

## Review: Food Industry By-Products used as a Functional Food Ingredients

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### Abstract

The food industry generate large amount of wastes or by-products annually around the world from a variety of sources. In that food wastes or by-products are an excellent source of nutraceuticals, bioactives, inherently functional and possess many components that are good for human health. Food wastes or by-products convert to the functional food ingredients it is the healthy trends in the food industry. The waste management is one of the major parts of food industries. The large volume of the low cost by-product gives economical advantage of its potentially valuable components and environmental benefits. Therefore, the recovery of by-products to health beneficial product and economic benefit to labour, stakeholder and country.

As people become increasingly aware of the relation between diet and good health. Consumer attitude towards health foods is promising development and the scope of functional foods is growing in the world markets. Consumers believe that foods are taken directly effects on their health as a good or as a bad. Today foods are not only used to satisfy our hunger but also to provide essential nutrients for humans and these nutrients having the health benefits, protecting and controlling from the diseases. The market for the functional foods has seen a tremendous demand in the recent years. This review article enlists various food industries by products that are being commercially used in functional food ingredients for human consumption.

**Keywords:** Food by-products; Functional food ingredients; Health; Economy

### Introduction

Food wastes or by-products are produced in the large amount in the food industries, annually around the world. About 38% of food wastes occur during food processing. Food wastes are produced by a variety of sources, animal-derived processing food wastes include-by-products from bred animals such as carcasses, hides, hoofs, heads, feathers, manure, offal, viscera, bones, fat and meat trimmings, blood; wastes from seafood such as skins, bones, oils, blood; wastes from dairy processing industry such as whey, curd, and milk sludge from the separation process; vegetable-derived processing food wastes includes peelings, stems, seeds, shells, bran, trimmings residues after extraction of oil, starch, juice and sugars. The disposal of these food industry wastes in the environment it is inconvenience to the ecosystem, because it's poor biological stability, significant nutritional value, high concentration of organic compounds, high water activity, poor oxidative stability and optimum enzymatic activity. The large amount of food wastes and it's microbial decomposition may cause adverse effect on the environment and human health and large cost for the waste treatment, it is additional charge on the food manufacturer. Already the food manufacturing industries have the low profitability and the additional impact of the processing cost of waste it is unhealthy to food industries, agricultural sector or also, countries economy. The demand for controls to minimize the impact of organic waste on human health or minimize the extra revenue on the waste treatment. Efficient use of by-products greatly influence of the economy of the country and environmental pollution. Proper waste management plays a vital role in the growth of food industries. Food wastes streams however present a promising source of functional compounds which may be utilized because of their favourable nutritional and rheological properties. The potentially valuable components present in foods wastes and by-products such as polysaccharides, proteins, fats, fibres, flavour compounds, phytochemicals and bioactive compounds which is beneficial to health. When Hippocrates said "Let food be the medicine be the food" nearly 2500 BC. Worlds consumers are become an educated and worries about healthier lifestyle. So, the rejection of preserved food

because of the use of chemical ingredients and constant debate on the cutting of the use of chemical ingredients in the food and promoting the use of natural ingredients. Consumers now days look forward not only safe or nutritious food products, but they also demand that it should be natural, organic or healthy food. The increasing interest of consumers in functional foods has brought about a rise in demand of natural food. The market growth for functional foods currently rising. The global demand for functional foods was estimated about \$100 billion in 2013. In 1999, a European Community (EC) concerted action on functional foods science in Europe (FUFOSE) defined of "functional food". It declared a food as "functional" if - "it is agreeably exhibited to influence helpfully one or more target capacities in the body, past sufficient nourishing impacts, in a way that is important to either and an enhanced condition of wellbeing and prosperity and/or lessening in danger of ailment". Utilitarian sustenance's are characterized as those that offer 'something additional' as far as medical advantages than the fundamental nourishment thing. Development of functional foods involves incorporation of specific compounds which is benefited to health. Now days, the leading causes of death in the world are due to cardiovascular diseases, diabetes and cancers. These diseases could be avoided using functional food in the diet. Many fruits and plants contained bioactive compounds, phenolic and flavonoids presents excessive free radical formation and reduced the risk of heart attack and cancers disease. The increases the intake of dietary fibres in diet which helps reduction in plasma and LDL-cholesterol, diabetes and gastrointestinal disorders. Fruit and vegetable, marine, meat and

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dairy by-products can be used as raw materials to obtain value added ingredients for the functional foods markets, which is one of the top trends in the food industry. This review presents the functionalities and health benefits of food by-products and their functional ingredients.

## Industry Relevance

Food industries are constantly trying to utilize as much of their product as possible, and this paper puts forward an alternative use for their 'waste' as a functional or financial benefit to their industries. In the food wastes are highly nutritional and functional food ingredients, such as polysaccharide, vitamins, minerals, dietary fibre and bioactives such as flavonoids and lycopene. The by-products functionally they hold such properties as increased water holding and binding, gelling and thickening. Technical and scientific growth it can be promote to utilization of by-products and make functional food ingredients and functional food products for increases their income and make sustainable and stable economic growth of food industries.

## Food Waste

Food waste or by-products most commonly refers to edible food products, which are intended for the purposes of human consumption, but have instead been discarded, lost degraded or consumed by pests, and does not include the inedible or undesirable portions of food stuffs. The various food industries are disposed their valuable waste and some food industries re-processed their waste and used as a functional food ingredients and developed their economy to survive in the neck cutting competition of the market. The food industries categorized by following.

- 1) Fruit and Vegetable Industry
- 2) Grain Processing Industry
- 3) Brewery and Winery Industry
- 4) Marine Industry
- 5) Meat Industry
- 6) Dairy Industry

## Fruit and vegetable industry

The potential utilization of xoconostle fruit cultivars as sources of antioxidants for food, pharmaceutical and colorant industries by-products showed a high amount in glucose, citric and linoleic acids, tocopherols, and isorhamnetin-O-(di-deoxyhexosyl-hexoside), and presented relevant antioxidant properties. By-products as functional food ingredients, namely for antioxidant-enriched formulations, instead of being discarded. Xoconostle (acidic cactus pear) and its by-products have recently received notable attention from health professionals as well as from consumers regarding the discovery of their health-promoting potential applications, such as antihypoglycemic, antihyperlipidemic, hypocholesterolemic, anti-inflammatory, antidiuretic, antiulcerogenic, immunestimulating activity and some cancers prevention. The mesocarp of this xoconostle fruit has been studied by the amount of antioxidant compounds, such as polyphenols, ascorbic acid and tocopherols. The different parts of the xoconostle fruit provide antioxidant activity in different percentages (62.96% in pericarp, 42.27% in mesocarp, and 51.70% in endocarp) [1]. Pomegranate peels and seeds, a by-product of pomegranate juice and concentrate industries, present a wide range of the pharmaceutical and nutraceutical properties [2]. Apple pomace is a waste or by-product biomass generated after apple fruit processing. Higher content of total dietary fibre (74%) and another

functional property such as density, water and oil holding capacity, swelling capacity including glucose dialysis retardation index (36.91%). Dietary fibres demonstrated to have imperative role in improvement and management of human health, particularly gastrointestinal system. The major part (approx. 95%) of the generated biomass is skin or pulp tissues, which consists of cell wall polysaccharides (e.g. pectin, cellulose, hemicellulose, lignin and gums) and phenolic compounds bound with skin, i.e. dihydrochalcones, flavonols, flavanols and phenolic acids [3]. Apple pomace is an important starting material for pectin extraction. Phlorizin, the most abundant phenolic compound in the apple pomace extracts, and that is the basic structure of a new class of oral antidiabetic drugs. Type 2 diabetes mellitus, cured by the inhibition of sodium-glucose co-transporter-2 (SGLT 2). In a recently patented process, that is dihydrochalcones are enriched and purified from undesired ortho-dihydroxy phenol compounds being prone to oxidation and covalent tying to proteins. While pigments from apple pomace are obtained by enzymatic oxidation of phlorizin utilizing contagious polyphenoloxidases, anthocyanin-based pigments may be extracted from grape skins without using sulfite applying a new enzyme-assisted process. Consequently, anthocyanins and phlorizin oxidation products are valuable options for the substitution of manufactured azo colors, some of which have been associated with health risks. De-oiled sunflower press cake is a promising wellspring of nourishment protein as an alternative to soy and egg protein being devoid of toxic substances and low in antinutrients [4].

Orange pomace was mainly rich in fibres with applications suited to products requiring improved water/oil holding and binding properties for example a high water hydration capacity (4.40 ml/g). It had a valuable nutritional composition: high dietary fibre content (40.47%), low fat content (2.14%) and a high mineral content. Apple pomace showed high visco-elastic properties that could improve structures within products [5]. Fibre and pectin derived from apple wastes are currently used as food ingredients and functional foods. Pectin is also used in pharmaceutical industries as drug carriers and excipients. Polyphenolic ex-tracts are also available on Asian market as additive in healthy food and as nutritional supplements. The numerous health benefits of apple peels and apple polyphenols such as antioxidant, antihyper-tensive, anti-cancer, anti-diabetic and hypolipidemic activities could provide new perspectives for their commercial utilisation [6].

Aloe vera (*Aloe barbadensis* M.), is an herb and little astringent in taste, extensively used in many medicinal and therapeutic remedies. Extracted gel of this plant exhibited very good antioxidant activity which is comparable to that of the synthetic antioxidant activity like butylated hydroxytoluene (BHT). Antioxidant activity this plant is accounted for to be because of its high substance of polysaccharide and glucosides piece. So, gel prepared from aloe-vera might become a valuable source of antioxidant components for its application in food technology. Apple peels are considered as important by-product of apple industry and crores of tonnes of these peels are wasted every year due to inadequate or under processing [6]. The high growth in consumption of green coconut water in Brazil comes with a proportional growth of its waste, constituted of coconut apply green coconut pulp in ice cream formulation to replace milk, fat, gums and emulsifier. According to sensory evaluation 93.2% of the positive responses fell in 8 and 9 of the hedonic scale. The results indicate that coconut pulp had used to manufacture free milk, no lactose, low fat and no cholesterol food [7]. Tomato waste polysaccharide, showing a structure similar to a xyloglucan biopolymer, was investigated its biological activity and showed that anticarcinogenic in the Brine Shrimp bioassay; moreover it also exerted a high anti-oxidant activity. Lemon

and Granadilla polysaccharides, showing a xylan-like and a pectin-like structure, respectively, were also investigated of their rheological properties and for their biological activities, both confirming to be anticarcinogenic compounds [8].

Globe artichoke is a rich source of bioactive phenolic compounds, furthermore inulin, fibre and minerals. In addition, artichoke leaf extracts have been long timely used in society solution, especially for liver protestations. Therapeutic properties of globe artichoke have been often been credited to the cynarin (1, 3-O-dicaffeoylquinic acid) content of these extracts. In various pharmacological tests, artichoke leaf extracts have displayed hepatoprotective, anti-HIV, anticarcinogenic, antibacterial, bile-expelling, antioxidative and urinate activities as well as the ability to inhibit cholesterol biosynthesis and LDL oxidation. Artichoke by-products, for example, leaves, outside bracts and stems that are produced by the globe artichoke processing plant, represent a high amount of discarded material, which could be used as a source of phenolics, and should be considered as a crude material for the generation of sustenance added substances and nutraceuticals. Inulin belongs to a group of fructose-based polysaccharides called fructans, which are not processed in the small digestive system because of humans lack the enzymes required for hydrolysis of fructans. The recent interest in inulins in nutraceutical has been due to their great influence on the composition of the gut microflora, and there are signs of advantageous impacts on mineral absorption, blood lipid composition, furthermore, anticipation of colon malignancy. Moreover, inulin is a low-calorie fibre that has potential for use in the production of fat-reduced foods. Globe artichoke is a substantial juvenile bloom rich in restorative substances.

The onion by-product offering better attributes for its potential improvement as a food ingredient: source of antioxidant and anti-browning bioactive compounds. Nowadays, one of the major concerns for the food industry is to keep the improvement of enzymatic cooking preceding or amid the processing of fruits and vegetables because of the change in the organoleptic and visual properties of the item. A quality loss is also a fact to take into account due to the phenolic compounds content reduction that happens amid the enzymatic browning. Sulfhydryl (SH or thiol) groups are good inhibitors of the enzyme PPO. Therefore, it is assumed that the thiol compounds contained in onion might be the active components in charge of the PPO inhibitory effect of onion. Onion extracts could be used as natural sustenance elements for the anticipation of searing brought about by PPO [9].

Star fruit (*Averrhoacarambola* L.) is a good source of natural antioxidants and that poly-phenolics are its major antioxidants. The residue of star fruit, which is regularly disposed of amid juice drink preparing, was found to contain much higher antioxidant activity than the extracted juice. The residue extract shows strong antioxidant activity in delaying oxidative rancidity of soya bean oil. The high content of substance and strong antioxidant activity of residue extracts indicate that residue powder may impart health benefits when used in functional food products. Fruits and vegetables are good dietary sources of natural antioxidants for dietary prevention of degenerative diseases. An inexorably developing business sector for nutraceuticals and practical sustenance's has triggered the study on normal wellsprings of cancer prevention agents and their potential for nutraceutical and utilitarian nourishments. Apple peel was accounted for as a quality included sustenance element for nourishment items to elevate great wellbeing because of its phytochemical substance. Pectins can be found in most natural product pomaces and, after extraction and filtration can be included as gelling specialists in various sustenance items, for example, jams, fillings, desserts, and so on. Pomace can likewise give other sustenance added substances including dietary filaments, lactic

corrosive, colors, vinegar, characteristic sweeteners and cellulose. Some tropical organic products contain protein-corrupting chemicals (papain in papaya, or bromelain in pineapple) usable as meat tenderisers or in washing powders or lager fermenting [9].

### Grain processing industry

Rice bran is a by-product of rice processing industry and constitutes around 10% of the aggregate weight of unpleasant rice. Rice wheat is a rich wellspring of vitamins, minerals, key unsaturated fats, dietary fiber and different sterols. Rice grain is finding expanded applications in nourishment, nutraceutical and pharmaceutical commercial ventures. Milling of paddy yields 70% of rice (endosperm) as the real item and by-products comprising of 20% husk, 8% bran and 2% germ. Rice bran is rich in antioxidant compounds like polyphenols, vitamin E, tocotrienols and carotenoids that help prevent the oxidative damage to DNA and other body tissues. Rice bran being high in dietary fibre and in view of its therapeutic potential, its addition can add to the improvement of quality included sustenances or practical nourishments that at present are sought after. Supplementation of rice bran has been effectively conveyed in various foods like bread, cakes, noodles, pasta, and ice creams without essentially influencing the functional and textural properties [10]. RBO rich in natural antioxidants might assume a part in lessening the risk of chronic diseases. Rice bran oil is rich in oryzanol and psitosterol. Oryzanol has been accounted for to have different wellbeing impacts including hypolipidemic impact, development advancement, and stimulation of the hypothalamus. Oryzanols have a few organic and physiological impacts, such as serving as an antioxidant and anti-blood cholesterol lowering agent.  $\gamma$ -Oryzanol has been shown to inhibit tumour promotion, inhibit tumour growth in tumour-bearing mice by the induction of natural killer (NK) activity, inactivation of macrophages and the inhibition of angiogenesis and effective in reduction of serum cholesterol levels. It can be used to treat nerve imbalance and menopausal disorders. Antioxidant activities reported for oryzanol and vitamin E in rice bran shield cells from the oxidative damage of plasma very low-density lipoprotein, cellular proteins and DNA. Rice bran protein is accounted for to have one of a kind dietary esteem and nutraceutical properties. It is a hypoallergenic food ingredient and possesses anti-cancer activity.  $\delta$ -Tocotrienol functions as a peroxisome proliferator activated receptor (PPAR) and improves the usage of entire body glucose and insulin sensitivity in diabetic mice [10].

The high fiber content in rice by-items can likewise back off the ingestion of the glucose, while the colonic fermentation products of fiber may enhance glucose utilization. Epidemiological studies have shown that antioxidants reduce oxidative damage to bimolecular structures that assume a part in the anticipation of chronic diseases. Antioxidants additionally help in abating the onset of diabetes and Alzheimer's sickness, and play a role in the prevention of coronary heart diseases and cancer. Tocotrienols have been appeared to address free radicals in cell films and help in the anticipation of coronary artery disease;  $\gamma$ -oryzanol (oryzanol) has been appeared to lower blood cholesterol and to reduce levels of cholesterol in the liver. In expansion to tocotrienols, fiber and  $\gamma$ -oryzanol, the phenolic corrosive portion of rice wheat might likewise be advantageous for the treatment of type 2 diabetes mellitus since it directs blood glucose level by elevating glucokinase activity and the production of glucokinase in the liver. Restorative potential, its option can add to the treatment of worth included sustenances or utilitarian nourishments that presently are sought after.

Macaroni is a conventional durum semolina based sustenance item which starts from the first century BC. *Durum semolina* (*tritium*

*durum* desf.) is the most legitimate crude material for the handling of top notch pasta or macaroni items. Macaroni is bubbled in salty water before utilization to change over starch to a digestible form through the so-called gelatinization process. Macaroni is widely consumed at homes, restaurants, dormitories and other food courts and after cooking process, some wholesome elements of macaroni relocate to the cooking water. By products of food processing speak to a noteworthy transfer issue for the business concerned; however, they are additionally encouraging wellsprings of mixes which might be used in view of their alluring innovative or wholesome properties. By-products of fruit, vegetable, potato and sugar handling are the essential cases utilized as a part of generation of new fixings and utilitarian mixes, for example, dietary fibre, phenolic acids, antioxidants. The powder of macaroni boiling water (PMBW), is important by-product especially for formulated products, such as dairy, bakery, meal, beverage and infant formula products [11].  $\beta$ -glucans extricated from grain flour, which progress lipid metabolism, reduce the glycaemic index, and lower plasma cholesterol, lignan concentrates from flaxseed, which act as anti-cancer, antioxidant, antibacterial, antiviral, and anti-inflammatory agents and phenolic compound extracted from cereal brans, which antioxidants provide resistance against free radical damage, cancer and cardiovascular diseases. Successful incorporation of various fractions of  $\beta$ -glucans into items, for example, pasta, noodles, breakfast oats, and dairy items was accomplished. Pearled barley, if enriched with  $\beta$ -glucans, can be joined into durum wheat semolina to give a pasta that displays great cooking quality. Flaxseed on the other hand flaxseed supper rich in lignans can be helpfully added to different cereal-based formulations like bread, muffins and other bakery products [12].

### Brewery and winery industry

Potential uses of lingering preparing yeast are animal encourage and human nutrition, flavouring agents production, obtaining enzymes (invertase), single cell protein (SCP) production, substrate for microalgae cultivation. The brewing process promotes the generation of three intrinsic wastes, the spent grain, the hot trub and the residual yeast. BSG as the main by-product of brewing industry, representing approximately 85% of total by-products generated, is rich in cellulose and non-cellulosic polysaccharides. Beer is the fifth most consumed beverage in the world apart from tea, carbonates, milk and coffee. Spent grains are the by-products of mashing process; which is one of the beginning operations in distillery so as to solubilize the malt and cereal grains to ensure adequate extraction of the wort (water with extracted matter). The amount of brewers' spent grain (BSG) generated could be about 85% of the total by-products. Raw material for extraction of compounds such as sugars, proteins, acids and antioxidants [13].

Grape growing and wine making generate a number of wastes and by-products. These materials include vine prunings, grape stalks, grape pomace and grape seeds, yeast lees, tartrate, carbon dioxide and wastewater. Custom, experience and basic "rustic" sense had taught ranchers that there is nothing to squander. Every byproduct would become fertilizer, animal feed, or fuel [14]. Wine waste is characterised by the presence of natural antioxidants much safer than synthetic antioxidants. Wine waste-derived antioxidants have been recently used in the food industry. Winery wastes could be an alternative source for obtaining natural antioxidants, which are considered totally safe in correlation with engineered antioxidants. Grape pomace speaks to a rich wellspring of different high-esteem items, for example, ethanol, tartrates and malates, citric acid, grape seed oil, hydrocolloids and dietary fibre. The utilization of grape seed extracts (GSE) has gained ground as a nutritional supplement in view of its antioxidant activity [15].

### Marine industry

Marine nourishment, because of its incredible biodiversity is a fortune place of numerous novel sound sustenance fixings and naturally dynamic mixes as fish oils, fish proteins, bioactive peptides, ocean growth, macroalgae and microalgae. In spite of having so much medical advantages, marine practical fixings have been under abused for nourishment purposes. Marine foods are seen as an amazing wellspring of high calibre protein, containing lipids with high levels of unsaturated fatty acids. The enhancement of human health by reducing the risk of cardiovascular disease [16]. Seafood's are naturally practical and have numerous parts that are useful for human wellbeing. Seafood's and their by-products are a great wellspring of nutraceuticals and bioactives, and these can be extracted/isolated and added to a range of nourishments subsequently upgrading usefulness of the foods in terms of human health. Fish is often referred to as 'rich food for poor people' and gives quality proteins, fats, vitamins and minerals. The nutrient intake of populations from fish is straight forwardly relative to the measure of fish consumed. By-products from seafood processing may account for up to 80% of the weight of the harvest depending on the species, and include a variety of constituents with potential use as nutraceuticals and bioactives. These include  $\omega$ -3 PUFAs from the livers of white lean fish, waste flesh parts of fatty fish, blubber of marine animals, hydrolysates from fish guts/cleanings, peptides, and products from crustaceans such as chitosan, chitosan oligomers, and glucosamines. Hence, by-products processed from seafoods could serve as important value-added nutraceuticals and functional food ingredients [17].

The fish pepsin can be used as a rennet substitute in cheese production. The modern diet is insufficient in omega fatty acids, subsequently the admission of sleek fish a few times each week is suggested. Incorporation of fish oils into normal nourishment fixings, which get to be can be considered as an option with a specific end goal to expand the admission of polyunsaturated fatty acids, especially eicosapentaenoic and docosahexaenoic acids. Hot-water extract of pulverized oyster shell produces polypeptides having tyrosinase inhibitory movement (a list for skin-brightening impacts) while  $\text{CaCO}_3$  from oyster shells can be used as a calcium supplement. Shrimp and crab shells can be recuperated to fabricate chitosan, a "fat-binder" used for weight administration to upgrade tying of bile corrosive and discharge of sterols, and thus, lowering cholesterol, and as soluble dietary fibre to enhance gastrointestinal capacity. Astaxanthin, the chromophore of shrimp shells, can be extracted and used as an antioxidant, since it has a viability 500 times higher than that of vitamin E, and as regulator of the plasma HDL-cholesterol level. In the fish industry, processing of raw fish into food products generates large quantities of by-products that contain proteins and lipids [18]. Marine algae are well known natural sources of gums, such as alginate, agar and carrageenan. Once their usefulness in the food, pharmaceutical and other industries [19]. Likewise, seafood is characteristically tender, easily digested, and a good source of many essential minerals. Marine nourishment sources have discovered huge mixes, which are good for health and are having nutraceutical esteem. These incorporate omega-3 oils, chitin and chitosan, fish protein hydrolysates, algal constituents, carotenoids, antioxidants, fish preparing by-products, for example, fish bone, shark cartilage, taurine and bioactive compounds. Omega-3 oils are much mainstream and broadly utilized than some other elements of marine source. Chitin and chitosan are polysaccharides, which are increasing much consideration. Fish protein hydrolyzates are enzyme hydrolysis products of fish proteins. Algae and seaweed have been observed to be great wellspring of dietary fibre and antioxidants and carotenoids on other hand fish bone and shark cartilage are extensively used as source of calcium [16].

## Meat Industry

According to the European Commission (EC), the term meat refers to the edible parts removed from the carcass of domestic creatures including bovine, porcine, ovine and caprine animals, poultry and wild game. Animal by-products may be defined as whole bodies or parts of creatures, products of animal origin or other products obtained from animals, which can, but are not intended for direct human consumption. The definition of by-products depends on several factors including traditions, society and religion, however they are for the most part acknowledged as carcasses, skins, bones, meat trimmings, blood, fatty tissues, horns, feet, hoofs or internal organs. Meat by-products are rich in lipids, carbohydrates and proteins. bioactive peptides can be created from meat proteins utilizing hydrolysis, cooking or fermentation. These bioactive peptides may also apply gainful physiological advantages. Bioactive peptides are known to have antimicrobial, antioxidative, antithrombotic, antihyper-tensive, anticancerogenic, satiety regulating and immunomodulatory activities and may affect the cardiovascular, immune, nervous and digestive systems. Peptides may also be effective in the treatment of mental health diseases, cancer, diabetes and obesity [20].

## Dairy industry

The dairy processing industry is the real segment of nourishment preparing industry in the India. Whey, a by-product of the dairy business, contains numerous profitable constituents, particularly solvent proteins, for example,  $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin, immunoglobulin, bovine serum albumin, lactoferrin, and lactoperoxidase. They are widely accepted as food ingredients in a few sustenance details (e.g., confectionery, bakery, health, and sport supplements), normally in dry form, whey items have pertinent nutritious (e.g., high content of essential amino acids), functional (e.g., gelation, foaming, and emulsifying agent), and biological (e.g., antimicrobial, anticarcinogenic, and biological (e.g., antimicrobial, anticarcinogenic, and immunomodulatory activities) properties for wellbeing. Advances in processing technologies of whey protein powders, their major practical and organic properties, and the most encouraging applications in rich protein source and high biological value [21]. Dumping of milk whey with sewage cause large-scale losses of valuable milk components also, builds the refinement expenses of dairy plants squanders. Whey it is a valuable nutrient. Now it is recognized as an important auxiliary dairy crude material which can even surpass the skim milk in deep processing technologies. Increasing deficiency of dairy crude material and innovation of new preparing technologies and equipment which made milk whey utilization more profitable. Milk whey has also rich mineral structure and considerable amount of nitrogenous substances such as whey proteins, free amino acids, urea, uric acid, creatine, creatinine and ammonia. Thereby milk whey can be used for direct biosynthesis of the bioactive mixes for sustenance improvement. The enriched whey can be used for production of functional foods for meeting human demand [22]. Curd it is one of the by-product of milk industry that is act as a probiotic functional food. There is strong evidence indicating that probiotics have preventive and therapeutic effect on pathologies such as acute diarrhoea, antibiotic associated diarrhoea, NEC, and allergic pathology [23].

## Conclusion

Food industry by-products will also boost new markets in functional food industry as functional food ingredients. The search for new functional food ingredients from natural sources is one of the most important challenges in food science and technology. By

using science and innovation to make valuable food by-products and increase profitability. Food industry by-products are a good source of proteins, minerals, fatty acids, fibre, and bioactive compounds. The importance of food industry by-products, it can serve as an important raw material for the development of functional foods. The demand for new functional foods is steadily increasing because of their disease curing properties. The efficient utilization of the by-products from food industry can help in reducing the negative cost, reduce environmental pollution, demonstrating sustainability in food industry and that has direct impact on the economy of the country. Food industry become contributes to the zero waste society and country.

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