anti-freeze proteins from seafood blood. Nowadays, the potential utilization of the above-mentioned major components has been the focus of attention.

Fish by-products are one of the most important raw materials for food, nutraceutical, pharmaceutical, and biotechnological applications. By-products include fish stomachs, viscera silage, and fish sauce. It has been stated that carnivorous fishes have high stomach pepsin contents, and silage is made from minced viscera or from the separated stomach. By ultrafiltration, concentration, and spray-drying, cod stomach silage can give a pepsin preparation.

Fish oil from fish processing waste and marine fish and chicken visceral wastes are rich source of polyunsaturated fatty acid concentrates, and in particular, of omega-3 essential fatty acids. Not only fish skin but also bones and fins are potential sources of collagen and gelatin.

Shrimp processing leads to massive amounts of shrimp biowaste and the major constituents of shrimp by-products are protein, chitin, lipid, minerals, and also valuable carotenoid astaxanthin. Chitosan, a valuable bioactive compound, has widely utilized in food, agriculture, biotechnology, cosmetics, medicine, and waste treatment. Shrimp cooking wastewater is

moreover an authentic foundation of astaxanthin and bioactive peptides.

The dairy by-product whey is also a very good source of peptide with remarkable biological activities. Whey is an abundant by-product of the dairy industry that corresponds to the liquid fraction remaining after, milk clotting and casein removal during cheese manufacturing. Whey includes the lactose and noncasein proteins of milk. Moreover, the bioactivity of the other components of cheese whey including lactose, oligosaccharides, and minerals, is well-known.

Cereal by-products are also very important, phenolic compounds can be extracted from cereal brans with the inclusion of anti-oxidants, and these valuable products provide resistance against free radical damage, cancer, and cardiovascular diseases. Gamma-Oryzanol extracted from rice bran is a potent antioxidant, a cholesterol-reducing agent, a tumour inhibiting agent, and a prevention agent in menopausal syndrome treatment.

Recently, nut by-products have also gained importance in food technology in particular; walnuts are unique due to their perfect balance of n-6 and n-3 poly unsaturated fatty acids, a ratio of 4:1, which has been shown to decrease the incidence of cardiovascular risk.

Chemoprevention is an active cancer (CA) preventive strategy to inhibit, delay or reverse human carcinogenesis using naturally occurring or synthetic chemical agents. Studies have resulted that several new phytochemicals possess cancer preventive effect such as polyphenols. Several cellular mechanisms contribute to the overall cancer preventive effects of dietary phytochemicals. Signal transduction pathways are potential molecular targets for chemoprevention by dietary phytochemicals. Increasing expression of detoxifying enzymes and/or antioxidant enzymes inhibit the cell cycle progression and cell proliferation, induce the differentiation and apoptosis, inhibit the expression and functional activation of oncogenes, increase the expression of tumour-suppressor genes, inhibit angiogenesis and metastasis by modulating cellular signalling pathways. Dietary supplements and/or food fortification supported food by-product could also be alternative for above-mentioned healthy constituents.