Dried Fruit Processors and Sanitation

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During the 18 years I have been associated with food science and technology I have become acutely aware that the public, upon which we depend for a livelihood, lacks comprehension as to the complexity of food processing and preservation. Likewise any discussion of sanitation reveals a diversity of viewpoints as to what is meant by the term. The dictionary defines sanitation as "the removal or neutralization of elements injurious to health. The adoption or application of sanitary practices". Obviously the broadness of this definition permits widely varying viewpoints as to its interpretation.

Upon being received from growers raisins, dried prunes, figs, and cut fruits are placed by processors in storage and subsequently processed as needed for shipment. Sanitary practices to give protection from damage by rodents, birds, and insects are employed by all processors. Besides holding the product under fumigation or in cold storage and general area cleanliness, alterations to and modifications of plant layout and buildings are often required to achieve the protection desired during storage.

Processing dried fruit essentially involves those operations which cleanse, rehydrate, preserve and package the product for the convenience of the user. In the present study the relative numbers of microorganisms to be found at various steps during processing has been used as an index of cleanliness and/or potential danger. The relative number of microorganisms is expressed as the total viable count per 1 milliliter liquid or per 4 square inches of surface area. No differentiation was made between bacteria, yeast and molds. In the following discussion of the individual processes a general flow sheet will be used since some variations exist from plant to plant.

Since raisins and Zante currants are dried in clusters there are a

number of steps unique to the processing of raisins. The removal of individual berries from the cluster and the cap stems by stemming and screening operations and subsequently mechanical separation by the use of forced air prepare raisins for subsequent cleansing and rehydration steps. The following observations have been made regarding the relative number of microorganisms found at various steps of the process. While the initial steps not involving water do separate stems, cap stems and other foreign objects from raisins the individual berries still have a considerable number of microorganisms present. As raisins may be received by the processor up to 16% moisture and restricted to 18% moisture or less on outgoing products the cleansing and rehydration of these products is done, by necessity, with cool to warm water. These operations are accomplished by transporting the individual berries in water over riffles and dewatering devices. This procedure efficiently loosens and removes the fine grit that may adhere to the raisins. The large volumes of water used in this operation dilute the microbial population to fairly low figures. Due to the large volume of water used and the problems of disposal this water is recirculated for varying periods of time before being replaced. As to be expected the relative number of organisms does increase with the length of time the water is recirculated. The relative number of organisms present on the dewatering equipment, conveyors, delivery chutes, and packaging equipment are fairly well equalized and is quite low.

The initial steps in processing of prunes involve screening to remove foreign material and size grading of the fruit. Prior to the cleansing and rehydration steps the fruit is blended by size to the specification of the buyer. The size-blended fruit is frequently cleansed by pumping the

fruit in cool water which effectively loosens and removes the fine dust adhering to the fruit. After a partial dewatering on screens or rotated perforated drums the prunes are rehydrated. Although the initial moisture content of prunes is higher than raisins when received (up to 19-20% moisture) the larger size of the individual fruits and the higher moisture contents of the outgoing product permit the use of steam and/or hot water for rehydration. The pumping and cleansing water is partially recirculated and has a varying but relatively high microbial population. However, after rehydration in steam or hot water virtually all microorganisms are eliminated. Sorbate solutions, frequently used on high-moisture fruits, are found to have a low number of organisms. There is a tendency however for this number to increase due to recirculation during processing. Conveyor and inspection belts, delivery chutes and filling machines have relatively low residual populations.

The processing of figs in general is quite similar to that just described for processing of prunes. The microbial count of the initial washing water is relatively high but after rehydration and steam treatment microbes are virtually eliminated. The fruit going into packages or bags has a relatively low microbial population due to a small amount of pickup from conveyors, inspection lines and weighing operations. The so-called "finger pack" in which figs are slit or cut on one side and then pressed into a flattened form manually tends to have slightly higher counts due to extra handling.

Figs and prunes are also extracted with water to produce juice and concentrate. The water from the washing operation prior to extraction has a relatively high microbial population which is eliminated during the

extraction of juice at elevated temperatures. The hot-filling of juice into bottles or cans and the temperatures employed in concentration result in sterile products.

Dried cut fruits are also screened to separate foreign material and size graded when received by the processor. Storage at reduced temperatures is normally employed to preserve their quality. Washing and rehydration is carried out in cool water which is recirculated. A moderate number of microorganisms is present in this water. After washing and rehydration and dewatering the dried cut fruits are placed on trays and resulfured by exposing the fruit to the fumes of burning sulfur. Resulfured fruits have virtually no viable organisms remaining. Subsequent sorting, weighing and packaging does allow the pickup of small numbers of microorganisms.

To generalize the results obtained so far in this study the following points can be made. Prior to the introduction of water into the process i.e. during screening, destemming, inspection, size grading and removal of foreign material from dried fruits there is little effect on the microbial population carried by the dried fruit. During hydro-pumping, fluming, washing and dewatering operations the number of microorganisms present is reduced. The amount of fruit cleansed and the recirculation of water used for this purpose results in varying populations depending upon the freshness of the water being used. Rehydration procedures when separate and distinct from the washing and cleansing operation further reduce the microbial population. In those instances when very hot water and/or steam are used virtually no viable organisms are found on the rehydrated product. Subsequent conveying on belts inspections, delivery chutes and packaging equipment may leave a residual population on the product going into the package. In some instances the sorbate solution, when used for preservation,

was found to contain low numbers of microorganisms. Manual adjustment of package weight, inspection personnel, conveyor belts and lacings as well as conveyor guides and delivery chutes are to be watched as additional sources of microorganisms.

If the definition of sanitation is again examined one can see that what has been discussed so far does not relate all of the sanitary practices concerning dried fruits. Equally important is the care taken in the conversion of fresh fruit to dried products. How the growers and driers (the primary processors) apply sanitary practices to the production of dried fruits has a direct bearing on the quality of the dried fruits further processed for ultimate consumer usage.

Some specific examples of sanitary practices employed by the primary processor or the grower are given below.

A vineyard of healthy vines, properly pruned and cared for, will give a crop of grapes which the vines are capable of developing to full size and maturity. These, when dried, will yield plump meaty raisins. Care by pickers to discard defective bunches, to remove the fruit from the vine in a manner so that the berries are not crushed or injured, and spreading the fruit on the trays in a uniform layer helps produce high quality, clean raisins. After drying is complete a second sorting will further assure only sound raisins are rolled and delivered for screening and boxing before storage and/or delivery.

Sanitary practices in the production of figs, particularly in reference to the Calimyrna variety, begins before the crop has formed on the tree. This is due to the necessity of pollinating Calimyrna figs so the fruits will mature. To assure proper pollination with the minimum of microflora being introduced into the fig necessitates that the grower clean up the

winter crop of Capri figs thus assuring a clean spring crop with its pollenating fig wasps. Ripe figs are partially dehydrated on a tree before dropping to the ground where they are harvested. Careful sorting of figs with their various defects on the ranch and proper care in storage again assures the best possible material for the secondary producer to work with.

Many prune growers mechanically harvest their crops. The result, in many instances, is that the fruit does not touch the ground. The use of clean boxes or bins to transport the freshly harvested fruit, prompt washing and dehydration and clean storage are all steps to insure the most sanitary product possible for delivery to the packer.

Careful harvesting of ripe apricots, peaches, pears, and attention to placing only sound fruit on clean trays by the cutters should be practiced. After sulfuring sun-drying in carefully prepared drying yards and subsequent sorting out of defective fruit before boxing for delivery to the secondary processor again assures the cleanest fruit possible for the packer to process.

In conclusion sanitation is a job to which attention must be paid all year long from the orchard to the remanufacturer and retailing outlets. Lack of attention at any one step increases the problems for all subsequent processes.