

**AI 3010 WASTE AND BY PRODUCT UTILIZATION**

**UNIT III NOTES**



## **Waste utilization in various industries**

Agriculture residues can be further divided into field residues and process residues.

Field residues are residues that present in the field after the process of crop harvesting, whereas the process residues are residues present even after the crop is processed into alternate valuable resource

### **Industrial wastes**

A huge amount of organic residues and related effluents are produced every year through the food processing industries like juice, chips, meat, confectionary, and fruit industries. These organic residues can be utilized for different energy sources.

India is bestowed with vast livestock wealth and it is growing at the rate of 6% per annum. The contribution of livestock industry including poultry and fish is increasing substantially in GDP of country which accounts for >40% of total agricultural sector and >12% of GDP. This contribution would have been much greater had the animal by-products been also efficiently utilized. Efficient utilization of by-products has direct impact on the economy and environmental pollution of the country. Non-utilization or under utilization of by-products not only lead to loss of potential revenues but also lead to the added and increasing cost of disposal of these products. Non-utilization of animal by-products in a proper way may create major aesthetic and catastrophic health problems. Besides pollution and hazard aspects, in many cases meat, poultry and fish processing wastes have a potential for recycling raw materials or for conversion into useful products of higher value. Traditions, culture and religion are often important when a meat by-product is being utilized for food. Regulatory requirements are also important because many countries restrict the use of meat by-products for reasons of food safety and quality. By-products such as blood, liver, lung, kidney, brains, spleen and tripe has good nutritive value. Medicinal and pharmaceutical uses of by-product are also highlighted in this review. Waste products from the poultry processing and egg production industries must be efficiently dealt with as the growth of these industries depends largely on waste management. Treated fish waste has found many applications among which the most important are animal feed, biodiesel/biogas, dietetic products (chitosan), natural pigments (after extraction) and cosmetics (collagen). Available information pertaining

to the utilization of by-products and waste materials from meat, poultry and fish and their processing industries has been reviewed here.

Waste 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 amount and kind of waste product which consists primarily of the organic residue of processed raw materials, can scarcely be altered if the quality of the finished product is to remain consistent. The utilization and disposal of product specific waste is difficult, due to its inadequate biological stability, potentially pathogenic nature, high water content, potential for rapid auto oxidation and high level of enzymic activity. The diverse types of waste generated by various branches of the food industry can be quantified based on the respective level of production.

Waste disposal and by-product management in food processing industry pose problems in the areas of environmental protection and sustainability (Russ and Pittroff 2004). Generally speaking, raw and auxiliary materials, as well as processing acids, enter the production process and exit as one of the following: a desired product, a non-product-specific waste or a product-specific waste. Product-specific waste unavoidably accumulates as a result of processing of raw materials. It is produced during the various steps of production, in which the desired components are extracted from the raw materials. After extraction, there are often other potentially useful components present in the remaining materials.

The current methods for further utilization of product-specific waste have been developed along traditional lines and are closely bound to the agricultural origins of the raw materials themselves. The two general methods of traditional waste utilization have been to use the waste as either animal feed or fertilizer. Many of the existing agricultural solutions to waste disposal balance out between legal regulations and the best ecological and economical solutions. Another characteristic of product-specific waste is that the generated mass of waste relative to production levels can only be altered through technical means, which unavoidably leads to a change in product quality. Typical examples of product-specific waste are spent grains from beer production or slaughter house waste from meat production. The product-specific waste from the food industry is characterized by its high proportion of organic material. The disposing of this waste can be difficult for the following reasons:

Many types of waste material either already contain large numbers of microbes and/or will be altered quickly through microbial activity. If regulations concerning infections/diseases are not properly observed, then hygienically unacceptable condition can arise, eg., maggots or molds. The breakdown of protein is always characterized by the evolution of strong odours.

- High water content: The water content of meat and vegetable waste lies between 70 and 95% by mass. A high water content increases transport cost of the waste. Mechanical removal of water through use of a press can lead to further problems with waste disposal due to the high levels of organic matter in the water.
- Rapid autoxidation: waste with a high fat content is susceptible to oxidation, which leads to the release of foul smelling fatty acids.
- Changes due to enzymatic activity: In many types of waste arising enzymes are still active which accelerate or intensify the reactions involved in spoilage.

Apple pomace contains high dietary fiber compared to other fruit by-products, such as citrus peel. There are studies in the literature showed that apple pomace has been used as a functional ingredient and source of additional fiber in developing biscuits, cakes, and bread. Furthermore, pectin extracted from apple pomace has been used as an alternative source of gelatinizing agent that is used mainly to produce jam or jelly. Tomato pomace, which is high in dietary fiber and minerals, has been used as a functional ingredient to develop several functional foods, such as bread, muffin, and low-calories jam added with tomato pomace had 15–20% higher dietary fiber as compared to the commercial apricot jam. Other pomaces, such as grape, contain high protein and dietary fiber and also a rich source of unsaturated fatty acids.

A dairy by-product may be defined as a product of commercial value produced during the manufacture of a main product. The newly acquired economic importance of a by-product will make it a main product in the future. Important by-products available from the dairy industry and their utilization are given in the Table

**Important by-products available from the dairy industry and their utilization**

S. No	Main Product	By-Product	Processing method	Products Made
1	Cream	Skim milk	Pasteurization	Flavoured milk
			Sterilization	Sterilized flavoured milk
			Fermentation	Cultured Buttermilk
			Fermentation and Concentration	Concentrated sour skim milk
			Concentration	Plain and Sweetened Condensed skim milk
			Drying	Dried skim milk or Skim milk powder or Non Fat Dry Milk (NFDM)
			Coagulation	Cottage cheese, Quarg, edible casein
2	Butter	Buttermilk	Fermentation and Concentration	Condensed buttermilk
			Concentration and Drying	Dried buttermilk
			Coagulation	Soft cheese
3	Cheese, Casein, Channa, Paneer	Whey	Fermentation	Whey beverage, Yeast whey
			Concentration	Plain and sweetened condensed whey, whey protein concentrate, whey paste, lactose
			Drying	Dried whey
			Coagulation	Ricotta cheese
4	Ghee	Ghee residue	Processing	Sweetmeat, Toffee, Sweet paste

Skim milk and its by-products Skim milk is a by-product obtained during the manufacture of cream. It is rich in solids-notfat content and has high nutritional value. In dairy plants, it is mostly utilized either in standardization for the manufacture of main dairy products or preserved by removing moisture in spray dried form. The skim milk when utilized in either of these two forms or consumed as liquid is not considered a by-product. It is regarded as a by-product only when it is either not economically utilized or utilized for derived by-products like casein and related products, coprecipitates, protein hydrolysates etc.

Casein and caseinates Casein has a long history of technical use in industries producing paper, textile, paint, leather, rubber etc. Edible casein and caseinates are also long established dairy by-products finding use in many dairy and food products. The world production of caseins/caseinates is hard to define due to lack of a significant data. However estimation could be about 3.5 lakh tonnes. The large producers are New Zealand (1.4 lakh tonnes), Netherlands (80,000 tonnes), and Germany (24,000 tonnes). The world market of casein/caseinates used in the food industry fluctuates between 2 to 2.5 lakh tonnes. The biggest importer of casein is United States of America, where food casein demand can be estimated at 20,000 tonnes per year and caseinates demand at 27,000 tonnes per year. About 20% of this demand is for nutraceutical applications. A lot of casein is utilized for the manufacture of imitation cheese. The second biggest importer is Japan.

### **Agro Waste Fired Boiler**

Agro-waste is agricultural waste from Agricultural or related industries. These wastes are cheap and easily available. Thermodyne Engineering Systems are the main producer of Agro Waste Fired Boiler. These are generally utilized as a part of rice husk, coconut shell, biogases, cashew nutshell, wood and different other agro squander energizes. These are manufactured utilizing immaculate metal and are high in requests among the customers in the market. These boilers are accessible in the market.

Agro waste fired boiler has applications in various types of industries like chemical, pharmaceuticals, food processing, laundry, hotels, hospitals, dairy, edible oil, textile etc. where steam is required for indirect & direct process heating purpose.