Role of Flavorings in Determining Food Quality

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Overview

- Flavor, Flavor Precepts and Flavor Quality
- Commercial Flavorings
- Importance of Product Form and Function
- Working with “Human Factors”
  - Considering Flavor (Human) Associations
- Other Important Flavoring Considerations
Significance of Flavor to the Food Industry

- **Flavor** is THE main determinant or driver of:
  
  - consumer acceptance of a food product
  
  - repeat purchase intent for a food product
Flavor

- **Flavor** is the integrated and nearly simultaneous response to the perception of taste, aroma and somatosensory (nerve) stimuli present in the oral and nasal cavities, generally as a consequence of the consumption of a food or beverage (Reineccius, 2006).

But many other factors influence our “flavor experience”

Flavor is a multi-sensory experience
Olfaction (aroma or odor) plays the predominant and characterizing role in food flavor quality, including recognition and overall food acceptance (Spence, 2015).

This explains why most commercial flavorings contain aroma compounds (that is, they deliver the aroma components of the target flavor).

Aroma (Odor) Perception and Quality

- People have enormous discriminating power
  - Odor perception linked to memory/emotion/experience
  - Individual odorants easily detected and discriminated
  - But, describing/naming them is difficult

- Perceived smells of odor mixtures is complex
  - People can identify only ~ 3 individual odorants in mixtures containing > 8 odorants
  - People process food aroma (mixtures) as precepts called "odor objects" (coded and stored in the brain)
Odor Objects (Precepts)

- Odor Quality is Concentration Invariant
  - Mainly a function of defined ratios of the perceived odorants in the mixture
  - Individual odorants in a mixture are rarely perceived at the same odor intensity, otherwise an “odor white” condition might occur (e.g., > 30 odorants at equal intensity in the mix).
  - Occasionally, a single odorant (or just a few) may profoundly impact the aroma of a food – these are called “character-impact odorants”

Odor Objects (Precepts)

- Character-impact odorants
Odor Objects (Precepts)

A + B + C

A: vanillin
B: β-ionone
C: benzaldehyde
What defines flavor quality? 

**Desirable Sensory Attributes**

- Immediate impact of identifying (expected) flavor (e.g. vanilla / chocolate / lemon)
- Rapid development of a balanced, full-bodied flavor
- Compatible mouthfeel and texture
- Lack of foreign or off-flavors
- Minimal (brief) aftertaste, i.e. “clean taste”

Why add flavor?

- Impart target flavor attributes (aromatics) to formulated products that lack flavor
- Compensate for flavor deficits or defects
  e.g. frozen concentrated orange juice (FCOJ)
- Mask off-flavors
  e.g. functional foods
- Compensate for flavor losses caused by processing or storage
  e.g. thermal degradation, flavor fade due to flavor interactions & binding
Commercial flavorings

- May contain either natural or artificial (chemically synthesized) aroma compounds or a combination of both (+ essential oils/extracts).

- Most contain mainly aroma substances
  - taste components & enhancers are generally added separately by manufacturers

- Savory flavors (e.g., spice extracts, process flavors) may contain both aroma and taste-active compounds

- Available as concentrates, diluted flavors (in carrier), or bound to/in carriers (encapsulated)
Product Form and Function

Bars/Cereals
- Low moisture/low water activity
  - moisture migration concerns
  - texture concerns
  - possible phase changes
- No or mild thermal process
- Immobile flavor system
- Ambient storage/long shelf-life
- Possibility of using encapsulated flavors
  - will reduce flavor interaction and flavor loss

Beverages
- High moisture
  - spoilage concerns
  - viscosity/consistency concerns
- pH restrictions/limitations
- Severe thermal process (UHT)
- Integrated/mobile flavor system
- Ambient or refrigerated storage
  - variable shelf-life
- Difficult to use encapsulated flavors
Work with (not against) the “Human Factor”

- Consider **odor precepts**
  - Food aroma (mixtures) are coded and stored (memory) as odor precepts = “odor objects” = “flavor objects”

- Consider the multimodal nature of the flavor experience
  - Work with learned/coded associations: Aroma – Taste – Texture – Appearance (Color) – Sound
Flavor (Cross Modal) Associations

- **Sweet Perception**
  - Add sweet aromatic compounds to enhance or boost “sweetness perception” without the need to increase sugar or sweeteners

- Reinforce positive concepts, e.g. “Freshness”
  - Top noting of processed orange juice, coffee, etc.

- **Saltiness Perception**
  - Add savory extracts or spices to enhance flavor without the need for more salt
Flavor Associations

- **Creaminess**
  - Add aroma compounds associated with cream/butter to enhance “perceived creamy flavor and mouthfeel”

- Be careful with “edgy” flavors
  - Green aromatics may evoke either positive or negative associations: raw, unripe, astringent mouthfeel, bitterness
More Flavoring Considerations

● Use a flavoring that complements residual or lingering aromatics and tastes
  ● a.k.a. assimilation masking
e.g. coffee/chocolate flavors – expect bitterness
  ● look for synergies (aromatic vs. taste compound)

● Shelf-life issues: consider flavor changes that may occur over time
  ● flavor fade caused by binding of flavors to proteins
  ● reformulate flavor to account for selective flavor binding (flavor rebalancing)
Flavor - Food Matrix Interactions

- Flavor partitioning, diffusion and mass transfer
  - e.g., low fat versus full fat products
  - fat modulates flavor release

- Flavor stability, retention/release
  - storage, packaging interactions
  - encapsulated flavors

- Flavor binding
  - e.g., flavor - protein interactions
  - leads to flavor loss (fade) and imbalanced flavor
Summary and Conclusions

- Flavor is a multi-sensory experience
- Flavor is a learned and remembered human experience
- In the consumer’s mind, flavor is a coded object – key to a creative flavoring strategies is to break the code and work with flavor-human associations
- Consider and work with the product’s chemical/physical nature and the technology used in its production
Thank you