

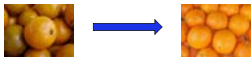


USDA  

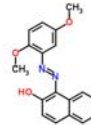
Evaluation of natural colorants and their application on citrus fruit



Xiuxiu Sun ^a, Elizabeth Baldwin ^a, Mark Ritenour ^b,
Anne Plotto ^a, Jinhe Bai ^a
^a USDA, ARS, USHRL, 2001 S. Rock Rd, Ft. Pierce, FL 34945
^b Indian River Research and Education Center, University
of Florida, 2199 S. Rock Rd Ft. Pierce, FL 34845

Do you think we need alternative colorants to Citrus Red No. 2?

- ❖ Citrus Red No. 2 has been listed by the International Agency for Research on Cancer (IARC) and European Union (EU) as a group 2B carcinogen.



Citrus Red 2

AKA: the color added to citrus peels
Causes urinary tumors in rats

Do you think we need alternative colorants to Citrus Red No. 2?

- ❖ Do you think Citrus Red No. 2 is harmful to citrus consumers under current application regulation?
- ❖ How consumers (or some consumer groups) think about Citrus Red No. 2.

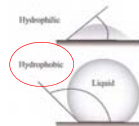


Do you think we need alternative colorants to Citrus Red No. 2?

- ❖ Therefore, a replacement of CR2 with natural or food grade colorants would benefit the Florida citrus industry.

The basic requirements for potential alternatives:

- ✓ 1) red and orange colors
- ✓ 2) hydrophobic characteristics so that the color can remain on the fruit surface and not transfer to hands, containers or packaging



Colorants collected based on literatures

- Annatto suspension (8% bixin)
- Paprika O/S FANS445
- β-carotene O/S FANS446
- Durabrite® carrot oleoresin
- Durabrite® paprika oleoresin

- ❖ They are all carotenoid compounds
- ❖ They are all hydrophobic

Results and Discussion

The CIELAB results of CR2 and five natural colorants on test paper dried for 3 hours at 23 °C under 300 Lux of standard fluorescent white light.

	L^*	a^*	b^*	a^*/b^*
CR2	76.82 b #	31.09 c	10.52 c	2.96 a
Annatto	54.30 e	45.57 a	39.44 b	1.16 b
Paprika	67.38 d	36.98 b	56.67 a	0.65 c
β -Carotene	87.83 a	-1.96 d	53.14 a	-0.04 e
Carrot oleoresin	88.13 a	-5.09 e	57.35 a	-0.01 e
Paprika oleoresin	72.76 c	30.08 c	55.61 a	0.54 d

Mean values followed by different letters within a column indicate significant differences using Duncan test ($p < 0.05$). CR2: Citrus Red No. 2.

Challenges resolved and remaining

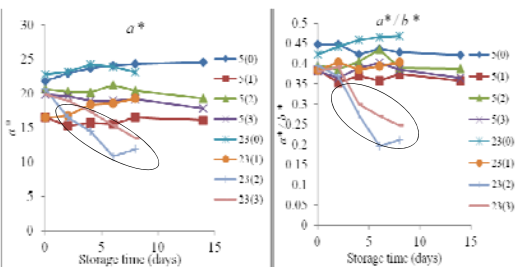
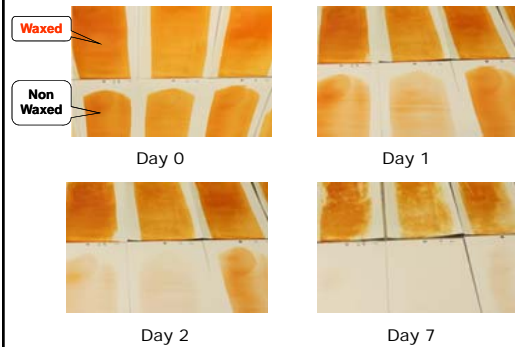
- ❖ Solubility
 - Soluble in pine oil, however, it is extremely difficult to make an application dilution in water.
- ❖ Once adding in water, the solution changes to jelly, even rock

Challenges resolved and remaining

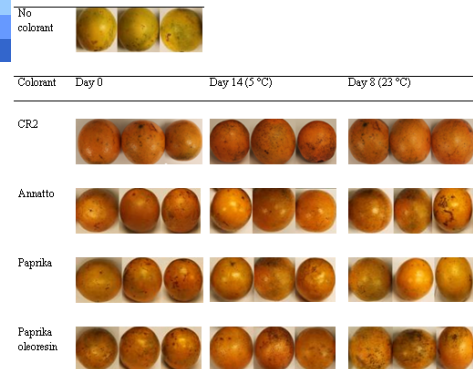
- ❖ Color stability
 - Fade of color under
 - Light
 - Warm temperature
- ❖ Oxidation of carotenoids



Wax protected carotenoids from fading



Changes of color (a^* , and a^*/b^* ratio) values of four colorants on citrus fruit under the storage conditions as 14 days at 41 F (5 °C) in the dark, or 8 days at 73 F (23 °C). (5(0)-Citrus Red No. 2, 5 C; 5(1)-Annatto, 5 C; 5(2)-Paprika, 5 C; 5(3)-Paprika oleoresin, 5 C; 23(0)-Citrus Red No. 2, 23 C; 23(1)-Annatto, 23 C; 23(2)-Paprika, 23 C; 23(3)-Paprika oleoresin, 23 C).



Appearance of citrus fruit with/without colorants at day 0, after 14 days at 5 °C in the dark, or 8 days at 23 °C under 300 Lux of standard fluorescent white light

Progress of our colorant project

- ❖ We developed a technology which successfully mixed red/orange color carotenoids to commercial citrus waxes.
- ❖ The waxes with colorants can be applied to citrus, to replace the current two-step (coloring then waxing) procedures.
- ❖ Further research is required to complete an industry adaptable product/procedure.

Acknowledgement

- Dr. Bob Hagenmaier
For his advice in the formulation development
- Food Ingredient Solutions, LLC
- WILD Flavors Inc
- Kalsec
For providing colorant samples



Take home message

- An one-step coloring and waxing technology will be available soon.
- Furthermore, the colorants and waxes are natural products.

