

# **ADSORPTIVE REDUCTION OF BITTERNESS FROM KINNOW (*Citrus reticulata* Blanco) JUICE**

by

**SATYA VIR SINGH**

Department of Chemical Engineering

Submitted

in fulfillment of the requirements of the degree of  
Doctor of Philosophy

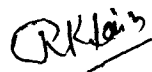


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## CERTIFICATE

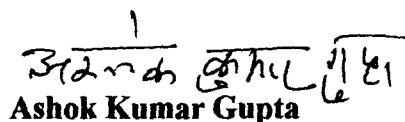
This to certify that the thesis entitled "**Adsorptive reduction of bitterness from kinnow (*Citrus reticulata Blanco*) juice**" the Studies, presented by Satya Vir Singh, is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by him under our guidance and supervision and that the results contained in it have not been submitted in part or in full to any other University or Institute for award of any Degree.



**Rajeev Kumar Jain**

Head

Horticulture Crop Processing Division  
Central Institute of Post-harvest  
Engineering and Technology  
Abohar (Punjab) 152 116 (India)



**Ashok Kumar Gupta**

Professor

Department of Chemical Engineering  
Indian Institute of Technology  
Delhi  
New Delhi 110016, (India)

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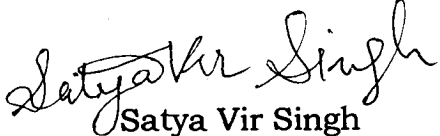
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## ABSTRACT

Kinnow fruit juice turns bitter within 3 to 4 hours of extraction. The two major bitter principles viz limonin and naringin are responsible for the bitterness. The bitterness in juice also depends upon the time of harvest of fruit and method of juice extraction. The juice is characterized by the parameters viz total soluble solids (T.S.S.), acidity, pH, vitamin C, naringin content and sensory evaluation.

The aim of the present study is to remove bitterness of stored kinnow fruit juice. For this purpose, food-grade nonionic polymeric adsorbent resin Indion NPA-1 was used. Preliminary studies were carried out with the stored kinnow juice. The adsorbent was contacted with clarified decanted juice. It was observed that bitterness in juice reduced, however acidity also decreased, although T.S.S. remained constant.

It was decided to carry out adsorption studies with vitamin C, citric acid and naringin. It was found out that vitamin C is not adsorbed and only small quantities of citric acid are adsorbed from its solutions. It was also found out that most of the citric acid is adsorbed very quickly.

Adsorption studies with naringin solution were carried out by two different methods i) Adsorption of naringin from its solution by the

adsorbent (ii) Adsorption of naringin from a mixture solution of (naringin+citric acid) by the adsorbent already saturated with citric acid. It was found out that the adsorption of naringin is unaffected by presence of citric acid.

At an equilibrium concentration of  $1.250 \text{ kg/m}^3$  of naringin 1 kg of adsorbent (dry basis) could adsorb 0.150 kg of naringin.

Experiments were also carried out for adsorption of naringin from stored kinnow juice. It was found out that adsorption of naringin was less than that observed with adsorption from solution of naringin and citric acid.

Adsorption of naringin from fresh juice was also studied. It was found out that adsorption was less as compared to that from mixture solution of naringin and citric acid.

It was found out that most of the naringin was picked up by adsorbent during the first 29000 s of contact with the adsorbent, in all the three cases.

Storage studies of debittered juice were also carried out. Fruit was cut into four pieces and juice was extracted in pulper along with peel; the froths on juice were removed. To this juice, preservative potassium

metabisulphite was added at a concentration of 1500 ppm. This juice was centrifuged after 24 hours. This entire process takes 3 to 4 days.

This centrifuged clear juice had a naringin content of 0.690 kg/m<sup>3</sup>. This was passed through a column containing the adsorbent saturated with citric acid. The juice coming out of the adsorbent column was collected and this juice had a naringin content 0.305 kg/m<sup>3</sup>. This treated juice did not show any bitterness. This juice was stored.

This debittered juice was stored in sample bottles of 125ml; each containing 100 ml juice. These bottles were made air tight and were kept for storage at ambient conditions. After 60 days, a random sample was picked and analyzed for its naringin content. It did not show any rise as compared to the value before storing. The juice was acceptable by a taste panel for at least 74 days of storage.

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