

Raw Material Cleaning

All food raw materials are cleaned before processing. The purpose is obviously to remove contaminants, which range from innocuous to dangerous. It is important to note that removal of contaminants is essential for protection of process equipment as well as the final consumer. For example, it is essential to remove sand, stones or metallic particles from wheat prior to milling to avoid damaging the machinery.

The main contaminants are: – unwanted parts of the plant, such as leaves, twigs, husks; – soil, sand, stones and metallic particles from the growing area; – insects and their eggs; – animal excreta, hairs etc.; – pesticides and fertilizers; – mineral oil; – microorganisms and their toxins.

Cleaning is essentially separation in which some difference in physical properties of the contaminants and the food units is exploited.

Methods of cleaning

There are a number of cleaning methods available, classified into

- (a) Dry Cleaning
- (b) Wet Cleaning

But a combination would usually be employed for any specific material. Selection of the appropriate cleaning regime depends on the material being cleaned, the level and type of contamination and the degree of decontamination required. In practice a balance must be struck between cleaning cost and product quality, and an 'acceptable standard' should be specified for the particular end use. Avoidance of product damage is an important contributing factor, especially for delicate materials such as soft fruit.

Dry Cleaning Methods

The main dry cleaning methods are based on

- (a) Screens
- (b) Aspiration
- (c) Magnetic separations.

Dry methods are generally less expensive than wet methods and the effluent is cheaper to dispose of, but they tend to be less effective in terms of cleaning efficiency. A major problem is recontamination of the material with dust. Precautions may be necessary to avoid the risk of dust explosions and fires. Screens

Screens are essentially size separators based on perforated drums, beds or wire mesh. Larger contaminants are removed from smaller food items: e.g. straw from cereal grains, or pods and twigs from peas. Typical screens used in food industries are shown in fig 1.



(Fig 1)

Screening gives incomplete separations and is usually a preliminary cleaning stage.

Aspiration

Aspiration exploits the differences in aerodynamic properties of the food and the contaminants. It is widely used in the cleaning of cereals, but is also incorporated into equipment for cleaning peas and beans. The principle is to feed the raw material into a carefully controlled upward air stream. Denser material will fall, while lighter material will be blown away depending on the terminal velocity.

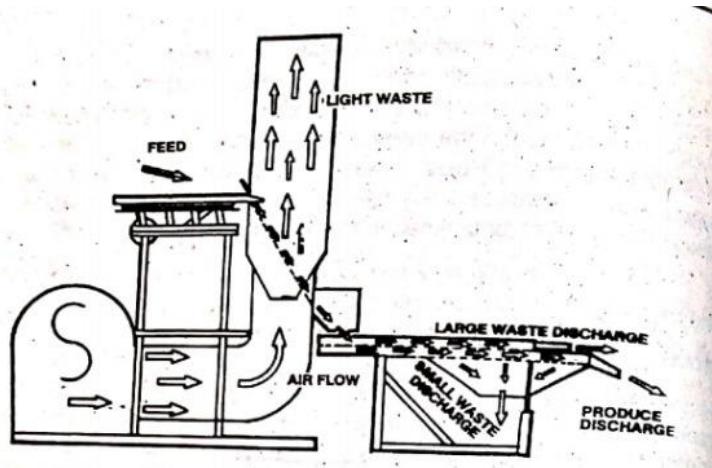


Fig 2. Principles of operation of combined pneumatic and screen separator

By using different air velocities, it is possible to separate say wheat from lighter or denser small stones. Very accurate separations are possible, but large amounts of energy are required to generate the air streams. Obviously the system is limited by the size of raw material units, but is particularly suitable for cleaning legumes and cereals. Air streams may also be used simply to blow loose contaminants from larger items such as eggs or fruit.

Magnetic cleaning

Magnetic cleaning is the removal of ferrous metal using permanent or electromagnets. Metal particles, derived from the growing field or picked up during transport or preliminary operations, constitute a hazard both to the consumer and to processing machinery, for example cereal mills. The geometry of magnetic cleaning systems can be quite variable: particulate foods may be passed over magnetised drums or magnetised conveyor belts, or powerful magnets may be located above conveyors. Electromagnets are easy to clean by turning off the power. Metal detectors are frequently employed prior to sensitive processing equipment as well as to protect consumers at the end of processing lines. Electrostatic cleaning can be used in a limited number of cases where the surface charge on raw materials differs from contaminating particles.

Wet Cleaning Methods

Wet methods are necessary if large quantities of soil are to be removed; and they are essential if detergents are used. However, they are expensive, as large quantities of high purity water are required and the same quantity of dirty effluent is produced. Treatment and reuse of water can reduce costs. common wet cleaning methods are

- (a) Soaking
- (b) Spray washing
- (c) Flootation
- (d) Filtration

(a) Soaking

Soaking is a preliminary stage in cleaning heavily contaminated materials, such as root crops, permitting softening of the soil and partial removal of stones and other contaminants. Metallic or concrete tanks or drums are employed; and these may be fitted with devices for agitating the water, including stirrers, paddles or mechanisms for rotating the entire drum. The use of warm

water or including detergents improves cleaning efficiency, especially where mineral oil is a possible contaminant, but adds to the expense and may damage the texture.

(b) Spray washing:

Spray washing is very widely used for many types of food raw material. Efficiency depends on the volume and temperature of the water and time of exposure. As a general rule, small volumes of high pressure water give the most efficient dirt removal, but this is limited by product damage, especially to more delicate produce. With larger food pieces, it may be necessary to rotate the unit so that the whole surface is presented to the spray.

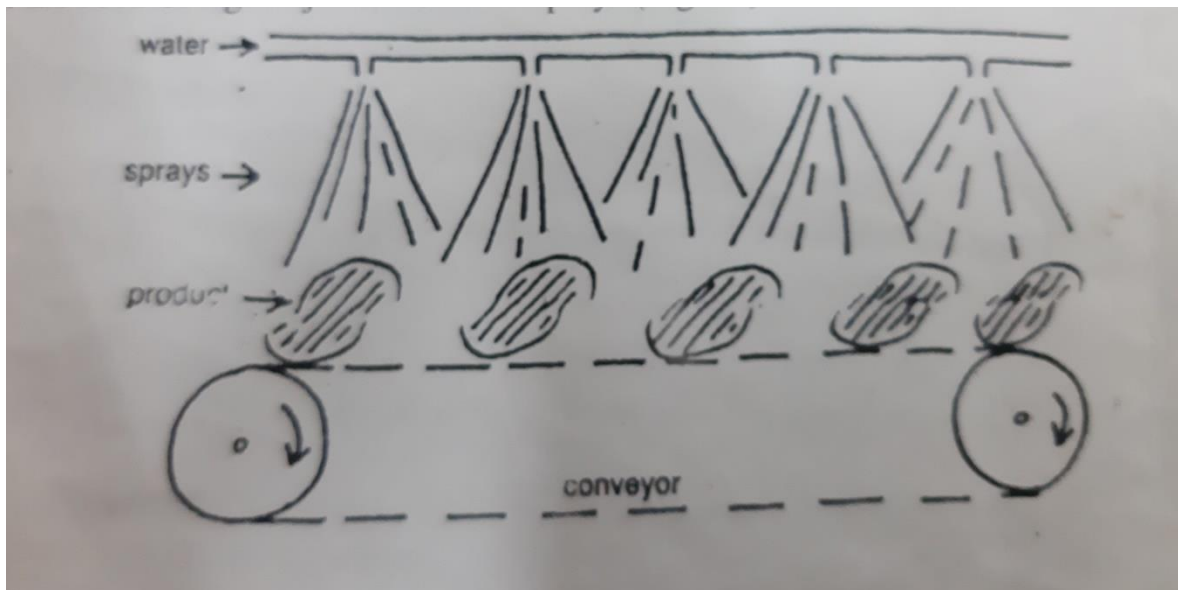


Fig. Spray washing

Abrasion may contribute to the cleaning effect, but again must be limited in delicate units. Other designs include flexible rubber discs which gently brush the surface clean.

(c) Flotation

Flotation washing employs buoyancy differences between food units and contaminants. For instance sound fruit generally floats, while contaminating soil, stones or rotten fruits sink in water. Hence fluming fruit in water over a series of weirs gives very effective cleaning of fruit, peas and beans .A disadvantage is high water use, thus recirculation of water should be incorporated.

(d) Filtration:

Contaminants from fresh milk, fruit juices and syrups are normally removed by filtration.