Anti-browning agents for fresh cut fruit

Identification
Key words  fruit, anti-browning agents, fresh, cut, PPO, oxidative browning
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How does it work?

Primary objective  Inhibition of enzymatic browning and microorganism decay processes, thus prolonging the shelf life of fresh-cut fruit.
Working principle  In general, fruit pieces are dipped in solutions containing one or more active compounds that prevent or control enzymatic browning. Oxidative browning is usually caused by the enzyme polyphenol oxidase (PPO) which, in the presence of O2, converts phenolic compounds in fruits and vegetables into dark colored pigments. Outlined below are a number of strategies that may be used to reduce PPO-induced discoloration:
Reduction of O2: because PPO requires O2 to induce cut surface discoloration, reducing the amount of O2 in a package of fresh-cut product by vacuum MAP or gas flushing may reduce cut surface discoloration. Discoloration can not be prevented totally since too little O2 may cause anaerobic metabolism and production of off flavours and odours. Careful design of a fresh-cut package is essential to assure that the proper amount of O2 is present.
Acidification: PPO most effectively catalyses discoloration at neutral pH values (approximately 7). Therefore, browning can be reduced by dipping products in mildly acidic food grade solutions of acetic, ascorbic, citric, tartaric, fumaric or phosphoric acid.
Reducing Agents: ascorbic acid or erythorbate (an isomer of ascorbic acid) are two common compounds used in the food industry to prevent PPO-induced discoloration. Ascorbic acid and erythorbate reduce PPO-induced discoloration at the cut surface by converting quinones (formed by PPO from phenolics) back to phenolic compounds. Unfortunately, once all the ascorbic acid or erythorbate is exhausted, PPO browning will proceed uninhibited. Ascorbic acid or erythorbate are commonly used as 1% solutions. These compounds are organic acids, so they may also reduce surface pH of commodities, thus slowing browning. [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]

Images
Additional effects  Enhanced microbial safety
Important process parameters  type of agent, concentration, dose, time, temperature, MAP parameters, gas flushing
Important product parameters  temperature, weight, cut surface
What can it be used for?

**Products**
- Fruits, vegetables, juices

**Operations**
- Stabilization before packaging of products

**Solutions for short comings**
- Control of discoloration is an important issue in fresh-cut fruit processing. Anti-browning agents are relative cheap compared to other techniques e.g. High pressure processing

What can it NOT be used for?

**Products**
- Some acids may leave off flavours and promote tissue softening and therefore must be used with care. Ascorbic acid cause important oxidative damage of fruit

**Operations**
- Risk or hazards
  - Vacuum packaging may include risks for harmful anaerobic microorganisms

**Other limitations**
- Some acids may leave off flavours and promote tissue softening and therefore must be used with care. Ascorbic acid cause important oxidative damage of fruit

Implementation

**Maturity**
- This technology is used in food industry

**Modularity /Implementation**
- This technology can be normally included in the production line

**Consumer aspects**
- The appearance of a food product plays an important role for consumers, although there are consumers who want to avoid any type of food preservative. Consumer aspects depend on type of anti-browning agents. Some agents are beneficial, some are harmless.

**Legal aspects**

**Environmental aspects**

Facilities that might be interesting for you

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<tr>
<th>Title</th>
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<tr>
<td>Auditorium IRTA</td>
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<td>Clean room – Histocell</td>
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<td>Video observation system for market research and product development tasks - Keki</td>
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Further Information

**Institutes**
- IRTA-Lleida, UTPV-CeRTA, Teagasc, Middle East Technical University, Agricultural Research Service

**Companies**
- Natural Biotechnology, NatureSeal, Airproducts
References


Source: