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Physiological Effects of Pre Heat Treatment on Pineapple Fruit Stored at Low Temperatures

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ABSTRACT. *The effect of pre heat treatments on the development of internal browning (IB) in pineapple (Ananas comosus L. cv Mauritius) grown in Sri Lanka was studied.*

In the first experiment, weighed fruits were stored in an incubator at different temperatures (32, 34, 38, 42, 46 and 50°C) for 24 h and transferred to a cold room at 15°C for further storage for three weeks. In the second experiment weighed fruits were dipped in hot water at 55°C for 10 min and stored in the cold room at 15°C temperature and 80-85% humidity for three weeks. A set of fruits without any pre heat treatment was stored at 15°C for three weeks as the control. Evaluations of quality changes of the fruit and biochemical parameters were conducted at weekly intervals followed by three days exposure to room temperature.

The pre heat treatment decreased the activities of polyphenol oxidase (PPO), peroxidase (POD) and ascorbic acid, acidity and the spoilage rate. The hot water treatment reduced the development of IB when compared to other treatments, but also induced loss of firmness and weight during the later stages of storage. Fruits in the control showed more intensity of IB than treated fruits.

It is concluded that pre heat treatment inhibits some physiological changes and maintains fruit quality, thereby increasing the storability.

INTRODUCTION

Internal browning (IB) is a physiological disorder commonly found in Mauritius pineapple (*Ananas comosus* L.) fruits under refrigeration. In the

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fresh fruit market IB is a serious problem. Since there are no external signs of damage, injured fruit often reaches the consumer causing great dissatisfaction.

Exposing fruit to high temperatures (>32°C) for a short period (24 h) before or after chilling stress can control low temperature induced IB (Paull and Rohrbach, 1985). Heat inactivation of the enzymes is feasible by applying temperatures greater than 50°C, but may produce undesirable changes in texture (Martinez and Whitaker, 1995). Selvarajah and Herath (1997) stated that the incidence of symptoms associated with IB was less when a pre heat treatment (32°C) was combined with edible coating. The objective of this study was to investigate the effects of pre heat treatment on IB in pineapple *cv* Mauritius grown in Sri Lanka.

MATERIALS AND METHODS

Freshly harvested Mauritius pineapple (*Ananas comosus* L.) fruits were stored in incubators at 32, 34,38, 42, 46 and 50°C for 24 h. They were transferred to a cold room (15°C temperature and 80-85% humidity) for further storage for three weeks. In the second experiment fruits were dipped in hot water at 55°C for 10 min and then stored in the cold room. A comparison was made with control samples (without pre heat treatment) which were stored under the same conditions.

Some physical (weight, texture and colour), physico-chemical (pH, titrable acidity and soluble solids), chemical (ascorbic acid) and biochemical (polyphenol oxidase activity, peroxidase activity) characteristics and sensory attributes (colour, firmness) of pineapple fruits were studied at weekly intervals. Prior to measurements, the fruits were removed from cold storage and kept for three days at ambient temperature.

RESULTS AND DISCUSSION

The hot water treatment significantly reduced the browning compared to other treatments up to the third week. Internal browning could still develop in incubator treated and refrigerated fruits upon removal to a higher temperature and to the atmosphere at a slightly lower intensity than the control. All pre heat treatments induced loss of firmness and weight during the later stages of storage.

Soon after pre heat treatment, losses of ascorbic acid were observed in the treated fruits, but the reduction of ascorbic acid content was greater in the control fruits than in treated fruits. The primary cause of loss of ascorbic acid is oxidation under aerobic conditions. Browning results from both enzymatic and non enzymatic oxidation of phenolic compounds. Oxidative or enzymatic browning is a reaction between oxygen and a phenolic substrate catalyzed by polyphenol oxidase (PPO). The occurrence of IB in pineapple fruit was mainly due to the oxidation of phenolic compounds by PPO to form a brown product (Zhou *et al.*, 1995). The control fruits had a higher enzyme (peroxidase and polyphenol oxidase) activity than the pre heat-treated fruits. Both peroxidase and ascorbic acid oxidase may cause direct oxidation of ascorbic acid (Henshell, 1982). The effects of high temperatures on the inhibition of the enzyme that catalyzed browning were evident.

Accelerated ripening and intense color development in shell and flesh occurred with incubator treatments. There was no significant difference in pH and titrable acidity between treated and control fruits. Total soluble solids (brix values) were higher in treated fruits than in the control fruits.

CONCLUSIONS

The results indicate that the use of pre heat treatments decrease the enzyme catalyzed browning. In addition pre heat treatment reduces some physiological changes related to browning and maintains fruit quality, thereby increasing the storability.

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