FAQ

1. What is the role of heat transfer in food engineering?

Heat transfer is one of the fundamental processing principles applied in the food industry and has applications in various unit operations, thermal processing, evaporation (concentration) and drying, freezing and thawing, baking, and cooking. Heating is used to destroy microorganisms to provide a healthy food, prolong shelf life through the destruction of certain enzymes, and promote a product with acceptable taste, odor, and appearance. Heat transfer is governed by heat exchange between a product and its surrounding medium. The extent of heat transfer generally increases with increasing temperature difference between the product and its surrounding.

Conduction, convection, and radiation are the three basic modes of heat transfer. Conduction heat transfer occurs within solid foods, wherein a transfer of energy occurs from one molecule to another. Generally, heat energy is exchanged from molecules with greater thermal energy to molecules located in cooler regions.

2. What is the role of mass transfer in food engineering?

Mass transfer involves migration of a constituent of fluid or a component of a mixture in or out of a food product. Mass transfer is controlled by the diffusion of the component within the mixture. The mass migration occurs due to changes in physical equilibrium of the system caused by concentration or vapor pressure differences. The mass transfer may occur within one phase or may involve transfer from one phase to another. Food process unit operations that utilize mass transfer include distillation, gas absorption, crystallization, membrane processes, evaporation, and drying.

3. What is the role of mixing in food engineering?

Mixing is a common unit operation used to evenly distribute each ingredient during manufacturing of a food product. Mixing is generally required to achieve uniformity in the raw material or intermediate product before it is taken for final production. Mixing of cookie or bread dough is an example, wherein required ingredients need to be mixed well into a uniform dough before they are portioned into individual cookies or loaves. Application of mechanical force to move ingredients (agitation) generally accomplishes this goal. Efficient heat transfer and/ or uniform ingredient incorporation are two goals of mixing. Different mixer configurations can be used to achieve different purposes. The efficiency of mixing depends upon the design of impeller, including its diameter, and the speed baffle configurations.

4. List some (5-10) key areas in food engineering?

1. Rheological Properties of Foods
2. Reaction Kinetics in Food Systems
3. Phase Transitions and Transformations in Food Systems
4. Transport and Storage of Food Products
5. Heating and Cooling Processes for Foods
6. Food Freezing
7. Mass Transfer in Foods
8. Evaporation and Freeze Concentration
9. Membrane Concentration of Liquid Foods
10. Food Dehydration
11. Thermal Processing of Canned Foods
12. Extrusion Processes
13. Food Packaging
14. Cleaning and Sanitation

5. What are the goals of food processing

Ans. The food industry utilizes a variety of technologies such as thermal processing, dehydration, refrigeration, and freezing to preserve food materials. The goals of these food preservation methods include eliminating harmful pathogens present in the food and minimizing or eliminating spoilage microorganisms and enzymes for shelf life extension.

The general concepts associated with processing of foods to achieve shelf life extension and preserve quality include (1) addition of heat, (2) removal of heat, (3) removal of moisture, and (4) packaging of foods to maintain the desirable aspects established through processing.

6. Define the terms drying, curing, canning and fermentation?

Drying: Extraction of moisture by sun, air, heat or vacuum to inhibit the growth of molds, bacteria and yeasts

Curing: The addition of a chemical compound (sodium nitrate or sodium nitrite) to food to slow the growth of bacteria.

Fermentation: The use of special bacteria molds or yeasts to prevent spoilage by converting the elements of food that spoil easily to stable elements that act as preservatives.

Canning/Aseptic Packaging: The packing of food in a container, sealing the container and heating it to sterilize the food.

7. Define the terms salting, freeze drying and pasteurization?

Salting: The addition of salt or a brine solution to foods to decrease the activity of molds, bacteria and yeasts.

Freeze Drying: The freezing of food and the subsequent removal of water from the frozen food through the use of heat and a vacuum.

Pasteurization: The heating of milk and other liquids which reduces the number of disease- producing bacteria.

8. Define the terms refrigeration, freeze, food concentration and irradiation?

Refrigeration: The lowering of the temperature of food to inhibit the growth of bacteria, molds and yeasts.

Freezing: The lowering of the temperature of food to temperatures below -2^0C to stop the growth of bacteria, yeasts and molds and to kill parasites.

Food concentration: Heating food until it boils and removing the water or partially freezing food and removing water in the form of ice crystals.

Irradiation: Passing energy through food to destroy insects, fungi, or bacteria that cause human disease or cause food to spoil.

9. Why thermal properties of food need to be studied?

Knowledge of thermal properties of food (thermal conductivity, specific heat, thermal diffusivity) is useful in identifying the extent of process uniformity during thermal processes such as pasteurization and sterilization

10. Describe size adjustment in food engineering?

In size adjustment, the food is reduced mostly into smaller pieces during processing, as the raw material may not be at a desired size. This may involve slicing, dicing, cutting, grinding, etc. However, increasing a product size is also possible. For example, aggregation, agglomeration (instant coffee), and gelation are examples of size adjustment that result in increase in size. In the case of liquid foods, size reduction is often achieved by homogenization. During milk processing, fats are broken into emulsions via homogenization.

11. What are the parameters to control in food safety and quality?

Qualities to control are

Temperature

5 – 60°C = the temperature danger zone
– Rapid multiplication of microorganisms
• <5°C very slow growth
• <-2°C – no growth – no death
• >60°C – death of microorganisms

Qualities to Control:

Moisture content & Protein content

Bacteria need a high moisture content
• Fungi can grow in lower moisture
– Dry foods won't make you sick
– Dry foods do spoil
• Bacteria need protein, fungi less so

12. Describe the role of separations in food engineering

This aspect of food processing involves separation and recovery of targeted

food components from a complex mixture of compounds. This may involve separating a solid from a solid (e.g. peeling of potatoes or shelling of nuts), separating a solid from a liquid (e.g. filtration, extraction) or separating liquid from liquid (e.g. evaporation, distillation). Industrial examples of separation includes crystallization and distillation, sieving, and osmotic concentration. Separation is often used as an intermediate processing step, and is not intended to preserve the food.

13. What is the importance of food engineering in India?

India is essentially an agricultural country and the economy is basically agrarian in nature. More than 70 per cent of the population lives in rural areas; and out of them 80 per cent depend on agriculture for employment and livelihood. For an agrarian economy, rural population can be considerably benefited by food technology at least in the following three ways:

1. Instant foods, energy foods and baby foods can be produced from the locally available raw materials which will reduce child malnutrition.
2. Integrated food management for storage, transportation and distribution.
3. Application of food technology practices for processing traditional foods by way of drying, pickling, salting and smoking (traditional foods are a rich heritage of India and cater to the nutritional requirements of rural people substantially).

14. What are the operations in world in processing?

Most food processes utilize six different unit operations: heat transfer, fluid flow, mass transfer, mixing, size adjustment (reduction or enlargement), and separation. A brief introduction to these principles is given below. During food processing, food material may be combined with a variety of ingredients (sugar, preservatives, acidity) to formulate the product and then subjected to different unit operations either sequentially or simultaneously.

Food processors often use process flow charts to visualize the sequence of operations needed to transform raw materials into final processed product.

15. What is the importance of separation in during processing?

Drying: Extraction of moisture by sun, air, heat or vacuum to inhibit the growth of molds, bacteria and yeasts

Salting: The addition of salt or a brine solution to foods to decrease the activity of molds, bacteria and yeasts.

Curing: The addition of a chemical compound (sodium nitrate or sodium nitrite) to food to slow the growth of bacteria.

Fermentation: The use of special bacteria, molds or yeasts to prevent spoilage by converting the elements of food that spoil easily to stable

elements that act as preservatives.
Freeze Drying: The freezing of food and the subsequent removal of water from the frozen food through the use of heat and a vacuum.
Smoking: The addition of smoke and heat to preserve food by the action of the chemicals from the smoked wood and the partial drying of the food.
Canning/Aseptic Packaging: The packing of food in a container, sealing the container and heating it to sterilize the food.
Pasteurization: The heating of milk and other liquids which reduces the number of disease- producing bacteria.
Refrigeration: The lowering of the temperature of food to inhibit the growth of bacteria, molds and yeasts.
Freezing: The lowering of the temperature of food to temperatures below 28 degrees F to stop the growth of bacteria, yeasts and molds and to kill parasites.
Food concentration: Heating food until it boils and removing the water or partially freezing food and removing water in the form of ice crystals.
Irradiation: Passing energy through food to destroy insects, fungi, or bacteria that cause human disease or cause food to spoil.