Clean Label Trends & Food Colorant Realities

Current trends, technology, regulations, labeling, and cultural/market influences

Winston Boyd, Ph.D., Focus International

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• What is natural, clean label?

• Headline – “Chobani class action stayed, awaits FDA decisions on 'natural,' 'evaporated cane juice’” – FoodDive, March 28, 2016

  • ‘The plaintiffs alleged that Chobani could not label its products as "natural" due to color additives that may not qualify as "natural" and that Chobani used the term "evaporated cane juice" to hide the sugar the product contains.’
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• What is natural, clean label?
  – Synthetic vs “natural”
  – Healthy, nutritious, non-GMO, organic, all natural
  – Sustainable, locally sourced
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What are some of the drivers?

Perceptions and Realities of:

- Safety and quality
- Health and wellness
- Suitability (Sustainability, Natural, Organic, Non-GMO)
- Convenience (distribution, shelf life, ease of preparation)
- Practicality
- Feasibility
- Economy (Cost, Price, Availability)
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• Perspectives influence perception of natural and clean label
  – Consumer
  – Activist
  – Regulator
  – Manufacturer/Marketer
  – Technologist

• Finding a balance that works
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• Regulatory Framework
  – FDA enforces the regulatory framework
    • Certified Colorants and Colorants Exempt from Certification
    • Diluents/Carriers
    • Processing aides
    • Labeling
  – There is no regulatory category for “natural” food colorants
    • Food colorants are additives, not ingredients
  – EU/EFSA?
    • Colorants and E numbers
    • New guidance
      – Foods that color
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• 21 CFR 74.xxx – List of permitted colorants requiring certification
• 21 CFR 73.xxx – list of permitted colorants that are exempt from certification
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Labeling Requirements for the US Market

• For the US Market
  – Certified colorants (Synthetics)
    • All must be explicitly labeled by designation
      – Ex. FD&C Blue #1 or FD&C Red #40 Lake
  – Exempt colorants (Naturals)
    • May be generically labeled with “Color Added”, or “Artificial Color”
      – Exception: Carmine must be explicitly labeled due to allergy concerns
    • May be labeled according to their identity on the positive list in 21 CFR 73.XXX
  – Other labeling considerations
    • Diluents, carriers, and processing aides need not be declared on the final food or beverage product label unless they perform a function in the finished product.
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The Challenge/Opportunity

– Replace synthetic food colorants with food colorants derived from natural sources
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Natural colorants as replacements for synthetic colorants

Synthetic Food Colorants Are:
- Broadly useful and efficacious across many applications
- Highly functional (vivid colors, easily used, predictable behavior)
- Inexpensive in comparison with natural food colorants
- Readily available

Natural Food Colorants Are:
- More narrowly useful and efficacious
- Functional, but tend to be less vivid and less predictable in behavior
- Expensive in comparison with synthetic food colorants
- Availability may be limited by crop/harvest
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Considerations in the use of natural food colorants

- Safety
- Availability
- Natural Variability
- Inherent (Chemical) Stability
  - Heat
  - Light
  - pH
  - Oxidation
  - Compatibility
- Ease of Use
  - Solubility, concentration
- Cost in Use
- Marketing/Perception
- Processing and Packaging
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The Challenge/Opportunity

- Replace synthetic food colorants with food colorants derived from natural sources
- Technical complexities?
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Anthocyanins

FIG. 11.5 Structure of radish anthocyanin pigments as determined by $^1$H-NMR $^{13}$C-NMR. (From Giusti et al., 1998b.)

From “Natural Food Colorants”
Fig. 7-7. Structural changes in anthocyanins with pH. The example is malvidin-3-glucoside at 25°C.
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Anthocyanins

Fig. 7-8. Effect of pH on the distribution of anthocyanin structures of malvidin-3-glucoside. A, B, C, and AH+ refer to the forms in Figure 7-5.

Fig. 7-6. Absorption spectra of cyanidin-3-rhamnoglucoside in buffer solutions at pH values 0.71–4.02. The concentration of the pigment is 1.6 x 10² g/L. Reprinted, with permission, from (14).

From “Colorants”, Egan Press
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Anthocyanins

Intramolecular stacking
(Sandwich-type)

Acylation

Intermolecular stacking
(Chiral-type)

Copigmentation

Self-association

anthocyanin
copigment
acyl group

Figure 8.2 Schematic presentation of mechanisms of anthocyanin stabilization.

From “Natural Food Colorants”
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Carotenoids

Capsanthin

Capsorubin

Beta-carotene

Lycopene

Paprika

Fig. 6-1. Structure and numbering sequence for β-carotene and lycopene.

Lutein

Tagetes

Zeaxanthin

Fig. 6-4. The carotenoids of paprika (capsanthin and capsorubin) and tagetes (lutein).

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Categories and Functionality

- Anthocyanins
- Carotenoids
- Caramel
- Betalains
- Anthraquinones
- Curcumin
- Chlorophyll
- Less familiar categories
  - Spirulina
- Minerals
  - Titanium Dioxide
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- Functionality
- Stability
- Shelf Life
- Functionalization
  - Additives, processing aides, carriers
  - Processing for functionalization
- Cost in Use
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Background Noise

• Wrong questions
  – “If there is any doubt why risk it?”
    • Caramel color and 4-Mel
  – The right question ... “What is the level of risk?”
  – “If you can’t pronounce it, don’t eat it.”
    • Dihydrogen Monoxide
    • Carageenan
    • α-(5,6-dimethylbenzimidazolyl)cobamidcyanide
  – The right question ... “Do you have access to the web?”
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• $\alpha$-(5,6-dimethylbenzimidazolyl)cobamidcyanide
  
  – aka B12
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• Conclusions
  – The current trend to replace synthetic colorants with natural colorants is driven by a complex set of factors.
  – Decades of successful and widespread use of synthetic colorants have created unrealistic expectations regarding the performance and price of natural colorants.
  – Meeting this challenge requires depth of knowledge related to performance characteristics, processing methods, formulation and application technology. *It also requires management of expectations.*
  – The right combination of colorant choice, formulation care, processing, packaging, and storage can generally produce the required results.
