

An introduction to product and process technologies

The term food industries cover a series of industrial activities directed at the processing, conversion, preparation, preservation and packaging of foodstuffs. The raw materials used are generally of vegetable or animal origin and produced by agriculture, farming, breeding and fishing.

The food industry today has become highly diversified, with manufacturing ranging from small, traditional, family-run activities that are highly labor intensive, to large, capital-intensive and highly mechanized industrial processes. Many food industries depend almost entirely on local agriculture or fishing. In the past, this meant seasonal production and hiring of seasonal workers. Improvements in food processing and preservation technologies have taken some of the pressure off workers to process food quickly to prevent spoilage. This has resulted in a decrease in seasonal employment fluctuations. However, certain industries still have seasonal activities, such as fresh fruit and vegetable processing and increases in production of baked goods, chocolate and so forth for holiday seasons. Seasonal workers are often women and foreign workers.

Manipulation of the raw materials, the ingredients during processing and the finished products is varied and diverse. The current trend is to minimize manual handling by mechanization, through “continuous processing” and automation. Mechanical handling may involve: self-propelled in-plant transport with or without palletization or super or bulk sacks (often containing several thousand pounds of dry powder material); conveyor belts (e.g., with beets, grain and fruit); bucket elevators (e.g., with grain and fish); spiral conveyors (e.g., with confectionery and flour); air fluming (e.g., for unloading grain, sugar or nuts and for transport of flours).

Storage of raw materials is most important in a seasonal industry (e.g., sugar refining, brewing, grain processing and canning). It is usually done in silos, tanks, cellars, bins or cold stores. Storage of the finished products varies according to their nature (liquid or solid), the method of preserving and the method of packaging (loose, in sack or super sack, in bundles, boxes or bottles); and the respective premises must be planned to suit the conditions of handling and preserving (traffic aisles, ease of access, temperature and humidity suited to product, cold-storage installations). Commodities may be held in oxygen-deficient atmospheres or under fumigation while in storage or just before shipment.

To extract a specific food product from fruit, cereals or liquids, any of the following methods may be used: crushing, pounding or grinding, extraction by heat (direct or indirect), extraction by solvents, drying and filtration.

Crushing, pounding and grinding are usually preparatory operations—for example, the crushing of cocoa beans and the slicing of sugar beet. In other cases, it may be the actual extraction process, as in flour milling.

Heat can be used directly as a means of preparation by extraction, as in roasting (e.g., cocoa, coffee and chicory); in manufacturing it is usually used directly or indirectly in the form of steam (e.g., extraction of edible oils or extraction of sweet juice from thin slices of beet in the sugar industry).

Oils can be extracted equally well by combining and mixing the crushed fruit with solvents that are later eliminated by filtering and reheating. The separation of liquid products is carried out by centrifuging (turbines in a sugar refinery) or by filtering through filter presses in breweries and in oil and fat production.

Operations in processing food products are extremely varied and can be described only after individual study of each industry, but the following general procedures are used: fermentation, cooking, dehydration and distillation.

Fermentation, obtained usually by addition of a micro-organism to the previously prepared product, is practiced in bakeries, breweries, the wine and spirits industry and the cheese products industry.

Cooking occurs in many manufacturing operations: canning and preserving of meat, fish, vegetables and fruits; ready-to-serve meat-processing plants (e.g., chicken nuggets); in bakeries, biscuit making, breweries; and so on. In other cases, cooking is done in a vacuum-sealed container and produces a concentration of the product (e.g., sugar refining and tomato-paste production).

Besides the drying of products by the sun, as with many tropical fruits, dehydration can be carried out in hot air (fixed dryers or drying tunnels), by contact (on a drying drum heated by steam, such as in the instant-coffee industry and the tea industry), vacuum drying (often combined with filtering) and lyophilization (freeze drying), where the product is first frozen solid and then dried by vacuum in a heated chamber.

Distillation is used in the making of spirits. The fermented liquid, treated to separate grain or fruit, is vaporized in a still; the condensed vapour is then collected as liquid ethyl alcohol.

It is important to prevent any deterioration of food products, as much for the quality of the products as for the more serious risk of contamination or threat to the consumers' health.

There are six basic methods of food preservation:

1. radiation sterilization
2. antibiotic sterilization
3. chemical action
4. dehydration
5. refrigeration.

Briefly, the first three methods destroy microbial life; the latter merely inhibit growth. Raw ingredients such as fish and meat, fruit or vegetables are taken fresh and preserved by one of the above methods, or a mixture of different foods are processed to form a product or dish, which is then preserved. Such products include soups, meat dishes and puddings.

References

Malagie, M., Jensen, G., Graham, J. C., & Smith, D. L. (1998). Food industry processes. *Encyclopedia of occupational health and safety*, 67, 2-7.