Role of Enzymes in the Commercial Processing of Fruits and Vegetables

M. J. Adams

Enzymes, promoters of vital chemical activity in plant and animal cells, play an important role in food processing. Among some beneficial, some detrimental, are induced in fruit and vegetable products.

The oxidizing enzymes cause the browning of wine and fruit juices, the reddening and blooming of potatoes, and in addition to the coloration that detracts from the appearance of the product, changes in nutritive value and flavor also occur as a result of the uncontrolled activity of these enzymes.

The hydrolytic enzymes, another important group of enzymes which can act in the surface and internal environments to induce changes in wine, foods preserved by freezing, fruit juices and other products.

Enzyme Activities

These two groups of enzymes, as well as others, are concerned in producing changes in color, flavor and texture during ripening of fruits and vegetables, and subsequently in the breakdown of these materials during storing and storing and storing. Even the changes produced by bacteria, yeasts and molds which find their way into the product may be carried on by enzymes which these micro-organisms contain.

The alcoholic fermentation of grape juice and of other fruit juices in the presence of yeast and other acetic acid fermentation in the production of vinegar, and the lactic acid fermentation of active acidity, temperature, concentration and contamination of substrate.

Other changes may be due to the complex transformation in the substrate or to an induced oxidation—the product of such oxidation—qumones — of other substances. The reaction responsible for the ripening of various fruits is involved in the rapid loss of Vitamins C in frozen apples or apple juice.

Measuring Enzymatic Activity

Discoloration of apples or other changes after the induced oxidation of substrates can be controlled by:

1. Active apples whose content of the inducing enzyme is low—ripe apples have less brown than green ones, and certain varieties such as Golden Delicious have less than others.

2. The higher the activity, the lower the rate of reaction.

3. Decreasing the substrate content, the concentration of antioxidants, the length of exposure to air, the temperature of the oxygen of the air.

4. The addition of substances which inhibit enzyme activity—such as idase or salt, table salt, sali, vitamin C, high concentrations of sugar, etc.; or by preheating the apples which can be done readily by heat. The heating of apples, according to some workers, produces undesirable changes in flavor and texture.

All of these methods have been applied in the treatment of prepared apple particles to retard the appearance of the color which has heretofore been associated with the reddening of certain orchard apples that are treated first with a salt brine, then immersed in a sulfite solution containing 0.5 per cent sulfur dioxide for three minutes and dispersed as if frozen in sealed containers for subsequent distribution.

Preparing apples for baking use, the frozen or dried apples that are treated first with a light salt brine, then immersed in a sulfite solution may be either dried or frozen, will retain more of its original color and flavor.

In the recommended process for preparing apples for bake use, the frozen or dried apples that are treated first with a salt brine, then immersed in a sulfite solution may be either prepared or frozen, will retain more of its original color and flavor.

Deactivating Enzymes to Destroy Enzymes

It is recognized that enzymes can be destroyed by heat, but the conditions under which this could be accomplished with the minimum injury to color, flavor, texture, and nutritive value had to be determined for each product.

Enzymatic activity is reduced by storage at low temperatures, but it can be accelerated. Care should be taken to avoid freezing, as temperatures of -8 °F. and below. Subjection to low temperatures, even those as high as -50 °F.-30 °F. will not destroy enzymes.

Similarly, all of the practices of deactivating seeds prior to storing them for long periods, as well as for preliminary investigations of preserving freezing of vegetation.

Enzymes that remain in moisture content alone was shown not to prevent the action of these enzymes that are most suitable for removal of enzyme activity, particularly at the temperature in which the material will be stored. The enzymes which bring about the solution of protein, thus reducing the moisture of the proteins by degrading the proteins, are useful in tenderizing meats. Enzymes that bring about the destruction of other substrates that contain fruit, vegetable and microbial enzymes, although the Division of Food Technology has concluded that drying out and pasteurization of fruits and vegetables, or fruit and vegetable products, or fruit and vegetable products, or fruit and vegetable products, is not desirable as a means of destruction of enzymes.

Inactivating Enzymes in Orange Juice

Another example of the type of investigations undertaken, the reaction of the cloud in orange juice can be mentioned. Orange juice, a

Continuous Production of California Timber Can Yield Profitable Returns

Perry M. Barr

Two types of landowners are affected in the development of the technology of profitable returns. The smallholder or farmer is often the owner of a considerable property of virgin forest land and is prompted to his cutting practices from those which have inadequate numbers of trees to permit a second harvest in a

Seventy-year-old second-growth pine in Nevada County, for example, has a yield of 40,000 board feet per acre, with an annual growth of 1,300 board feet.

It is not unreasonable to expect that 12,000 acres of land in the West of Sierra second-growth region of California are occupied by young forests and a considerable number, possibly two-thirds, of this extensive area consists of small ownerships.

Good Management, Good Revenue

In comparison with conditions in Europe and the eastern United States, these second-growth stands are excellent forests and even under less favorable economic conditions, if properly managed, they can furnish their owners with considerable and increasing revenue.

Good management of such woodlands involves two fundamentals: maintenance of their continuous production by protection from fire and destructive cutting, and efficient marketing of the forest products which they produce and the market for them.

By such a plan, logging would be more economical, being concentrated on a local area each year, while still yielding the timber to the consumer at a price below the market price.

The value of the forest for stand prices depends upon the demand for this product, which may, in turn, depend upon the conditions of the market. This has been illustrated by forest management.

It is reasonable to expect that the present low prices for sawtimber and pulpwood will be maintained for some time. It is also reasonable to expect that the present high prices for sawtimber and pulpwood will be maintained for some time. It is also reasonable to expect that the present high prices for sawtimber and pulpwood will be maintained for some time.

The following publications are available without cost at any state College of Agriculture:

CALIFORNIA CULTURE IN CALIFORNIA, by Milo N. Wood, Est. Clk., revised January, 1947 (189 pages). This book contains, in 35 to 560 acres have been organized in the western Pine Section, and a report on Oregon describes 300 to 3,000 acres of timberland, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood.

This report describes the type of trees which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood, which may be used for pulpwood.

Good management for the producer of sawtimber, lumber and pulpwood involves two fundamentals: maintenance of their continuous production by protection from fire and destructive cutting, and efficient marketing of the forest products which they produce and the market for them.

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