Chemical (anti-oxidant) Controls for...

DISCOLORATION OF MUSHROOMS

Standard chemicals used to prevent darkening in processed fruits can be used, along with careful handling, to extend shelf life.

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In Missouri's mushroom industry, the problem of darkening or oxidation of mushrooms cuts heavily into profits. It shortens the shelf life of mushrooms and the period that mushroom packs remain acceptable to consumers. This discoloration occurs (1) naturally with time, (2) upon bruising and (3) as a result of brief exposure to water.

The mushroom is an exceedingly delicate plant structure. The whole plant darkens gradually with time and bruises incurred during harvesting, grading and packing operations darken rapidly. Careful handling can contribute much to the life of the product, but further controls are needed.

Under some cultural conditions, mushrooms will "set" beneath rather than at or near the surface of the casing soil. In these instances, the mushroom cap becomes soiled as it forces its way through the casing soil. It would be desirable if such mushrooms could be washed immediately following harvest. But washing fresh mushrooms accentuates certain oxidative processes and a characteristic pinkish color appears almost immediately over their entire surface.

Chemicals have been used for some time to inhibit oxidation in many phases of food processing, particularly in the preparation of fresh, frozen, canned and dried food products. Housewives are familiar with the fact that home canned or frozen peaches are inferior if an antioxidant, such as ascorbic acid, is not used in processing them.

Experiments were conducted recently to study methods of reducing or inhibiting the oxidative processes in mushrooms. The chemicals employed were all standard ones which have been used to delay or prevent oxidation in processed fruits and vegetables. Results of these experiments and suggestions based on them follow.
Experiments with Anti-oxidants for Mushrooms

Ascorbic acid, isoascorbic acid, sodium bisulfite (Na HSO₃) and common table salt (NaCl) were evaluated. The mushrooms were placed first in a plain water bath for 1½ minutes to remove soil and other particles; then they were removed from the wash-tank and allowed to drain and dry.

Next, the washed mushrooms were dipped for 1½ minutes in water containing ascorbic acid at 0.3, 0.2 and 0.1 percent; sodium bisulfite at 900, 600, 300 and 0 ppm (parts per million); and salt (NaCl) at 1 percent and 0.5 percent.

All ascorbic acid formulations resulted in an increased darkening of the mushrooms; the intensity of the darkening varied directly with the concentration of the ascorbic acid. The isoascorbic acid formulations were a little better than the ascorbic acid ones but they still left much to be desired.

Finally, experiments were conducted where-in only sodium bisulfite and salt were used as anti-oxidants. Concentrations of 900, 600 and 300 ppm sodium bisulfite were employed in combination with 1 percent and 0.5 percent NaCl.

The best treatment appeared to be sodium bisulfite used at 900 ppm in combination with 1 percent salt. Mushrooms receiving this treatment remained marketable for more than nine days after harvest.

An additional modification of the treating procedure was made in that the plain water rinse was omitted. Since the formulation is so inexpensive it is believed that the added time and labor involved in a preliminary rinse is unwarranted. Where mushrooms are excessively dirty it may be desirable to treat fewer mushrooms in a given volume of solution. Omission of the initial water rinse did not decrease the effectiveness of this treatment.
Convenient Procedure for Cleaning Mushrooms and Delaying Oxidation:

1. Weigh 35 grams Na HSO₃ (sodium bisulfite) and 383 grams of NaCl (common table salt).
2. Add these ingredients to 10 gallons of clean fresh water.
3. To prepare larger amounts of solution use proportionately more Na HSO₃ and NaCl.
4. Dip washed mushrooms into the tank containing sodium bisulfite and salt, agitate briefly to assure complete wetting and allow to soak for 1½ minutes.
5. Remove mushrooms with a strainer and drain them prior to packing. (Avoid excessive drying and air currents.)
6. The anti-oxidant solution should safely treat 250 pounds of mushrooms, after which a fresh solution should be prepared. Decomposition of sodium bisulfite is fairly rapid and extending the solution beyond 250 pounds of mushrooms may lessen the effectiveness of the treatment.
7. Where larger volumes of solution are prepared, the number of mushrooms treated can be increased proportionately; for example, 20 gallons should treat 500 pounds of mushrooms.

Precautionary Measures

1. Use reagent grade sodium bisulfite (Na HSO₃). Currently, the approximate cost is $1.00 per pound in 5-pound lots. It has been found that commercial grade Na HSO₃ causes some undesirable discoloration.
2. Do not permit treated mushrooms to dry excessively or become exposed to air currents. In our experiments excessive drying appears to accentuate oxidation.
3. Since this procedure is new to some growers, experimentation with small amounts of mushrooms before treating large batches is a good precaution.