

PWN°02 : EFFECT OF WATER ACTIVITY ON NON-ENZYMATIC BROWNING IN DIFFERENT FOOD MATRICES

Objectives

- Understand the Maillard reaction in different food matrices.
 - Demonstrate the effect of humidity (water activity, a_w) on the intensity of non-enzymatic browning.
 - Compare the behavior of three types of foods with different compositions.
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Principle

The Maillard reaction, or non-enzymatic browning, corresponds to the interaction between reducing sugars and amino acids at high temperatures ($\geq 120^\circ\text{C}$). It produces characteristic brown colors and aromas. The degree of browning varies greatly depending on the water activity (a_w) of the environment. This experiment shows that browning is maximal at intermediate a_w , reduced in very dry (limited mobility) or very wet (dilution) conditions.

Materials and Products

- Milk powder (15 g)
- Baguette bread (15 g, crumb, in pieces)
- Potato (15 g, grated or thinly sliced)
- Distilled water
- Dry rice (for "low a_w " condition)
- Precision balance
- 9 Petri dishes
- Preheated oven at 140°C
- Aluminum foil
- Timer, tongs, gloves/lab coat

Procedure

For each food (3 x 3 conditions):

1. Weigh 3 x 5.0 g of each: milk powder, bread, potato.
 2. Place each portion into a labeled Petri dish:
 - **Condition 1:** low aw: add 2 g dry rice to the dish (rice not in direct contact)
 - **Condition 2:** high aw: add exactly 0.5 mL distilled water (pipette) onto the sample
 - **Condition 3:** control (natural aw): add nothing
 3. Let rest 10 min at room temperature (dishes open).
 4. Cover with aluminum foil.
 5. Heat for 25 min at 140 °C.
 6. Allow to cool for 5 min.
 7. Observe each dish:
 - Color: from light to very brown
 - Odor: note any aroma (neutral, toasted, caramel...)
 - Other (texture, other remarks)
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Questions for Students

1. How does water activity affect the intensity of non-enzymatic browning ?
2. Which condition produced the least browning and why?
3. Why is the browning less intense when extra water is added?
4. Which sample (among the foods tested) browned the least and why?

5. Results Tabl

Fill in the table with your observations for each sample: color (intensity and visual aspect), odor/aroma, and any additional comments

Food	Condition (aw)	Water Added (mL)	Dry Rice (g)	Color	Odor/Aroma	Additional observations
Milk powder	Low	0	2			
	High	0.5	0			
	Control	0	0			
Bread	Low	0	2			
	High	0.5	0			
	Control	0	0			
Potato	Low	0	2			
	High	0.5	0			
	Control	0	0			