Research Update: natural colorants to improve skin color of 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 in 2013
- Meetings between the citrus packers and our research group (2015 and 2016)
- Special thanks to Dr. Xiuxiu Sun (research associate) and 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.
   - What did we do: make an emulsion/microemulsion.

- 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
What did we do to protect the color from fading?

- Incorporated the colorant into wax

Day 0
- Waxed
- Non Waxed

Day 1
- Waxed
- Non Waxed

Day 2
- Waxed
- Non Waxed

Day 7
- Waxed
- Non Waxed
Colored wax coating

- Annatto+ Carnauba wax
- Carnauba wax
New challenge of color fading:
• Experimental wax: morpholine was used and color fading is no longer a problem.
• Commercial wax: when replace morpholine by ammonia in the commercial formulation, color fading remains problematic.
Annatto

Citrus red 2
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>
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</thead>
<tbody>
<tr>
<td>Control (Wax only)</td>
<td>![Image]</td>
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<tr>
<td>CR2 then wax</td>
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<tr>
<td>Paprika in wax</td>
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Evaluation of Natural Colorants and Their Application on Citrus Fruit as Alternatives to Citrus Red No. 2

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Formulating a Natural Colorant Containing Wax for a One-step Color-add Application for Fresh Citrus

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Current technology and commercial challenges

Technology:
- accumulation of colorants/waxes in the valleys of the uneven citrus fruit surface.
- color fading in morpholine free wax.

Commercialization:
- DECCO has formulas available.
- Paprika performs better.
Acknowledgement

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Dr. Elizabeth Baldwin  Dr. Robert Hagenmaier
Dr. Anne Plotto

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Kirk Mugler (DECCO)
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Take home message

- A one-step coloring and waxing technology has been developed, and is available commercially.
- A packinghouse supplier is continually working on improvement of the technology.