

**PHYSIOLOGY OF CHILLING-RELATED  
POSTHARVEST RIND BREAKDOWN OF NAVEL  
ORANGES (*CITRUS SINENSIS* (L.) OSBECK)**

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## List of Abbreviations

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<b>ABA</b>	abscisic acid	<b>MDA</b>	malondialdehyde
<b>APX</b>	ascorbate peroxidase	<b>MJ</b>	methyl jasmonate
<b>ANOVA</b>	analysis of variance	<b>MS</b>	methyl salicylate
<b>BHT</b>	butylated hydroxytoluene	<b>NSW</b>	New South Wales
<b>CAT</b>	catalase	<b>PAL</b>	phenylalanine ammonia lyase
<b>CI</b>	chilling injury	<b>PCD</b>	programmed cell death
<b>CLSM</b>	confocal laser-scanning microscope	<b>POD</b>	peroxidase
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation	<b>PPO</b>	polyphenol oxidase
<b>DPI</b>	Department of Primary Industries	<b>PUFA</b>	polyunsaturated fatty acids
<b>EC</b>	electrical conductivity	<b>REML</b>	residual maximum likelihood
<b>FA</b>	fatty acid	<b>RH</b>	relative humidity
<b>FPA</b>	formalin-propionic acid	<b>ROS</b>	reactive oxygen species
<b>FOX</b>	ferrous oxidation-xylenol orange	<b>SA</b>	salicylic acid
<b>GMA</b>	glycol methacrylate	<b>SAR</b>	systemic acquired resistance
<b>GR</b>	glutathione reductase	<b>SEM</b>	scanning electron microscope
<b>HAA</b>	hydrophilic antioxidant activity	<b>SERB</b>	stem-end rind breakdown
<b>HSP</b>	heat shock protein	<b>SMP</b>	simulated marketing period
<b>JA</b>	jasmonic acid	<b>SOD</b>	superoxide dismutase
<b>LAA</b>	lipophilic antioxidant activity	<b>TA</b>	titratable acidity
<b>LOOH</b>	lipid hydroperoxides	<b>TBA</b>	thiobarbituric acid
<b>LOX</b>	lipoxygenase	<b>TBARS</b>	thiobarbituric acid-reactive substances
<b>LRW</b>	London Resin white	<b>TBZ</b>	thiabendazole
<b>LSD</b>	least significant difference	<b>TCA</b>	trichloroacetic acid
		<b>TPP</b>	triphenylphosphine
		<b>TSS</b>	total soluble solids
		<b>VIC</b>	Victoria
		<b>XO</b>	xylenol orange

# Thesis Summary

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Chilling-related postharvest rind breakdown of navel oranges is a significant economic problem worldwide.

Chilling injury (CI) symptoms on navel orange fruit vary, and descriptive classification is generally *ad hoc*, making inter-study comparisons difficult. In this study, external symptoms of CI were related to patterns of cellular collapse in affected flavedo tissue, and a classification system developed to aid consistent symptom identification and improve communication within the supply chain.

Potential markers of senescence were evaluated because older fruit were found to be more susceptible to CI. Electrolyte leakage, moisture content and protein content of flavedo tissue were ineffective indicators of both senescence and chilling stress. Rind colour and internal maturity were generally good indicators of fruit age, but lacked sensitivity over short time periods to be of use.

Although there was a strong seasonal effect on CI incidence, pre-storage treatments, including hot water and methyl jasmonate, generally reduced the incidence of CI. Because these treatments elicit defence responses that protect tissue from chilling stress, the response and efficiency of plant defence systems is probably an important factor in chilling tolerance.

The concentration of lipid hydroperoxides (LOOH) in flavedo tissue was lower in fruit that were stored at a chilling temperature (1°C) compared to fruit that were stored at a non-chilling temperature (12°C) and lipid peroxidation did not increase during storage at 1°C. There was also a lower concentration of LOOH in the chilling sensitive variety than in the chilling tolerant variety. Therefore, increased lipid peroxidation is not related to chilling stress and subsequent injury but the results do suggest a role for LOOH in stress signalling. Antioxidant activity in the lipophilic fraction of flavedo tissue extracts increased as fruit senesced and was strongly correlated with carotenoid content. LOOH concentrations in flavedo tissue also increased as fruit senesced. The antioxidant activity of both the lipophilic and hydrophilic fractions of flavedo tissue extracts was higher in fruit stored at 12°C than in fruit stored at 1°C.

## Statement of Authorship

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Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma.

No other person's work has been used without due acknowledgement in the main text of the thesis.

The thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

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