
PW3 : Role of phospholipids and lipids in food emulsions and fat-structured systems: Model mayonnaise – Model chocolate – Chocolate ganache

I. Objectives

This practical work aims to prepare and compare a model mayonnaise, a model chocolate made from basic ingredients, and a simple chocolate ganache, in order to illustrate the role of phospholipids as natural emulsifiers (egg yolk), to distinguish between oil-in-water emulsions and fat-structured systems, and to relate texture, appearance and stability to interfacial phenomena and fat crystal structure.

II. Short Review

Phospholipids (e.g., from egg yolk) are natural emulsifiers because they contain a hydrophilic head and hydrophobic tails, allowing them to stabilise oil–water interfaces.

- **Mayonnaise** = oil-in-water emulsion stabilised by egg yolk.
- **Ganache** = water (cream) dispersed in melted chocolate fat; stabilised mainly by proteins and cocoa components.
- **Chocolate** = fat-continuous suspension (cocoa butter + solids). Proper cooling (tempering) forms stable fat crystals that give gloss, snap and good melting.

III. Materials and reagents

- **Common equipment:**

Beakers, spatula, whisk, thermometer, hot plate or water bath, balance, moulds and labels

- **For mayonnaise :**

Vegetable oil, egg yolk, water or vinegar and salt

- **For chocolate and ganache:**

Cocoa butter, cocoa powder, powdered sugar and cream (30–35% fat)

Part A – Model Mayonnaise (O/W Emulsion)

Formulations :

- **A1 – Without emulsifier:**
10 g water + 0.2 g salt + 30 g oil
- **A2 – With egg yolk:**
1 egg yolk + 5 g water + 0.2 g salt + 30 g oil

Method :

1. Place water (or egg yolk + water) and salt in a beaker.
2. Add oil dropwise, whisking continuously.
3. When the emulsion begins to thicken, add oil in a thin stream.
4. Note viscosity, homogeneity, brightness.
5. Let rest 30 minutes and observe any phase separation.

Expected Results

- A1: unstable, rapid oil separation (no emulsifier).
- A2: stable, thick emulsion thanks to phospholipids.

Part B – Model Chocolate (Fat-Continuous System)

Base Formulation

- 32 g cocoa butter
- 18 g cocoa powder
- 50 g powdered sugar

Method

1. Melt cocoa butter at **50–55 °C** (do not exceed 60 °C).
2. Add cocoa powder gradually with a spatula.
3. Add powdered sugar and mix until homogeneous.
4. Divide into two portions:

B1 – Non-tempered Chocolate

- Pour directly into moulds and let solidify at room temperature.

B2 – “Tempered” Chocolate

- Cool the chocolate while stirring gently until **27–28 °C**.
- Rewarm slightly to **30–32 °C** then pour into moulds and let solidify.

Expected Results

- Non-tempered: dull surface, crumbly, possible white bloom later.
- Tempered: shinier, smoother, cleaner break.

Part C – Simple Chocolate Ganache (Emulsion without mixer)

Formulation (per sample)

- 20 g melted model chocolate
- 20 g hot cream (60–70 °C)

Samples

- **G1 – Proper emulsification:** Add hot cream in small portions, whisking after each addition.
- **G2 – Poor emulsification:** Add all the cream at once, whisk briefly.

Method

1. Melt the chocolate to about 40–45 °C.
2. Prepare hot cream.
3. Make G1 and G2 following the additions above.
4. Observe texture, smoothness, graininess, phase separation.
5. Let cool and observe stability.

Expected Results

- G1: smooth, glossy, homogeneous ganache (small droplets, good dispersion).
- G2: grainy, dull, unstable ganache (“broken”) due to large droplets and poor emulsification.