Formulating a natural colorant containing wax for a one-step color-add application for fresh citrus

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Introduction

- Initiation of the project to search an alternative to Citrus Red Number 2

- Request from Peter Chairs to Dr. Liz Baldwin, USDA-ARS research leader

- Basic advises from Dr. Alvin Chen (JBT): water insoluble materials.

- Dr. Xiuxiu Sun (Postdoc hired by Dr. Mark Ritenour and runs tests in USDA.

- Dr. Robert Hagenmaier (retired USDA scientist): Technical adviser
Challenges

1. Solubility
   Soluble in pine oil, however, it is extremely difficult to make an application dilution in water.

- Once added to water, the solution becomes jelatinous and can harden

Natural colorants

In pine oil
Challenges

2. Color stability

Fading of color when exposed to AIR

- Oxidation of carotenoids
Wax protected color (carotenoids) from fading

Day 0

Day 1

Day 2

Day 7
Why not formulate a wax + colorant mixture and change the current two-step process to one?
Colored wax coating

- Annatto + Carnauba wax
- Carnauba wax
Morpholine is easy to use in the basic formulation, but is now being replaced by ammonia for all formulations.
Comparison between the current two-step CR2 + wax vs. the one-step paprika in wax

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Day0</th>
<th>Day7 (20 °C)</th>
<th>Day14 (10 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Wax only)</td>
<td><img src="image1" alt="Control Day0" /></td>
<td><img src="image2" alt="Control Day7" /></td>
<td><img src="image3" alt="Control Day14" /></td>
</tr>
<tr>
<td>CR2 then wax</td>
<td><img src="image4" alt="CR2 Day0" /></td>
<td><img src="image5" alt="CR2 Day7" /></td>
<td><img src="image6" alt="CR2 Day14" /></td>
</tr>
<tr>
<td>Paprika in wax</td>
<td><img src="image7" alt="Paprika Day0" /></td>
<td><img src="image8" alt="Paprika Day7" /></td>
<td><img src="image9" alt="Paprika Day14" /></td>
</tr>
</tbody>
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Where are we?

- Technology: accumulation of colorants/waxes in the valleys of the uneven citrus fruit surface

- Commercialization: we are working with several wax suppliers and packers toward improving the formulation and application in citrus packinghouses.
Acknowledgement

Our team:
Dr. Xiuxiu Sun
Dr. Elizabeth Baldwin
Dr. Mark Ritenour
Dr. Robert Hagenmaier

Advises and supplies:
Dr. Alvin Chen (JBT FoodTech)
Food Ingredient Solutions, LLC ; WILD Flavors Inc
Kalsec
Use controlled-release chlorine dioxide to control diplodia stem-end rot

Diplodia stem-end rot symptoms (28 days at 50°F+ 7 days at 68°F)
Take home message

• Paprika and annatto are alternatives to Citrus Red No. 2.
• A one-step coloring and waxing technology has been developed.
• Curoxin chlorine dioxide reduces incidence of diplodia stem-end rot in Grapefruit.