1. Size Reduction:

Size reduction is a process of reducing large solid unit masses into small unit masses, coarse particles or fine particles.

It is an important unit operation at home as well as in the indutry and has several functins, viz:-

a) A definite size range may be a consumer requirement, e.g. production of carrots slices or dices
b) It may help in the extraction of desirable constituents from the raw material, e.g. milling wheat grains for the production of flour or crushing fruits for juices.
c) Size reduction facilitates mixing of various ingredients as smaller sized particles are easier to mix, e.g. production of cake mixes and baby foods.
d) Some other operations in food processing and preservation are facilitated by smaller sized particles. For example, when potatoes are to be fried, blanched or boiled, smaller pieces expose more surface area, hence are easier to process.

In Food processing several operations demand prior size reduction of the raw materials. Examples are blanching, canning, dehydration, freezing etc. Grain milling also involves size reduction operations. Different fractions of milled product from special market categories: whole wheat flour, white flour, semolina etc. form special products of the wheat grains.

Meat for canning and for use in meat dishes is cut into smaller pieces, while for sausages, burgers and other similar products it is minced. Minced meat provides a large surface area which facilitates mixing of other ingredients and subsequent formation of stable meat emulsion.

2. Blanching:

Blanching is also known as scalding. Blanching is the heating of some plant food materials in hot water or live steam for a very short period of time (ranging from few seconds to few minutes) mainly to destroy the active food enzymes.

Most vegetables and some fruits are blanched prior to further processing operations, such as canning, freezing or dehydration. Blanching is a mild heat treatment, but is not a method of preservation. It is a pretreatment usually performed between preparation and subsequent processing.

Mechanisms and Purposes of Blanching

Plant cells are discrete membrane-bound structures contained within semi rigid cell walls. The outer or cytoplasmic membrane acts as a skin, maintaining turgor pressure within the cell. Loss of turgor pressure leads to softening of the tissue. The heating effect leads to enzyme destruction as well as damage to the cytoplasmic and other membranes, which become permeable to water and solutes.

The major purpose of blanching is frequently to inactivate enzymes, which would otherwise lead to quality reduction in the processed product. For example, with frozen foods, deterioration could take place during any delay prior to processing, during freezing, during frozen storage or during subsequent thawing. Similar considerations apply to the processing, storage and rehydration of dehydrated foods. Enzyme inactivation prior to heat sterilisation is less important as the severe processing will destroy any enzyme activity, but there may be an appreciable time before the food is heated to sufficient temperature, so quality may be better maintained if enzymes are destroyed prior to heat sterilisation processes such as canning.

It is important to inactivate quality-changing enzymes, that is enzymes which will give rise to loss of colour or texture, production of off odours and flavours or breakdown of nutrients. Many such enzymes have been studied, including a range of peroxidases, catalases and lipoxygenases. Although other enzymes may be more important in terms of their quality-changing effect, peroxidase is chosen because it is extremely easy to measure and it is the most heat resistant of the enzymes in question.

Blanching causes the removal of gases from plant tissues, especially intercellular gas.. In addition, removing oxygen is useful in avoiding oxidation of the product and corrosion of the can. Removal of gases, along with the removal of surface dust, has a further effect in brightening the colour of some products, especially green vegetables. Shrinking and softening of the tissue is a further consequence of blanching. This is of benefit in terms of achieving filled weight into containers, so for example it may be possible to reduce the tinplate requirement in canning. It may also facilitate the filling of containers.

It is important to control the time/temperature conditions to avoid over processing, leading to excessive loss of texture in some processed products.

A further benefit is that blanching acts as a final cleaning and decontamination process. The effectiveness of blanching in removing pesticide residues or radionuclides from the surface of vegetables. Very significant reductions in microorganism content can be achieved, which is useful in frozen or dried foods where surviving organisms can multiply on thawing or rehydration. It is also useful before heat sterilisation if large numbers of microorganisms are present before processing.

The precise blanching conditions (time and temperature) must be evaluated for the raw material and usually represent a balance between retaining the quality characteristics of the raw material and avoiding over-processing.

The following factors must be considered:

- fruit or vegetable properties
- overall blanching effect required for the processed product, which could be expressed in many ways including: achieving a specified central temperature, achieving a specified level of peroxidase inactivation, retaining a specified proportion of vitamin C
- size and shape of food pieces
- method of heating and temperature of blanching medium.

Time/temperature combinations vary very widely for different foods and different processes and must be determined specifically for any situation.

Blanching Equipment

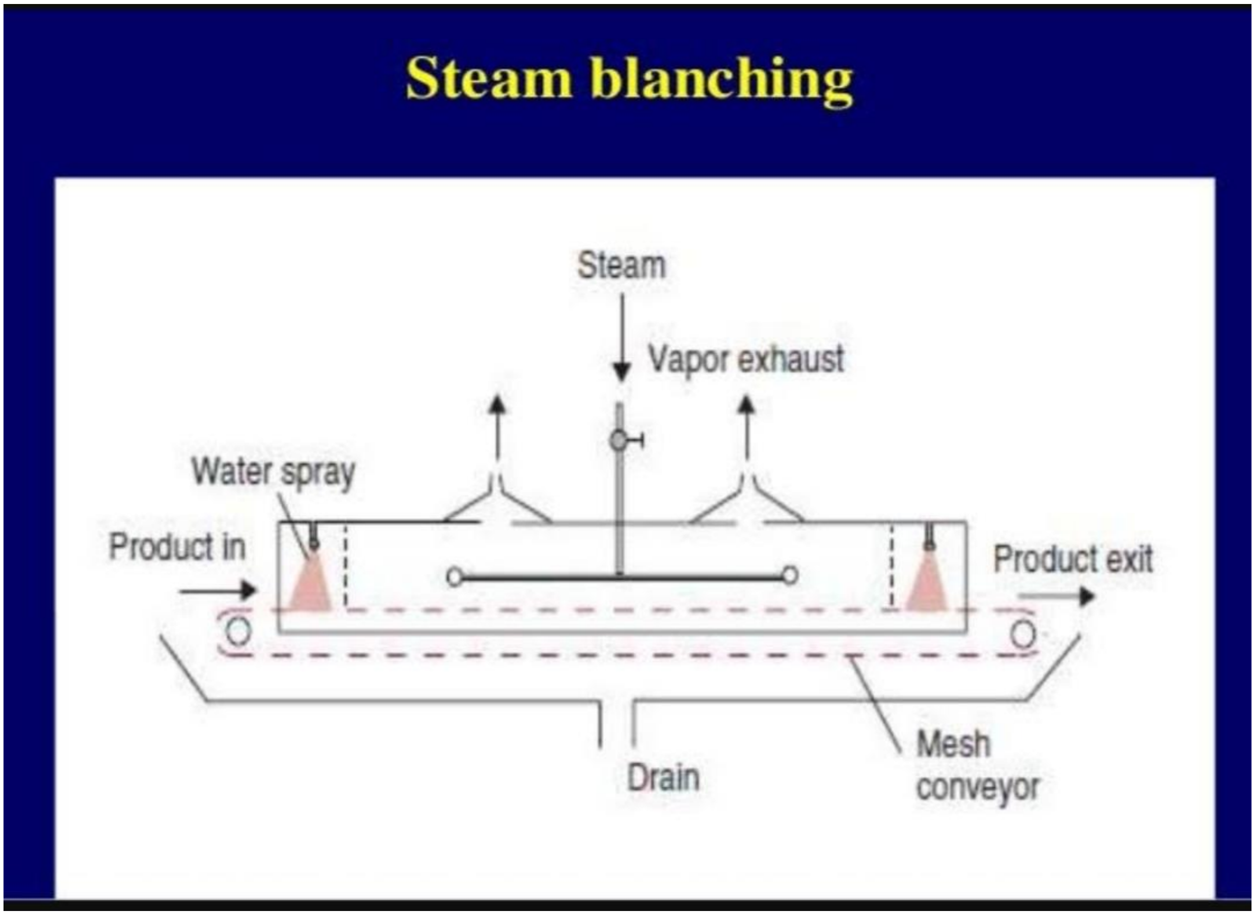
The two main approaches in commercial practice are to convey the food through saturated steam or hot water. Cooling may be with water or air.

a) Steam Blancher

Conventional steam blanching consists of conveying the material through an atmosphere of steam in a tunnel on a mesh belt. Uniformity of heating is often poor where food is unevenly distributed; and the cleaning effect on the food is limited. However, the volumes of wastewater are much lower than for water blanching.

b) Rotary Water Blancher

The food enters a slowly rotating mesh drum which is partly submerged in hot water. The heating time is determined by the speed of rotation.


Steam blanching
Steam
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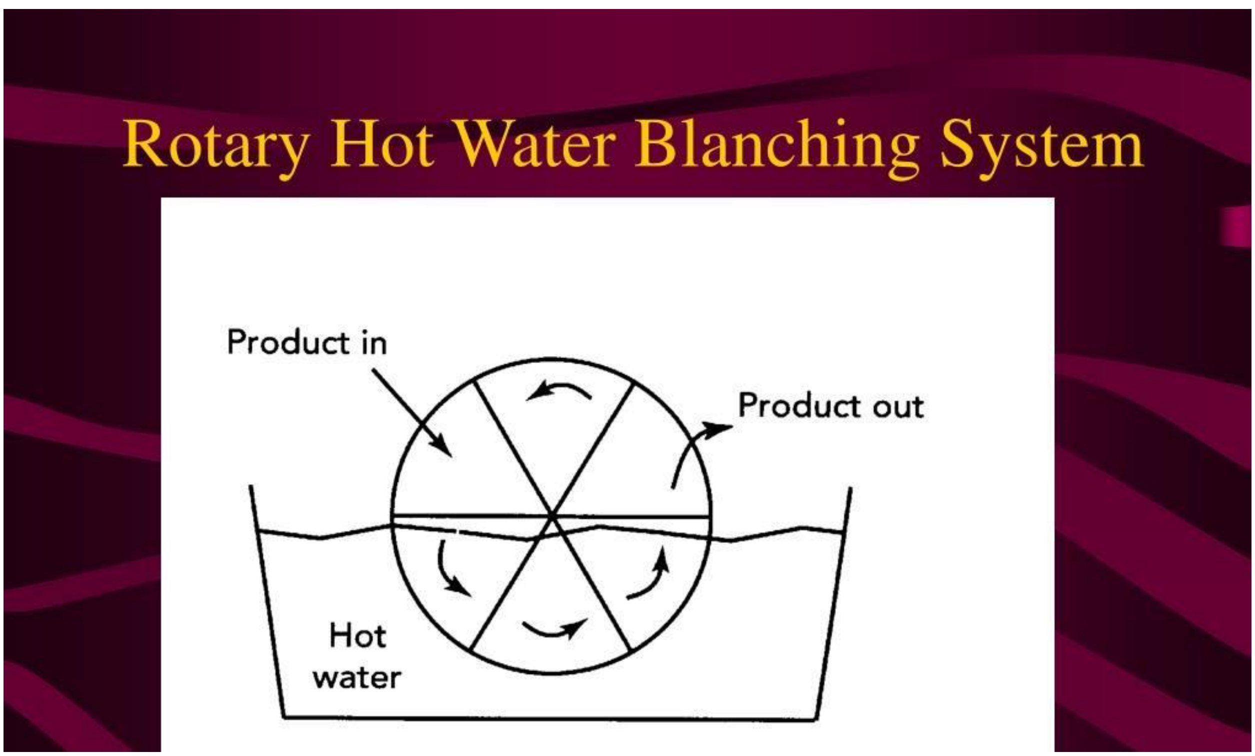
Water spray
Product in
Product exit
Drain
Mesh conveyor


Rotary Hot Water Blanching System
Product in
Product out
Hot water

3. Sulphiting of fruits and Vegetables

Sulphur dioxide (SO_2) or salts releasing this gas may be added to foods to control enzymic and nonenzymic browning, to control microbial growth, or as bleaching or reducing agents or antioxidants. The main applications are preserving or preventing discolouration of fruit and vegetables.

The following sulphiting agents are permitted by European law: sulphur dioxide, sodium sulphite, sodium hydrogen sulphite, sodium metabisulphite, potassium metabisulphite, calcium sulphite, calcium hydrogen sulphite and potassium hydrogen sulphite. However, sulphites have some disadvantages, notably dangerous side effects for asthmatics; and their use has been partly restricted by the US Food and Drug Administration. Sulphur dioxide dissolves readily in water to form sulphurous acid .

Sulphites react with many food components. It should be noted that some of the reactions lead to undesirable consequences, in particular leading to vitamin breakdown. For example, Bender reported losses of thiamin in meat products and fried potatoes when sulphiting agents were used during manufacture. In contrast, the inhibitory effect of sulphiting agents on oxidative enzymes, e.g. ascorbic acid oxidase, may aid the retention of other vitamins including ascorbic acid and carotene. Sulphites may be used to inhibit and control microorganisms in fresh fruit and fruits used in the manufacture of jam, juice or wine.