





WESENSE SOLUTION

# WHY **FLAVOR** DELIVERY MATTERS IN **SNACK**



- FLAVOR/AROMA LOSS DURING PROCESSING
- OXIDATION OF FLAVOR OILS
- UNEVEN SEASONING. DISTRIBUTION
- RAPID FLAVOR FADING DURING EATING
- BITTERNESS IN HEALTHY SNACKS

## Key message

Flavor delivery is becoming as important as flavor creation.

**Creating flavor is only the starting — delivering the right sensory experience is the real challenge.**

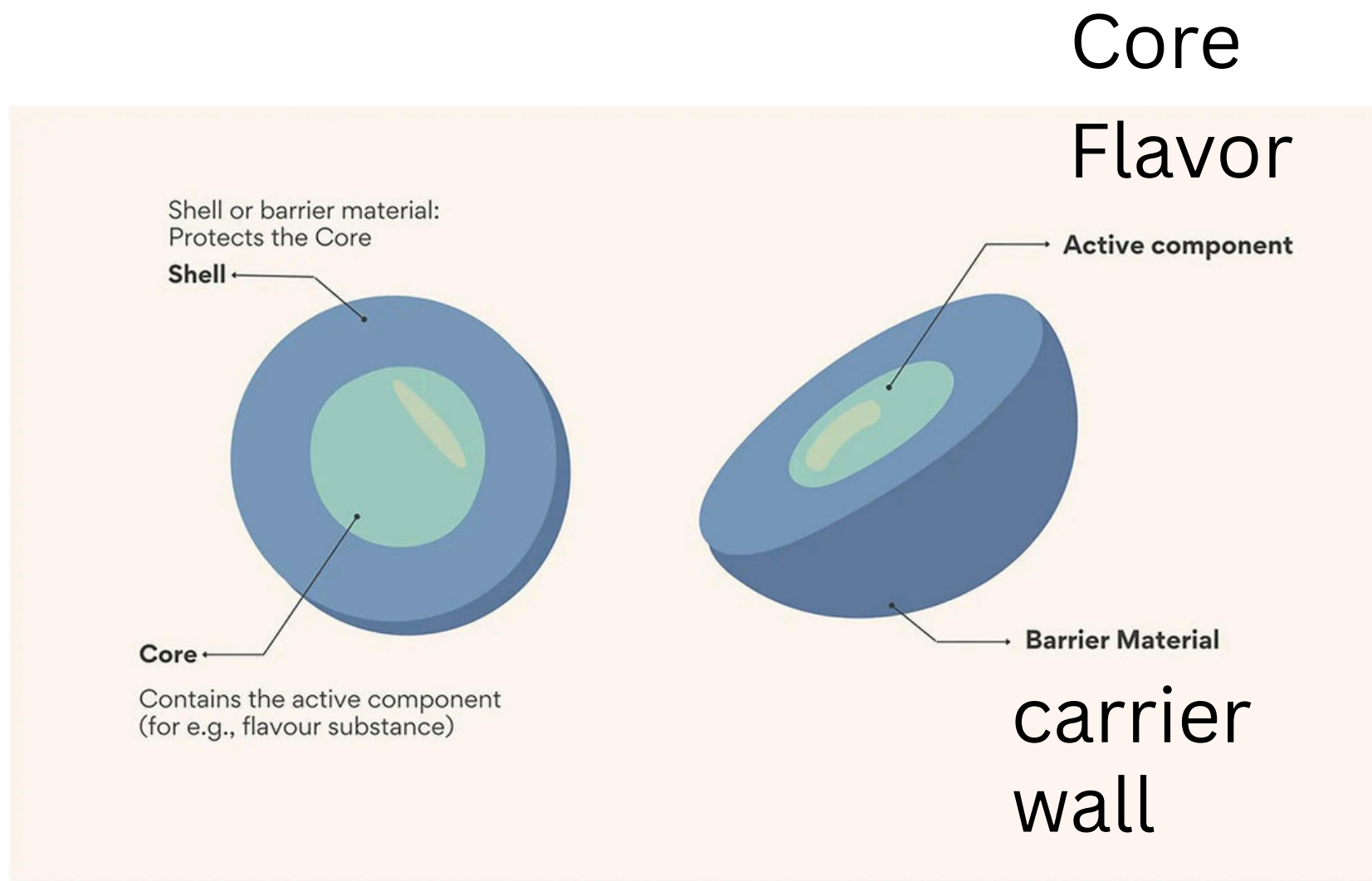


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# WHAT IS FLAVOR MICROENCAPSULATION?

Microencapsulation is the process of **entrapping flavor compounds** within protective wall materials



Schematic showing the main structure of a microcapsule. Shell (also referred to as wall or carrier materials) are used as a physical barrier to trap core or active components such as flavour substances. (doi: 10.3389/fnut.2023.1019211, 2023 )

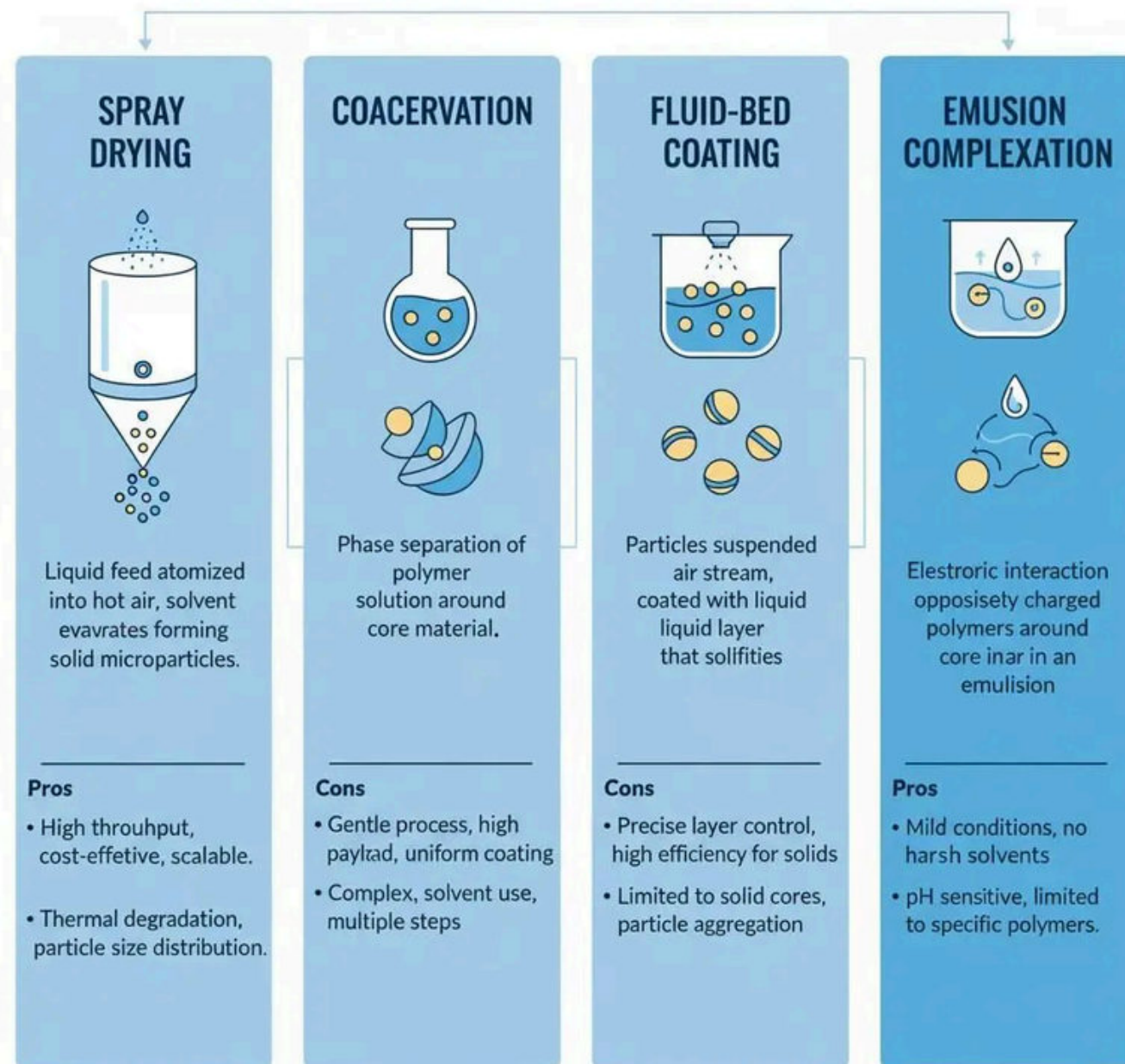


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# WHAT IS FLAVOR MICROENCAPSULATION?

**Microencapsulation** is a technique where flavor compounds are enclosed within a protective coating to improve stability and control release.

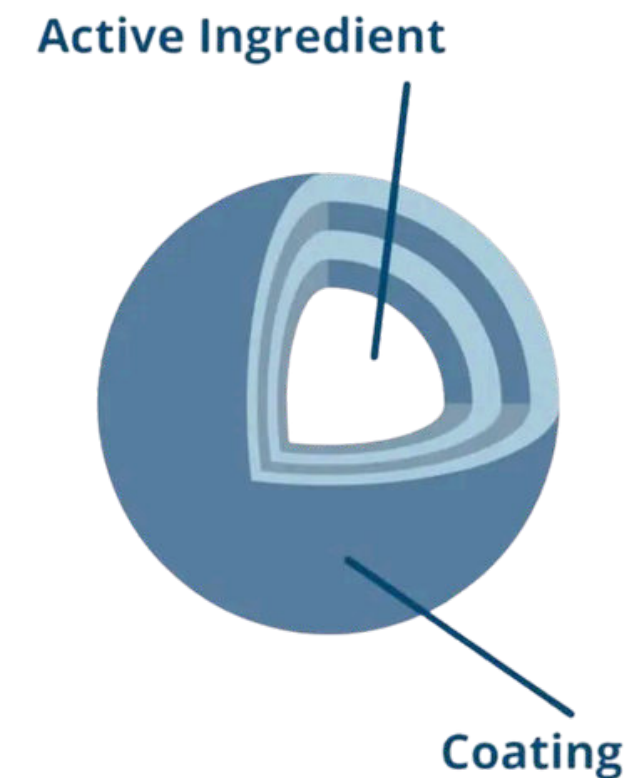
## MAJOR MICROENCAPSULATION TECHNIQUES



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## Typical wall materials

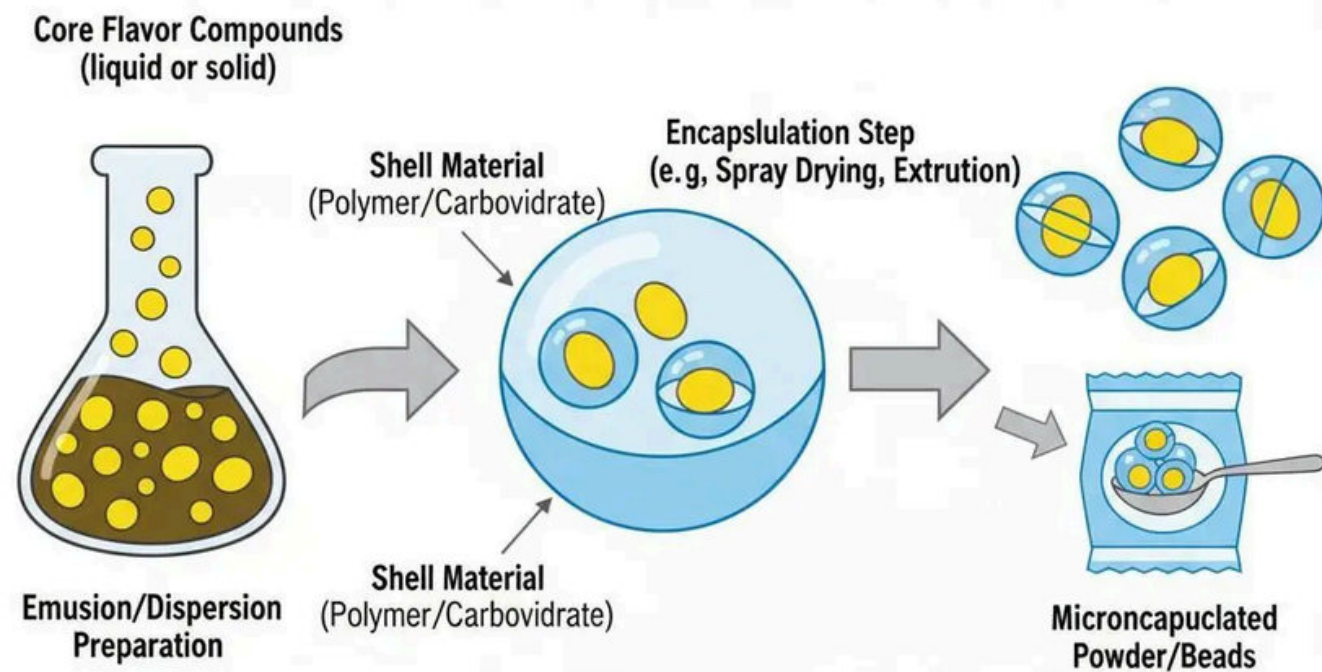
- maltodextrin
- gum arabic/alginate
- modified starch
- proteins



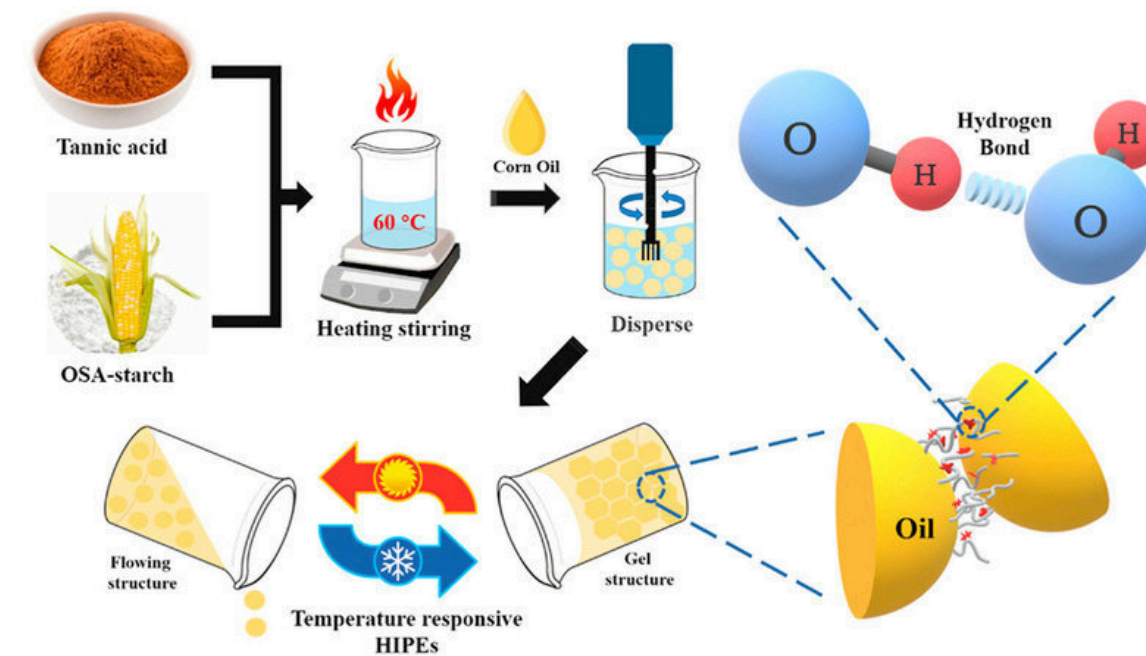
Cr. balchem.com



## MICROENCAPULATION PROCESS



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## FUNCTIONS

- PROTECT VOLATILE COMPOUNDS
- PREVENT OXIDATION
- FLAVOR MASKING
- IMPROVE STABILITY
- ENABLE CONTROLLED RELEASE

- **BENEFITS**

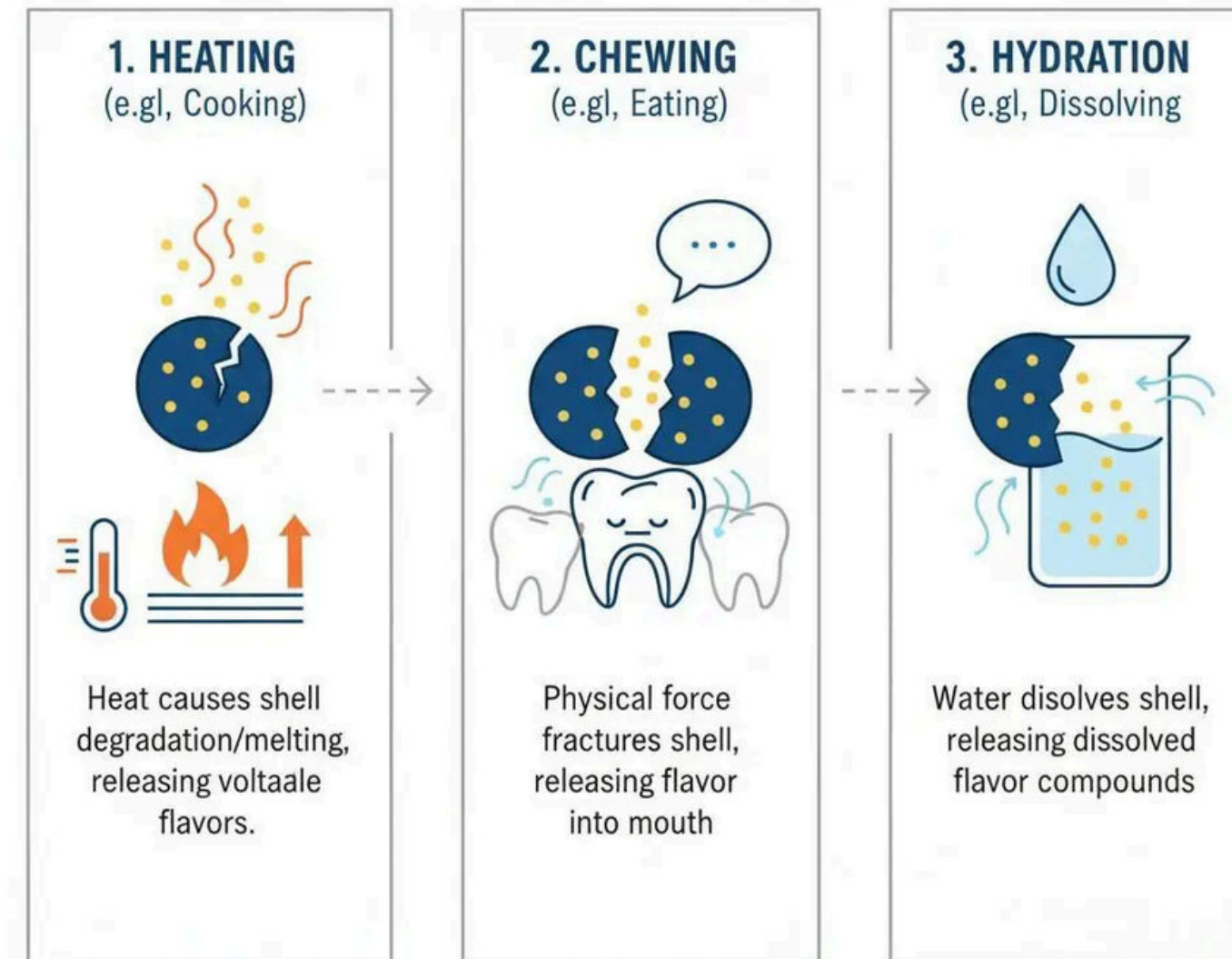


## FLAVOR RELEASE FROM MICROCAPULES

# FLAVOR BURST:

## Controlled Release Mechanisms

Microencapsulation allows control over when and how flavor is perceived



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### THERMAL RELEASE

:Triggered by heat (e.g., baking or cooking)

### MOISTURE ACTIVATION

Rehydration in beverages or sauces

### MECHANICAL RUPTURE

Crushing or chewing of solid foods

### ENZYMATIC DEGRADATION

Gradual release in biological systems



DESIGNING MULTI-DIMENSIONAL  
FLAVOR JOURNEY

# THE SENSORY ARCHITECT - SNACK

from the first bite to the final swallow

- Microencapsulation helps
  - separate flavor timing
  - enhance aroma impact
  - control aftertaste

Stage	Sensory
first bite	garlic aroma
chewing	umami
late chewing	chili heat
after swallow	lingering spice



# SENSORY CHALLENGES IN SNACK PRODUCTS

Controlling flavor perception over time is one of the biggest challenges in snack design

Ingredient	Sensory issue
pea protein	beany
soy protein	grassy
whole grain	bitter



## 1 Flavor loss

>>> volatile compounds evaporate

## 2 Uneven flavor perception

>>> seasoning distribution

## 3 Off-flavors

>>> healthy ingredients

## 4 Temporal sensory imbalance

>>> flavor disappears too fast

>>> aftertaste unpleasant



# TEMPORAL SENSORY PERCEPTION IN SNACK

The "Timeline" of Taste

- Which flavors should be release?
- When is the right time to produce positive consumer experience?
- What off-flavors needed to be masked?

## HOW DO WE *know it (them)?*

### TEMPORAL PROFILING

How to measure it over?

### SENSORY THRESHOLDS

Managing the threshold of detection

### THE "MOUTHFEEL" FEEDBACK

Because Encapsulation isn't just about taste



ALDENAIRE & PARTNERS

# TEMPORAL SENSORY PERCEPTION IN SNACK

MICROENCAPSULATION  
ENABLE

- delay flavor onset
- extend flavor duration



## TEMPORAL DOMINANCE OF SENSATIONS (TDS)

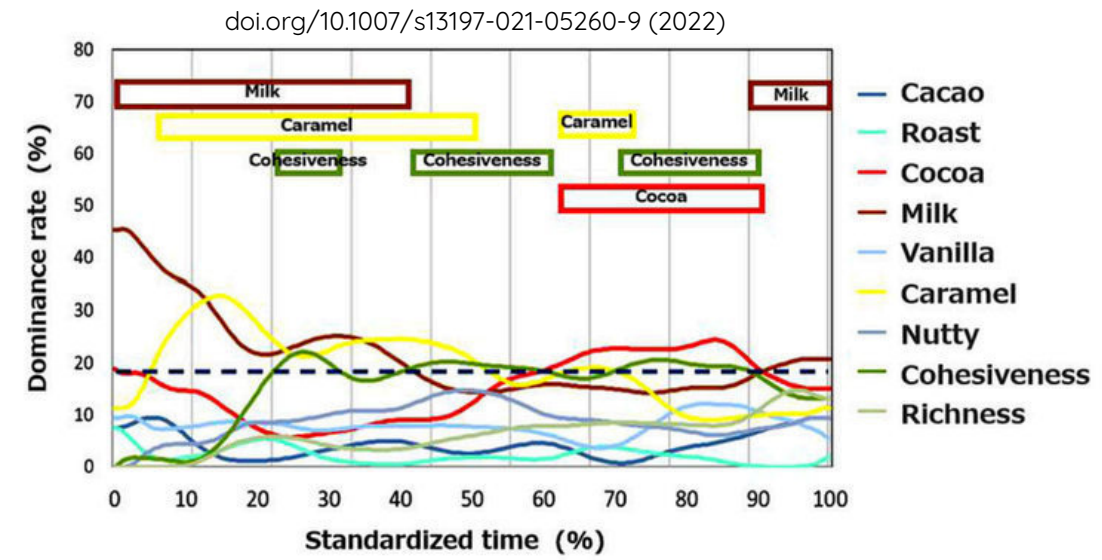
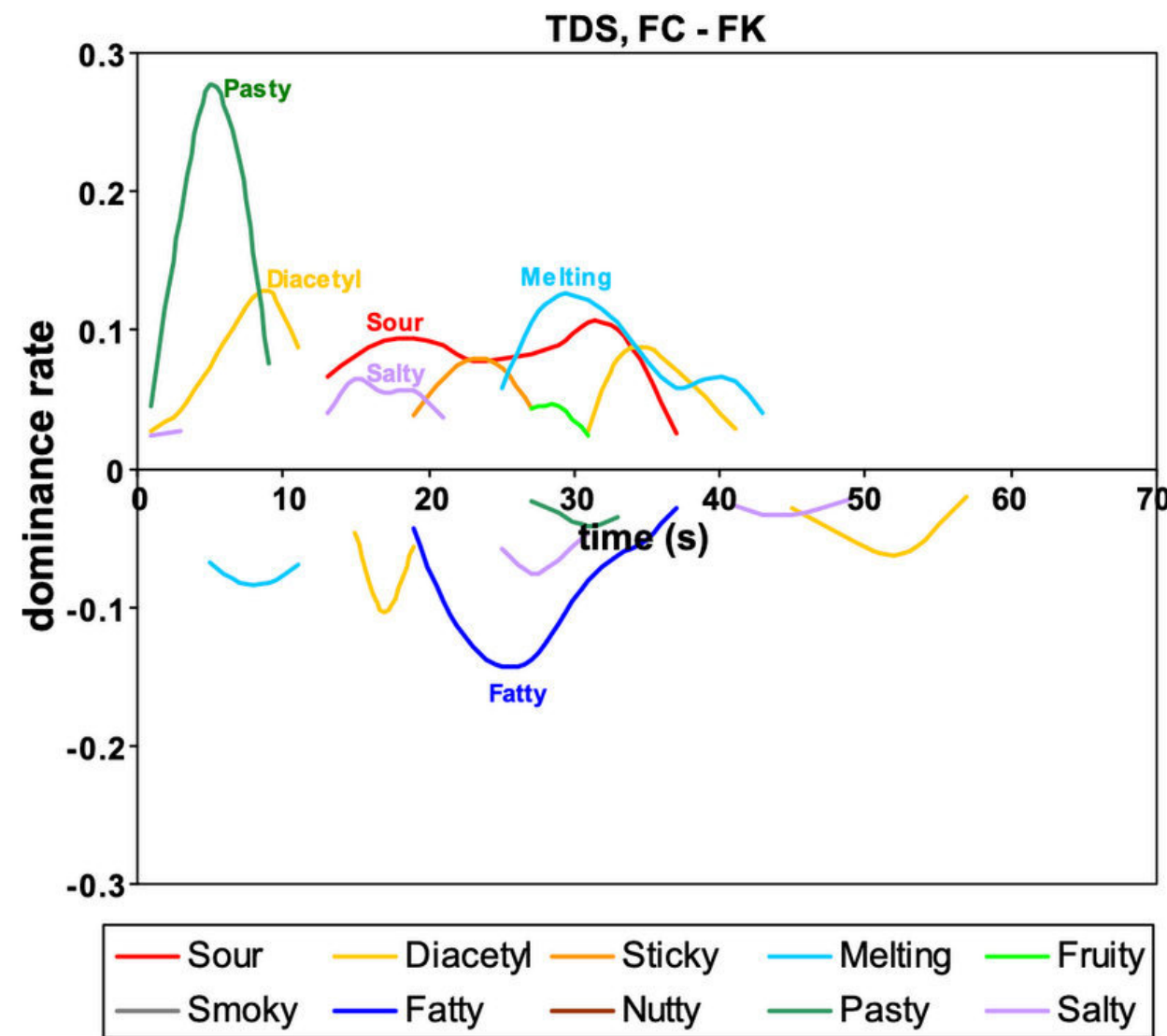
To define which sensory attribute dominate in consumer perception over time

## TIME-INTENSITY PROFILE

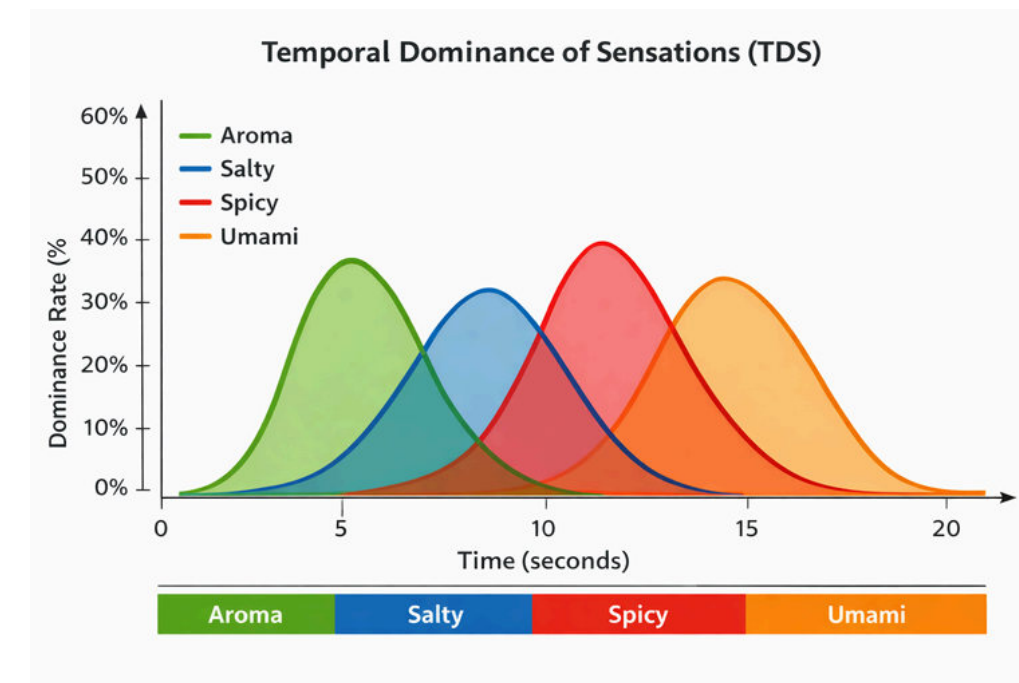
To observe the release intensity of a specific attribute over time



# TEMPORAL DOMINANCE OF SENSATIONS (TDS)



Time	Sensory
0-2 sec	aroma
2-5 sec	crunch
5-10 sec	flavor burst
10-20 sec	lingering



Time	Dominant sensation
0-5 sec	aroma
5-10 sec	salty
10-15 sec	spicy
15-20 sec	Umami

**Fig. 3.** TDS graphical representation for the difference between products FC and FK. N. Pineau et al. / Food Quality and Preference 20 (2009) 450-455



# TIME INTENSITY PROFILE

The "Timeline" of Taste

IFF FLAVORFIT™ [masking] delivers innovation in the linger / aftertaste component of the taste curve:



Cr. Iff.com

## THE CHALLENGE

Traditional flavors often have a "burst" followed by a rapid drop-off

## ENCAPSULATION SOLUTION

By using multiple types of "shells" (some that dissolve in water, some that break via chewing), sensory scientists can create a sustained release

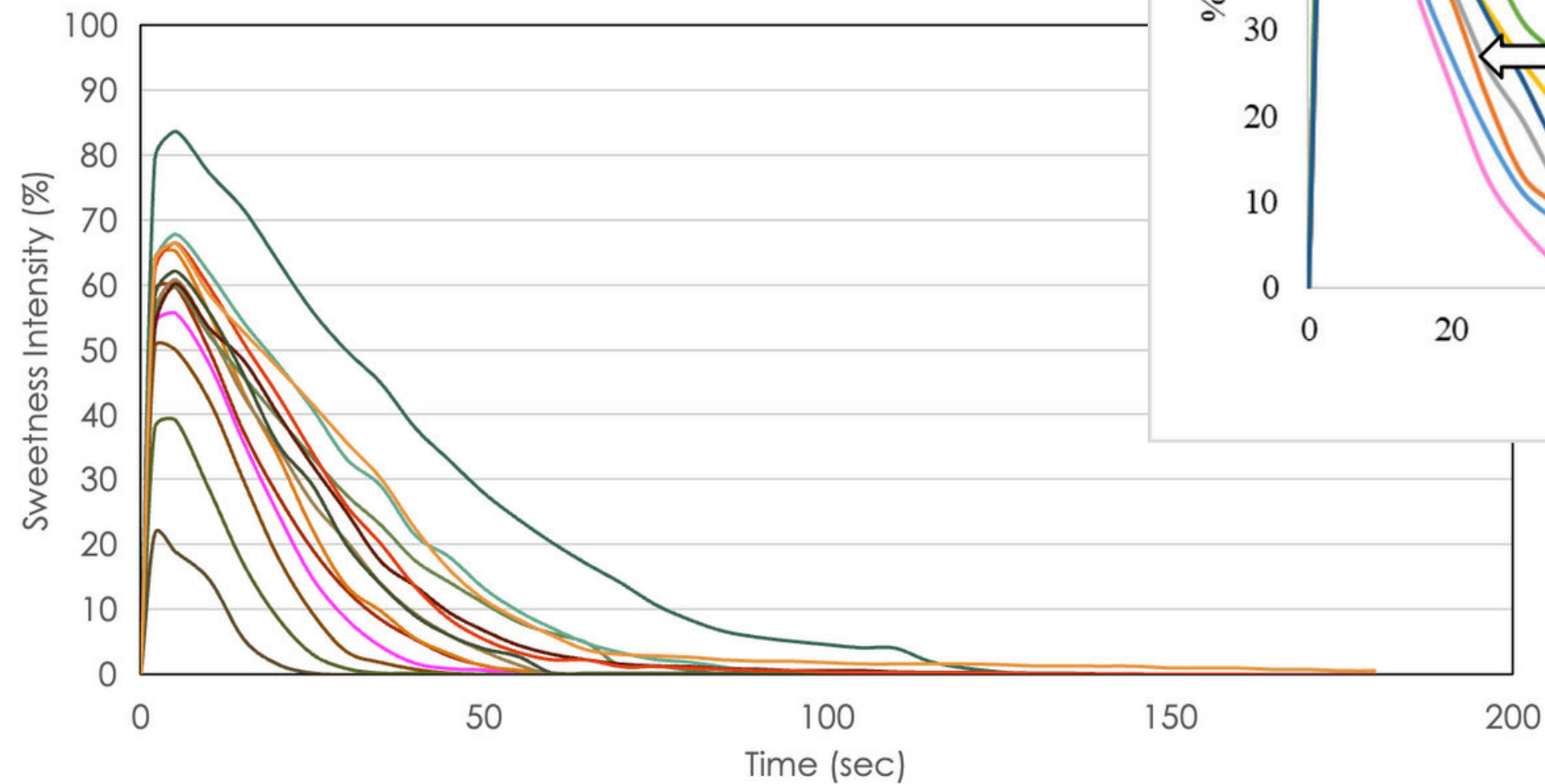
## IN PRODUCTS

sensory data helps engineers layer encapsulated flavors

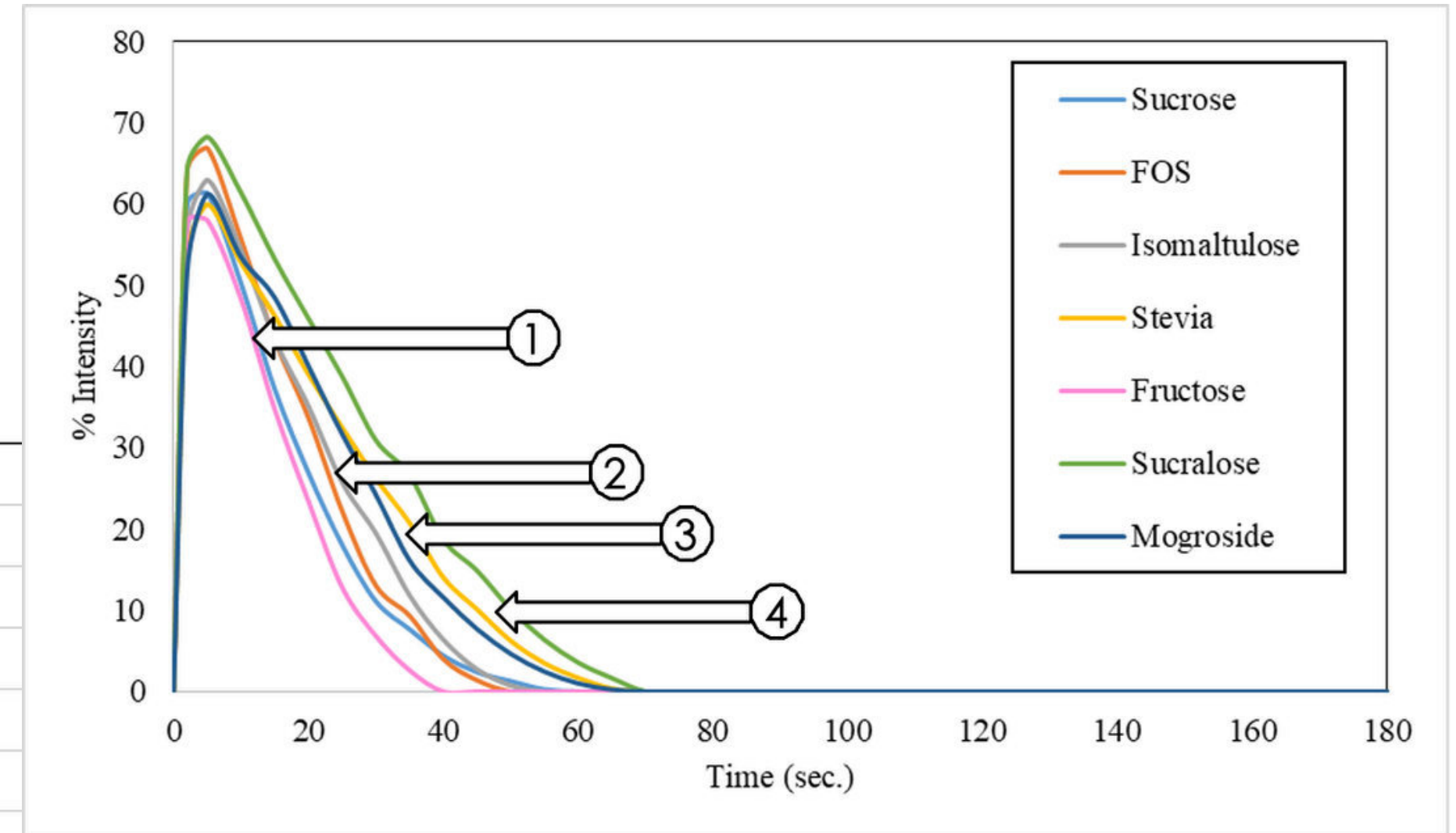


# TIME INTENSITY PROFILE

The "Timeline" of Taste



- Sucrose
- Fructose
- Cellobios
- P-stevia
- OligoliteTM
- Sucralose
- Erythritol
- Stevia-R
- PalatineTM
- Mogroside
- Risumalt®
- Stevia-enzyme
- Allulose
- PalatineTM Sweetened



Time-intensity curve WeSense



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# TIME INTENSITY PROFILE

Step to conduct

Panel selection based on ability to discriminate sweetness taste

Panel training (n=12)

Sample evaluation in changes in sweet tastes of samples as time passed

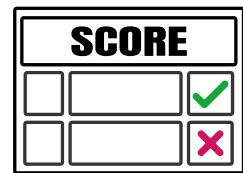
Panel performance evaluation (accuracy, repeatability, consistency)

- Obtained result: Time-intensity curve

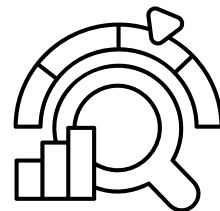


# TIME INTENSITY PROFILE

Step 1 : panel training (~100 hr)



Train scale/scoring card

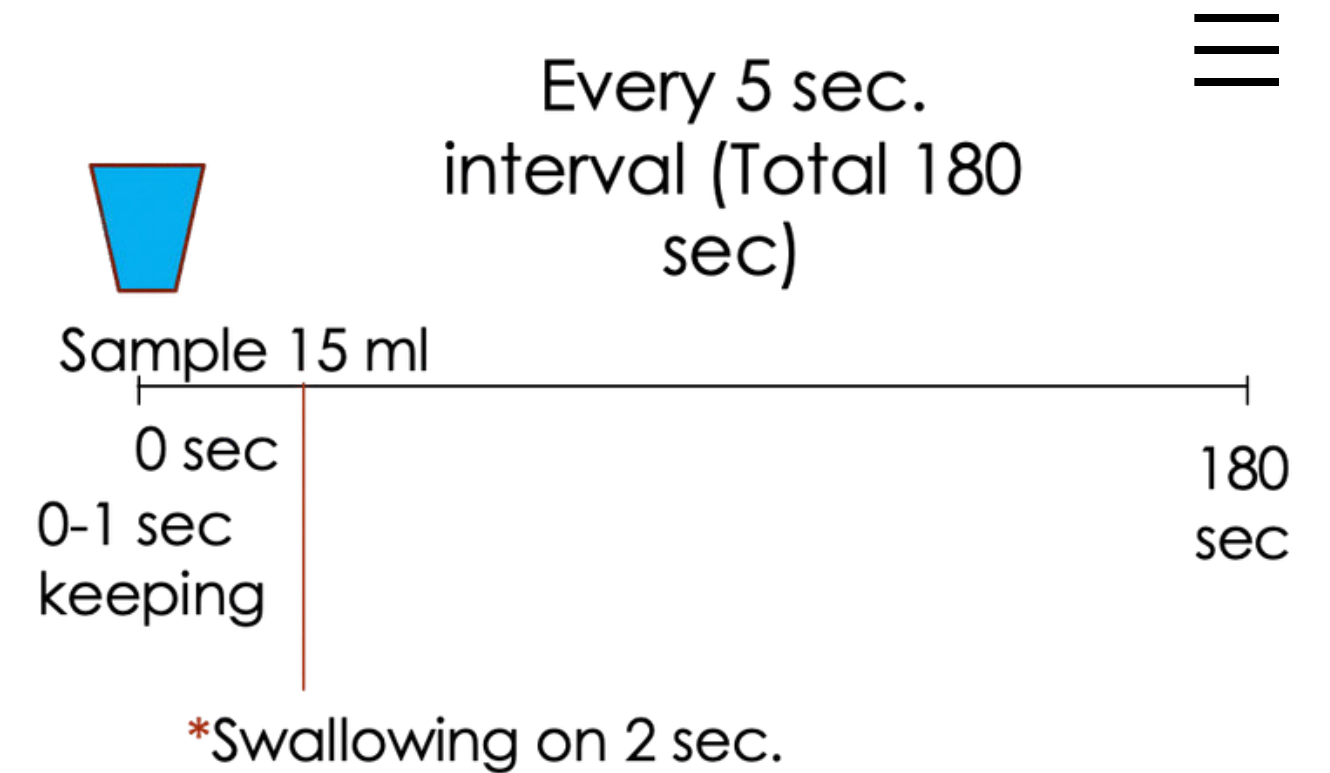


Train references (2-15% sucrose)



Train the test protocol

- time in mouth
- time to swallow
- rating interval



(0 =imperceptible sweetness;  
100 =very strong sweetness)  
10% sucrose = score 60

- Instruction**
- Taste sample
  - No sipping
  - Swallow at 2 sec
  - Rate until no appearance of sweetness
  - Must take cracker & water between each sample
  - No more than 4 sample served per section
  - At least 5 min break between each sample
  - Rating/scoring



# TIME INTENSITY PROFILE

## Step 2 : panel assessment

### ✓ Repeatability

The degree of deviation of the measurements from the mean that can be consistently read in all determinations.

### ✓ Accuracy

how to measure quantity relates to a known standard. Here, to test the accuracy of a measurement, the mean of a number is compared with a known standard

### ✓ Consistency

how to measure quantity relates to a known standard. Here, the mean of a number is compared with a consensus of a group.

Table 5. ANOVA table in RCBC of Maximum Time (Tmax) Printed Form and Computerize Method

Printed Form			Computerize	
Source	F Value	Pr	F Value	Pr >
<b>Maximum Time (Tmax)</b>				
judge	7.05	<.0001	12.41	<.0001
rep	0.65	0.4227	0	0.9825
sample	4.12	0.003	1.19	0.3283
Judge* <b>sample</b>	1.15	0.2997	0.81	0.7768
Rep* <b>sample</b>	2.09	0.0811	1.89	0.1105
Judge* <b>rep</b>	0.5	0.8922	2.33	0.0195

#### How to evaluate panel performance

Repeat the test up to 3 tests	Recognize and accurate scoring the reference standard	Accurate results to the rating score of group consensus
Repeatability	Accuracy	Consistency
SD	Count the number of corrected responses	
DOD < 1% SD < 0.1% (QDA®)	95% corrected answer	DOD < 1% SD < 0.1% (QDA®)



# TIME INTENSITY PROFILE

Step 3 : product evaluation

## Maximum intensity (Imax)

maximum intensity score on graph (-)

## Maximum time (Tmax)

Time at which the maximum intensity score has been rated (second)

## Time end (Tend)

Time at which the rating score reach zero or nearly zero (second)

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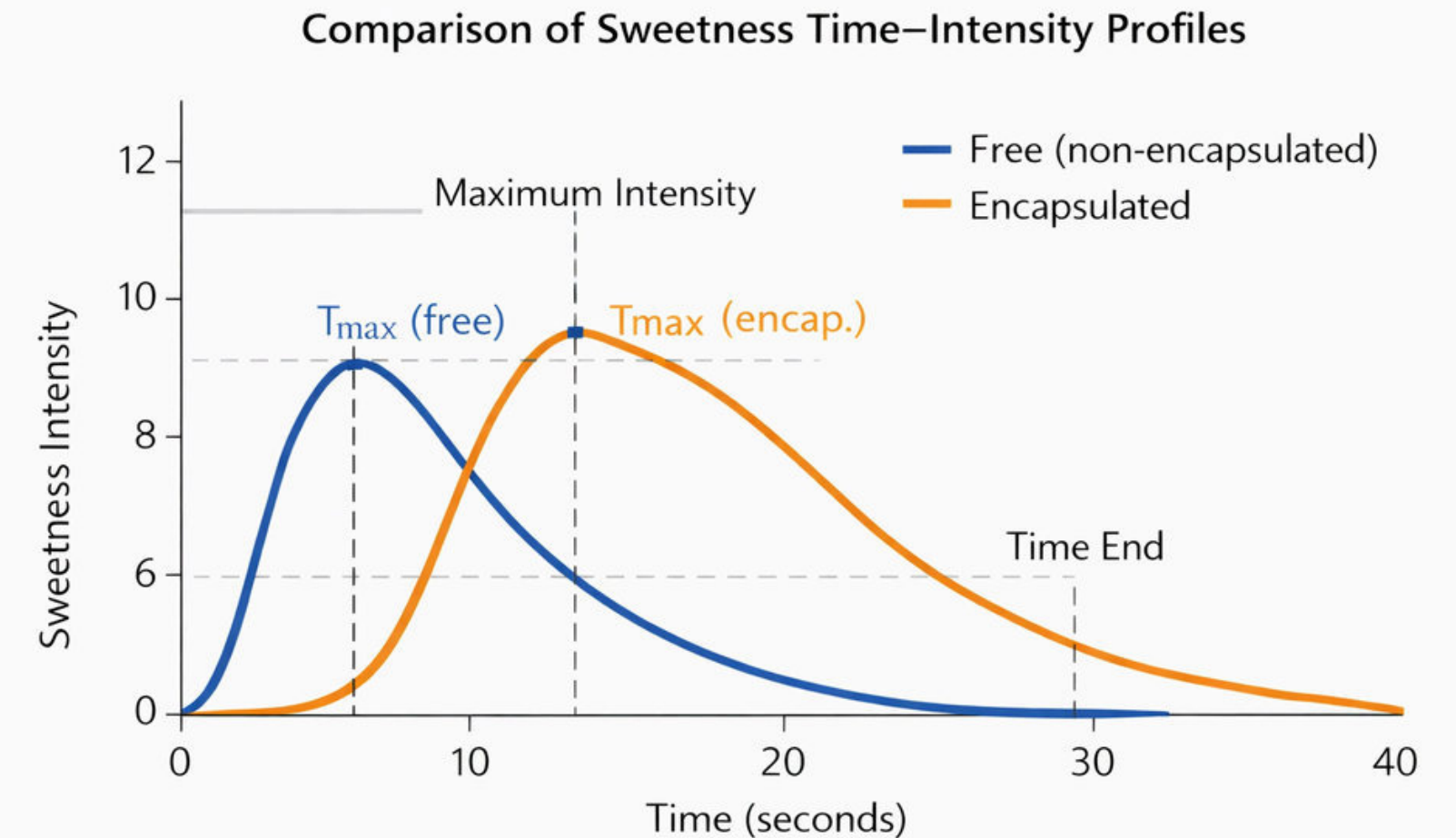


Fig. 1. Comparison of Temporal Dominance of Sensations (TDS) curves between a



# TIME INTENSITY PROFILE



Step 3 : product evaluation

## Maximum intensity (Imax)

maximum intensity score on graph (-)

## Maximum time (Tmax)

Time at which the maximum intensity score has been rated (second)

## Time end (Tend)

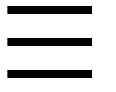
Time at which the rating score reach zero or nearly zero (second)

Table: Mean time to reach maximum intensity (Tmax) and time end (Tend) of 7 sweeteners (WeSense)

	Stevia	Mogroside	PP	FOS
Tmax	5.96±2.72a	4.85±1.63b	4.17±1.80b	4.33±1.60b
Tend	69.38±15.87a	66.04±10.37a	55.21±8.14b	42.50±8.56c

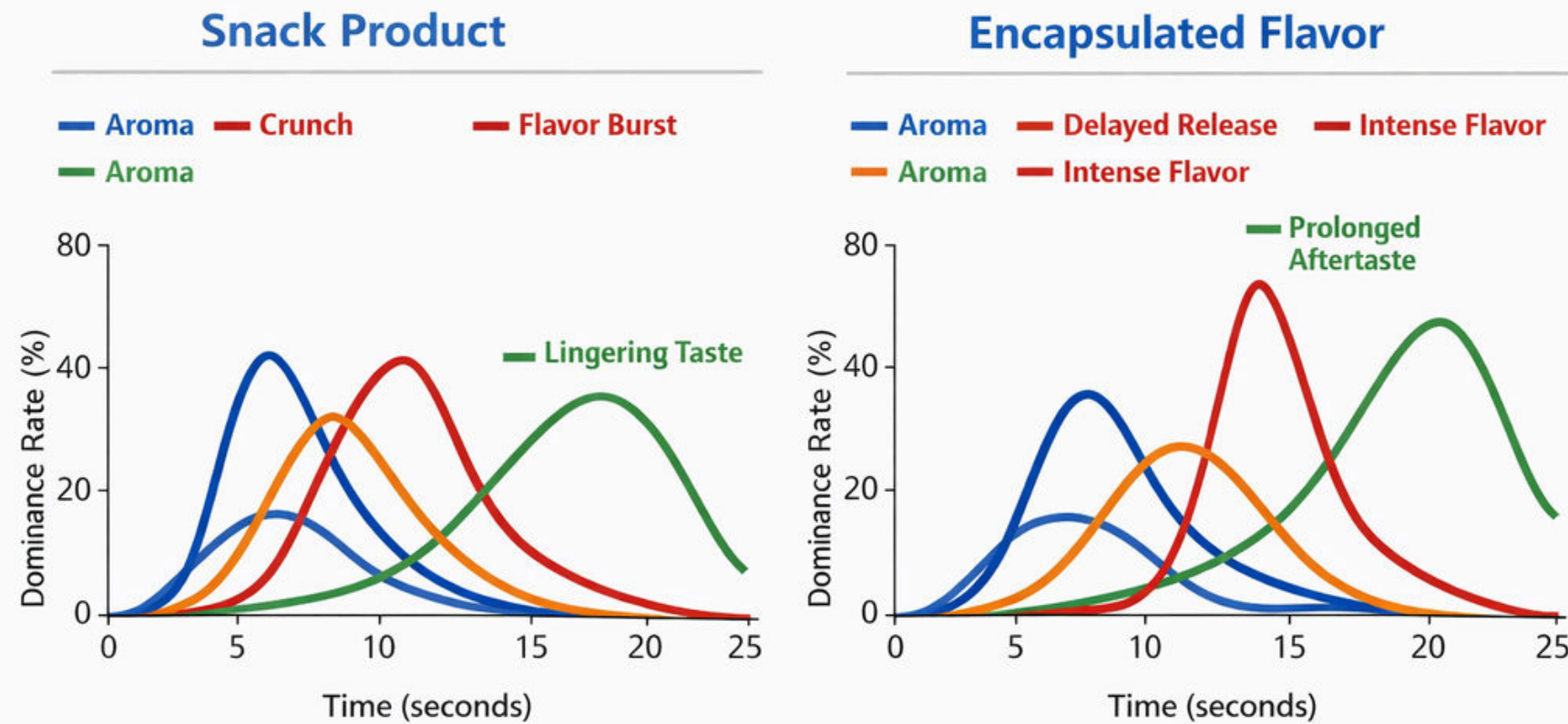
Different letters indicate that sweeteners have, statistically, different maximum time and ending time for sweet taste (p<0.05)

1. Fast release, short duration
2. Fast release, medium duration
3. Fast release, slow duration
4. Slow release, slow duration



# TEMPORAL DOMINANCE OF SENSATIONS (TDS)

Temporal Dominance of Sensations (TDS)



Parameter	General snack	Encapsulated
Onset	Fast	Delayed
Peak intensity	Medium	Intense
Tmax	Short	multi-phase
Tend	Short	prolonged
Experience	hit & fade	sustained & layered
order of perception	Single peak	Multi-phase

Encapsulation modifies the temporal sensory profile by delaying flavor release, increasing peak intensity, and prolonging aftertaste, resulting in a more sustained and controlled sensory experience compared to conventional snack products.



# TDS vs Time-Intensity

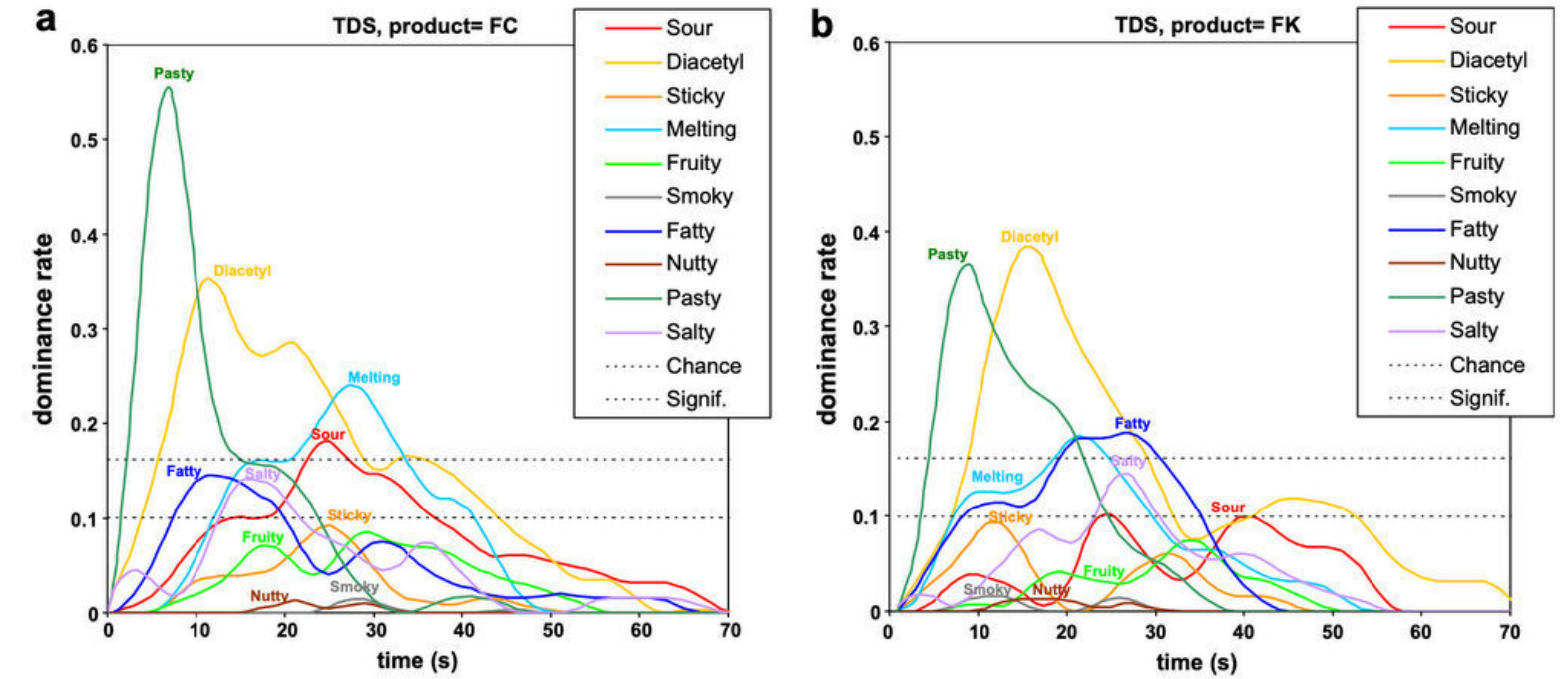


Fig. 2. (a) TDS graphical representation for product FC. (b) TDS graphical representation for product FK.

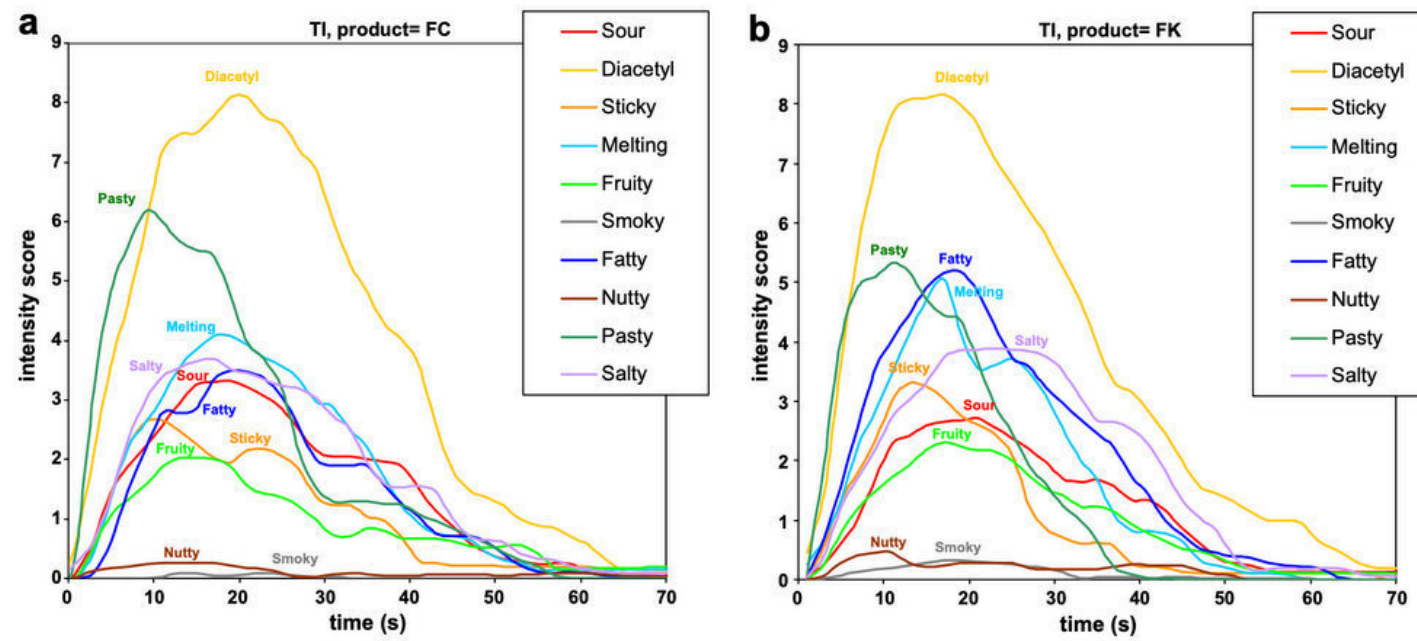


Fig. 4. (a) TI curves for product FC. (b) TI curves for product FK.



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# MANAGING SENSORY THRESHOLDS

Because we all are unique.

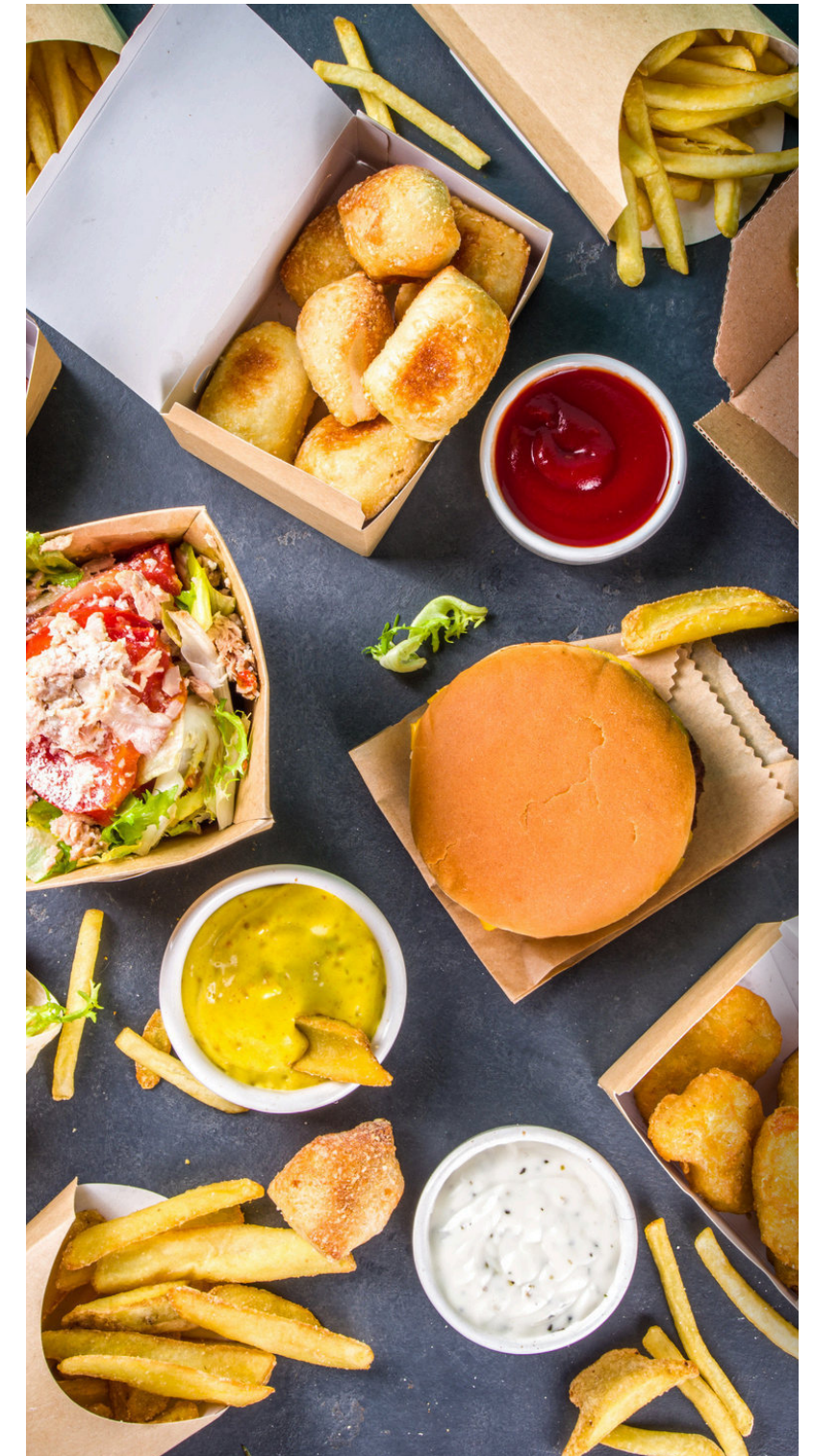
## AROMA RELEASE

- sensory scientists conduct "Difference Tests." We determine if the encapsulation is thick enough to mask the bitterness

## MASKING BITTER NOTES

- Sensory science measures the aromatic gases released when an encapsulated bead burst—to ensure the "scent impact" matches the "taste impact."

Every person has a "detection threshold"—the minimum concentration of a substance required to taste it. Sensory science helps determine the exact amount of encapsulation needed to stay above or below these thresholds





### GRITTINESS

If the capsules are too large (usually over 30–50 microns), the tongue perceives them as "sand" or "grit." Sensory scientists help set the maximum particle size for a smooth "creamy" yogurt vs. a "crunchy" topping

### COOLING EFFECT

Some encapsulated ingredients, like menthol, are designed to trigger cold receptors in the mouth. Sensory science ensures the "cooling" sensation happens in the throat rather than just on the lips

# THE "MOUTHFEEL" FEEDBACK

ENCAPSULATION **ISN'T** JUST  
ABOUT TASTE

## The Technology: Thermal- Release Encapsulation

## Goal

To ensure the fat doesn't just "leak out" into the pan but stays in the meat until it's eaten

## Sensory test

Panels use a "Spider Web" (Radar) chart to rate attributes like oiliness, sizzle sound, at different stages: first bite, mid-chew, and after-swallow.

Real beef has "marbling" (intramuscular fat) that melts slowly; plant oils (like coconut or canola) usually melt all at once.



## The Technology: Thermal- Release Encapsulation

# Solution

The fat is encapsulated in a protein or starch shell that has a specific melting point (70 – 80°C). This keeps the fat solid during raw handling and only releases the "juiciness" as the burger reaches a medium-well internal temperature

Real beef has "marbling" (intramuscular fat) that melts slowly; plant oils (like coconut or canola) usually melt all at once.





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# THE ART OF MASKING: HEALTHY SNACKS CHALLENGE

How healthy snack tasty

## Encapsulation strategies

- encapsulated sweeteners
- encapsulated flavor oils
- delayed release masking agents



### HEALTHY SNACK

pea protein	beany
soy protein	grassy
whole grain	bitter

### ENCASULTAION

- mask bitterness
- delay release of unpleasant notes
- enhance desired flavor

# Key takeaway

Sensory science is essential for designing next-generation snack experiences



1

Flavor perception is dynamic and temporal



2

Sensory science helps us understand consumer experience



3

Microencapsulation enables precision flavor design

