



POLYTECHNIC INSTITUTE OF SANTARÉM

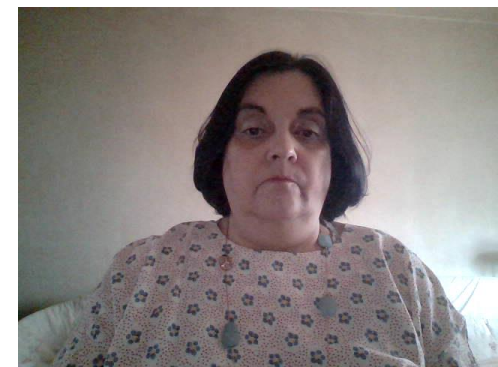
IX INTERNATIONAL WEEK VIRTUAL

INTERNATIONALIZATION IN TIMES OF PANDEMIC:
CHALLENGES AND GOOD PRACTICES

Food Emulsions

Maria Gabriela de Oliveira Lima Basto de Lima

Santarém, may 14th of 2021



Emulsion

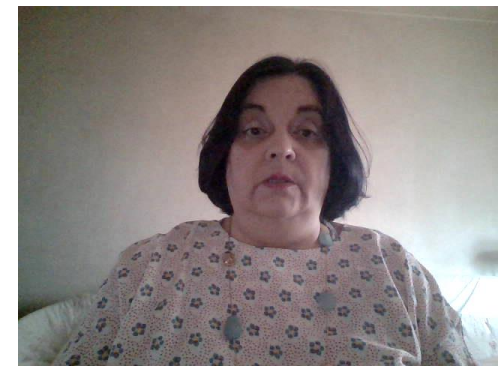
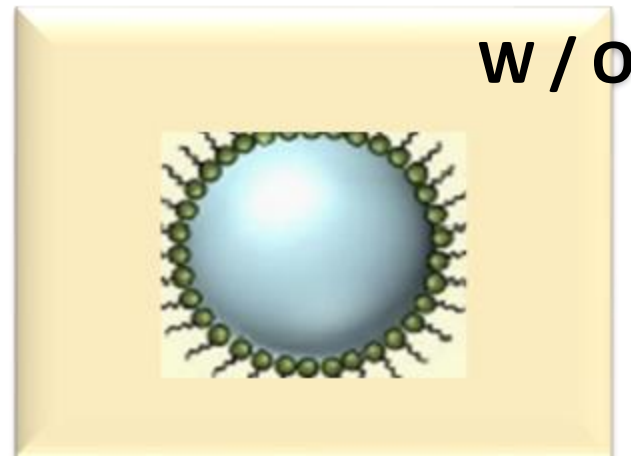
Multiphase thermodynamically unstable system consisting of two immiscible phases, one aqueous phase and a **lipid phase**, in which one phase is dispersed in another in the form of spherical drops.

In the interface is possible to stabilize this system.

Basically, there are two types:

oil-in-water (o/w) - **dispersed** phase is **lipid**, and the continuous phase is aqueous, forming a **normal micelle** at the **interface**;

water-in-oil (w/o) - dispersed phase is aqueous, and the **continuous** phase is **lipid**, with an **inverse micelle** forming at the **interface** (McClemments, 2007).

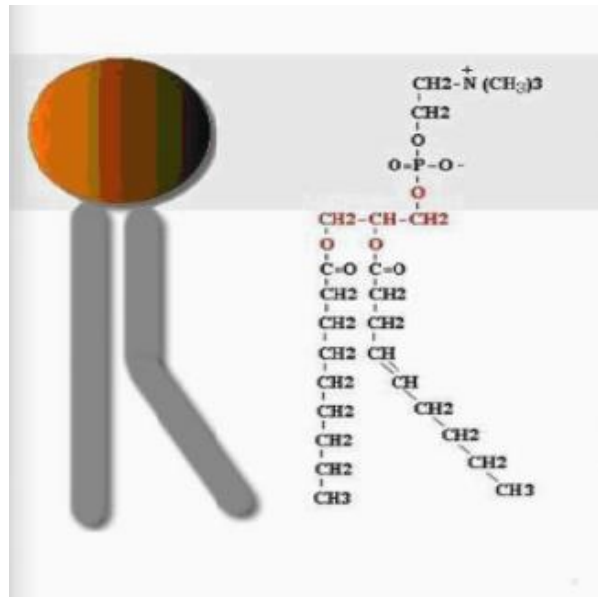


Emulsion

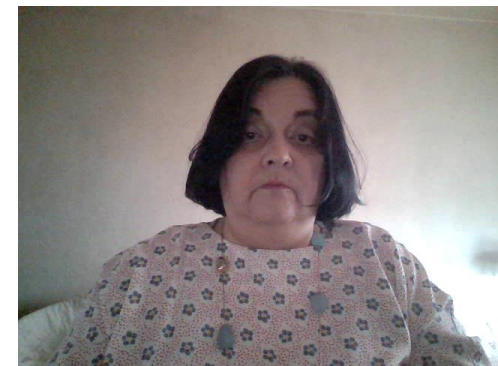
There is competition at the **interface** for adsorption of various **emulsifier** components, they are **amphiphiles** substances which have **polar** and **nonpolar** groups having affinity for both phases (Dickinson et al., 2013).

The emulsifier reduces the interfacial tension between immiscible phases.

It is the membrane that holds the drops.

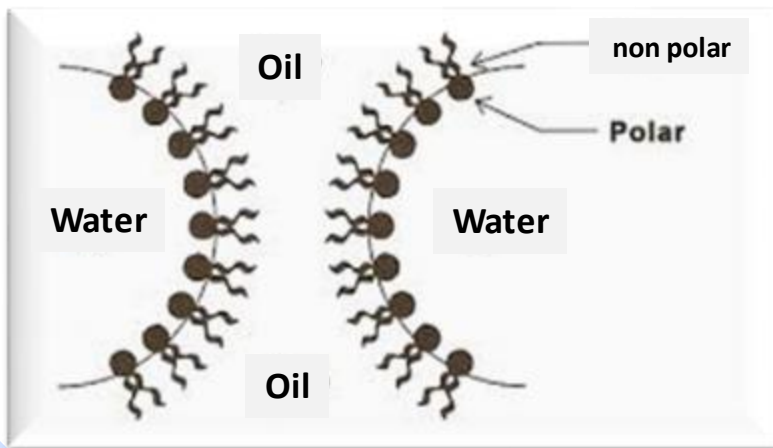


Several emulsifiers can be used, such as mono acyl glycerols (MAG), diacyl glycerols (DAG) and triacyl glycerols (TAG)

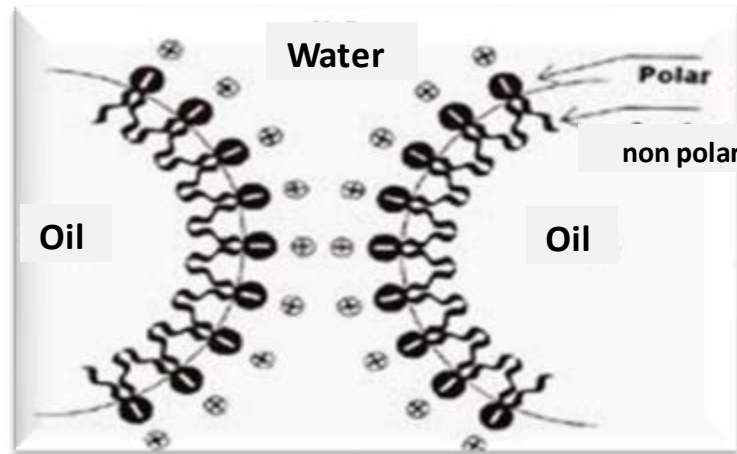


Emulsion

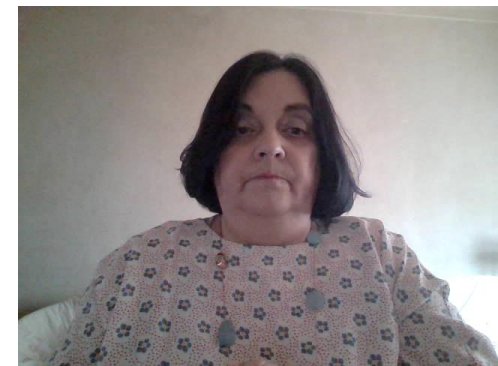
Wilder Dwight Bancroft (1867-1953) suggested that the phase in which the emulsifier is more soluble can form the continuous phase by reducing the interfacial tension on that side of the film.



*Hydrophilic
emulsifier*



*Hydrophobic
emulsifier*



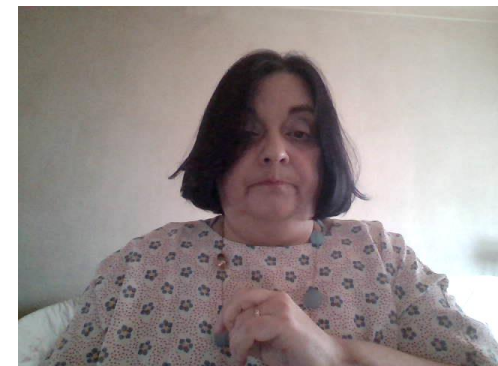
Food Emulsions

Vegetable spread cream is essentially a w / o emulsion

Lipid phase

Hydrophobic Substances:

blend of vegetable oils, colorants, stabilizers, emulsifiers, phytosterols, lecithin, MAG, DAG and TAG, flavourings, antioxidants, and liposoluble vitamins.



Food Emulsions

Vegetable spread cream is essentially a **w / o** emulsion

Aqueous phase

Hydrophilic Substances:

Skimmed milk proteins, sorrelho and buttermilk, and small amounts of salt, preservatives, thickeners and water-soluble vitamins.



Food Emulsions

Vegetable spread cream is essentially a **w / o** emulsion

Interface

Solid fat crystals and emulsifiers, that forms a three-dimensional network which surrounds the drops of the dispersed aqueous phase, and is embedded in the continuous lipid phase, forming a membrane at the interface.



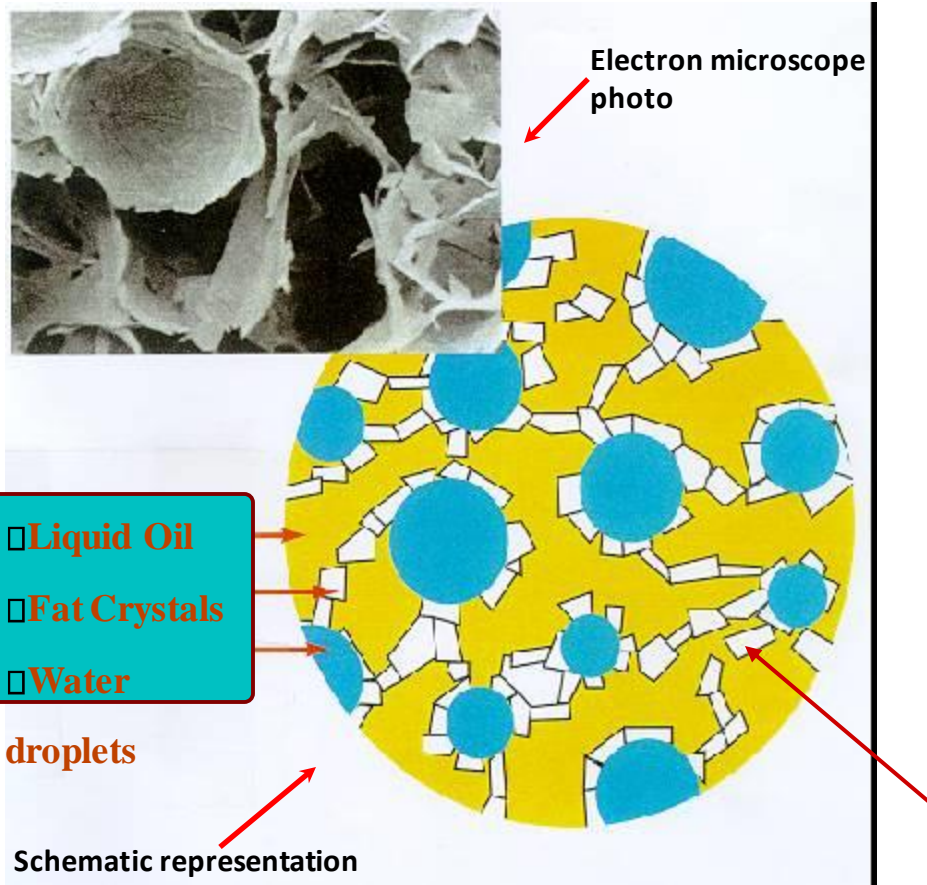
Manufacturing spreadable creams



**SCIENCE, ART
OR ??**



Manufacturing spreadable creams

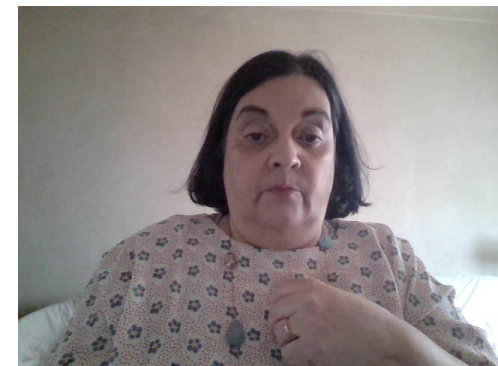


What we have to do

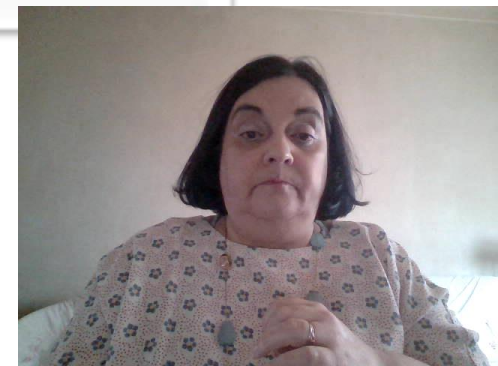
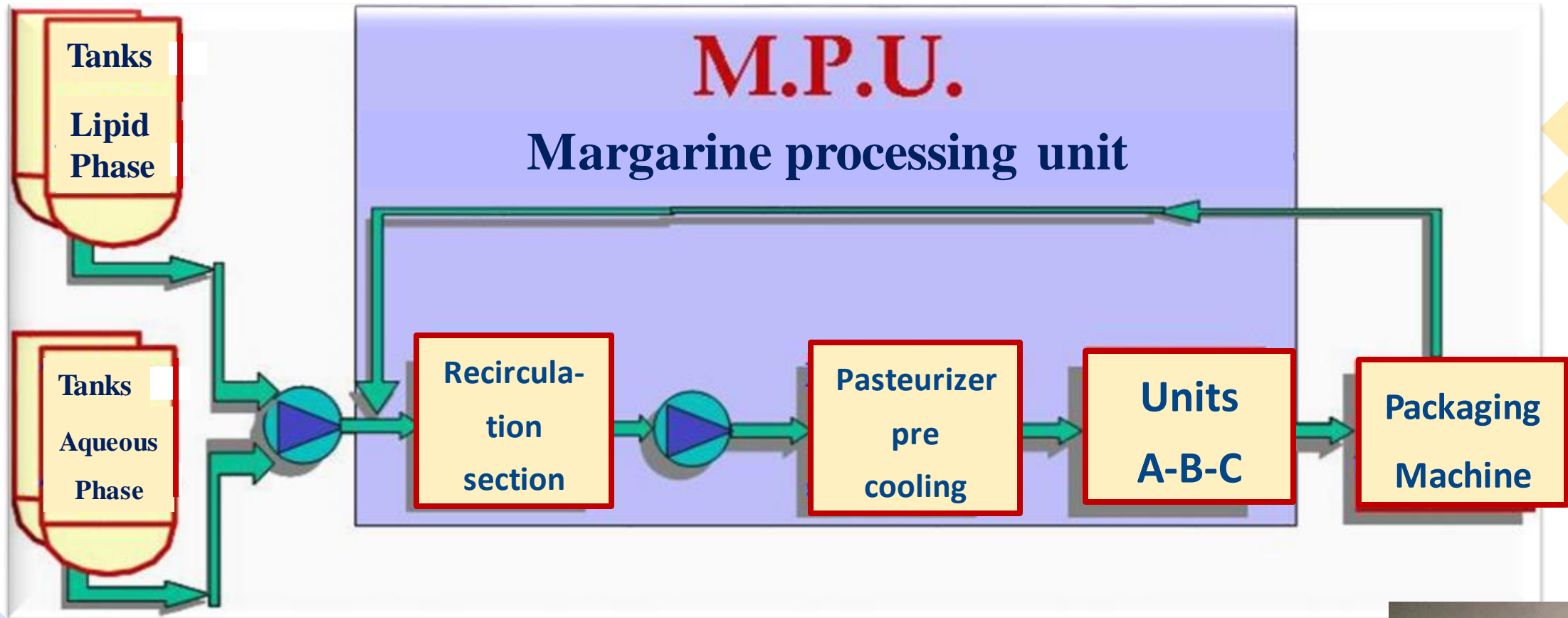
- Mix all Ingredients
- Create Crystals
- Manipulate Crystals
- Create Water Droplets

It is like a sponge soaked in the lipid phase, wherein the droplets of the aqueous phase are entrapped in the lipid crystals network.

The rheological behaviour of a spreadable cream mainly depends on the crystalline form of the fatty acid and the processing techniques used.

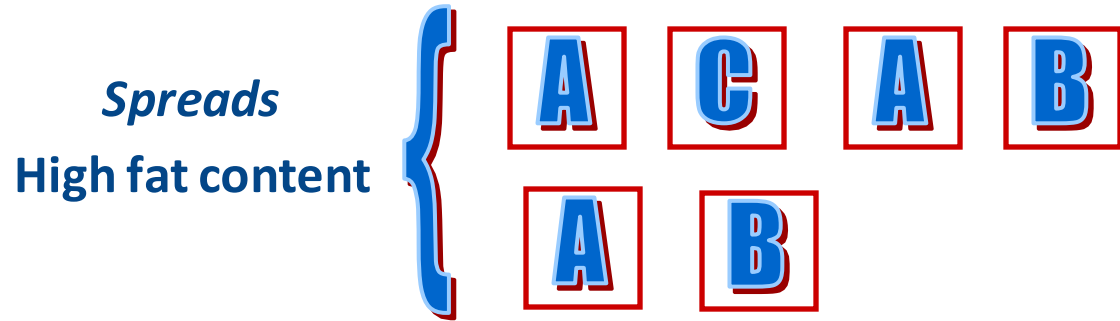


Manufacturing spreadable creams



Manufacturing spreadable creams

CRYSTAL MANIPULATION– WORKING



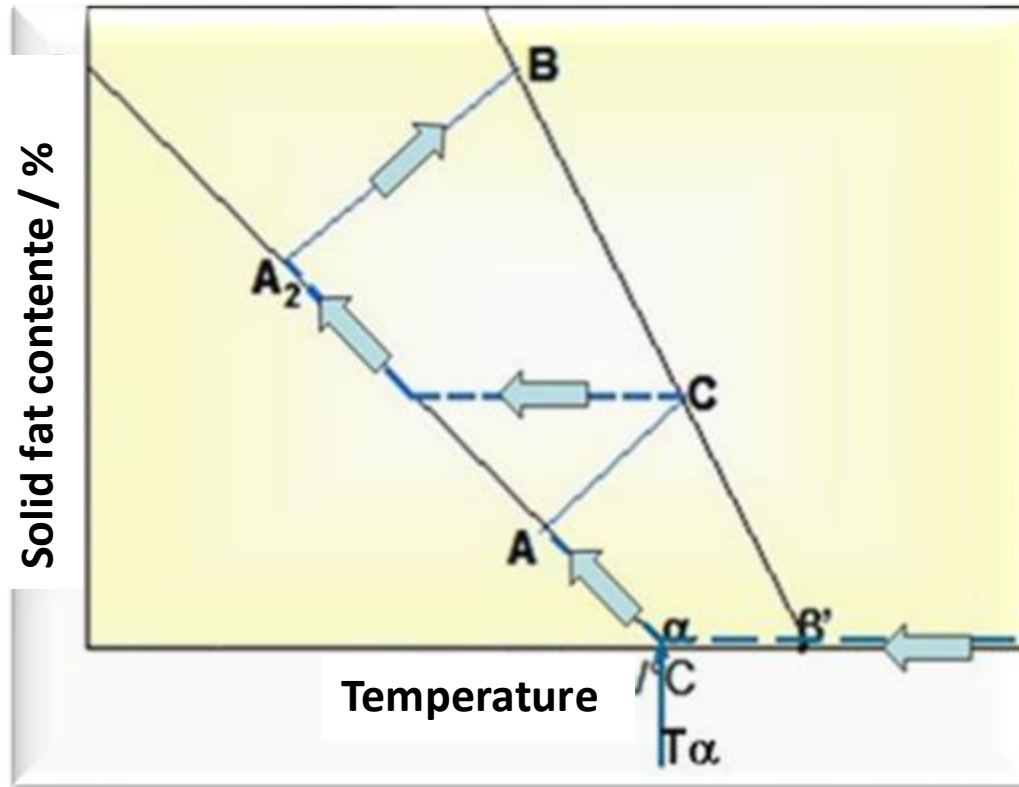
Spreadable creams are not only stabilized by emulsifiers, but mainly by fat crystals. Emulsifiers simply make the task easier.



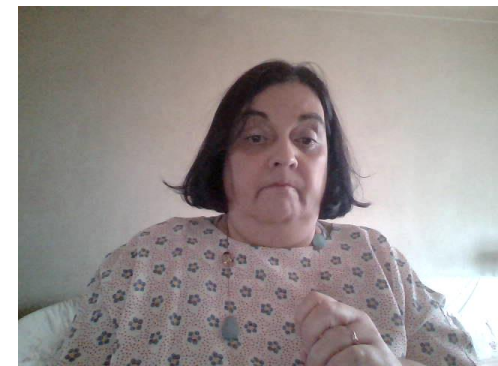
Manufacturing spreadable creams

CRYSTAL MANIPULATION–WORKING

Cooling steps (A) and rest (C) are repeated and can be combined. There is conversion of α to β' lipid crystals, polymorphism.



Then the liquid is transported to crystallization unit (B), where crystalline structure of spread cream continues to grow, resting until it has suitable firmness for packaging.

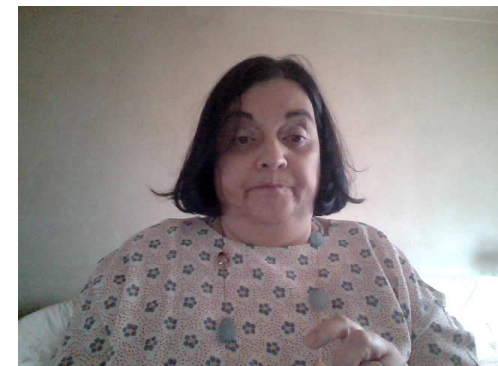
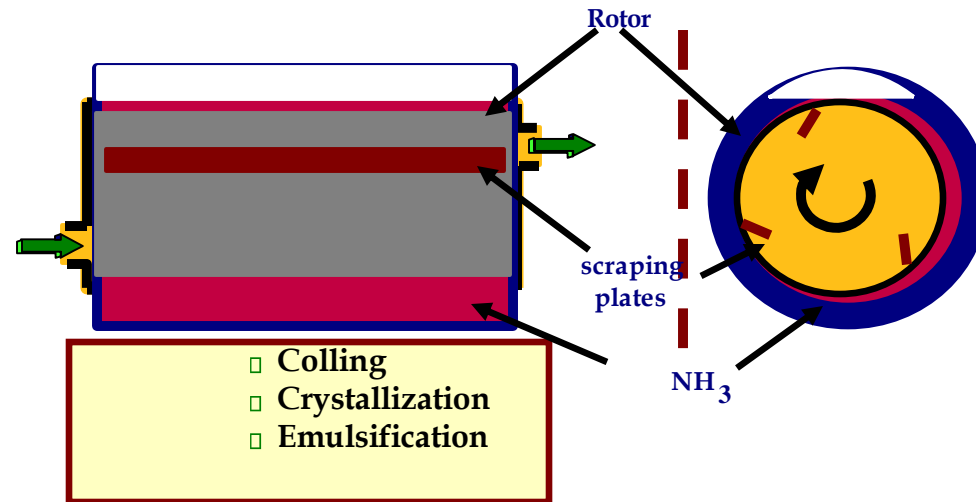


Manufacturing spreadable creams

A - UNITS - TWO MAIN TYPES



- Unit

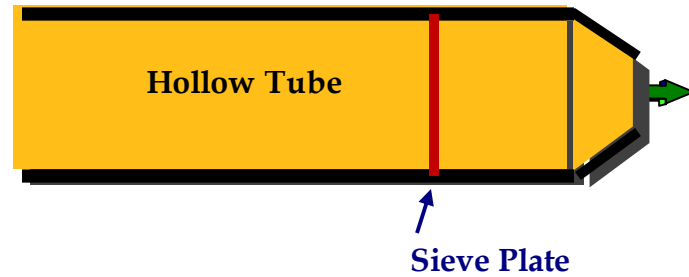


Manufacturing spreadable creams

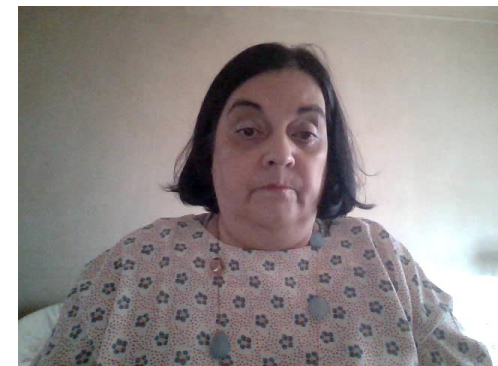
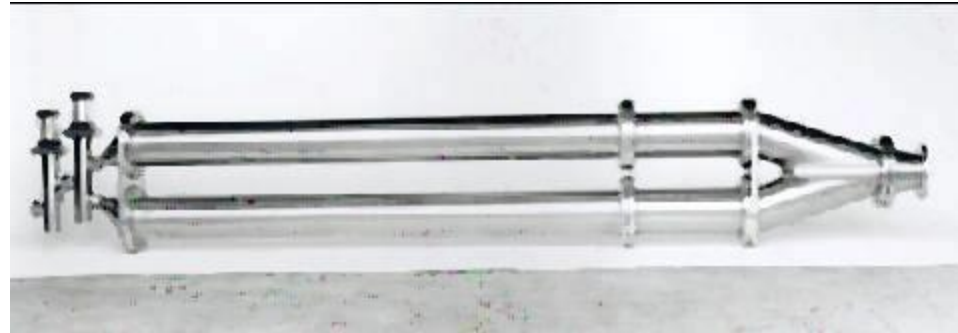
THE B - Unit



- Unit



- Crystallization
- *Little Working*



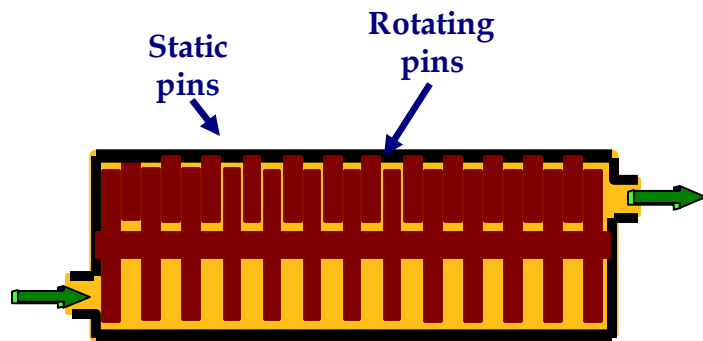
Manufacturing spreadable creams

THE C - Unit

CRYSTAL MANIPULATION- WORKING



- Unit



- Crystallization
- Continuous Work



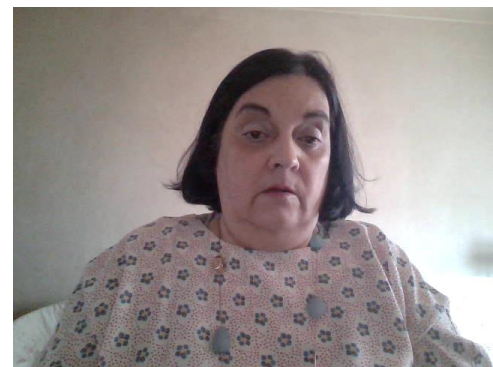


Collaborator and consultant



Agrio et Emulsio - new products development

Lima, M. G. O. L. B.; Laranjeira, C. M.; Henriques, M. O. I.; Ruivo, P.; Matos, M. F.; Mira, H.; Oliveira, A.; Raimundo, A.; Ribeiro, A.; Brandão, C.; Felix, N.; Guerra, M.; Macedo, A.; Carvalho, M. J.; Caldeira, I.; Canas, S.; Alves, M.; Orvalho, T.; Diogo, A. C..

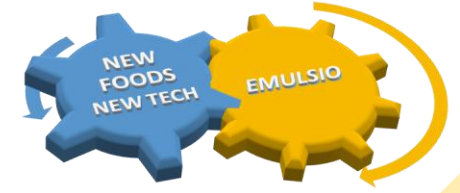


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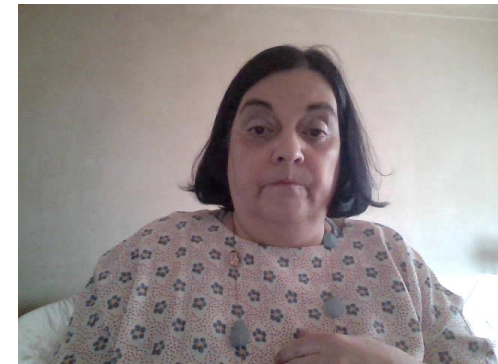
UNIÃO EUROPEIA
Fundo Europeu
de Desenvolvimento Regional

Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



MAIN GOAL:

- **To formulate and design innovative food emulsion like spreadable cream.**
- **Using sustainable methodologies with potential application in certain markets such as gourmet, diet and vegan.**
- **Valuing underutilized regional raw materials.**
- **Verification of gastronomic applications in food pairing and food design.**



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



Spreadable creams developed with different additions:



Strawberry fructose syrup with aqueous phase of vegetable origin.



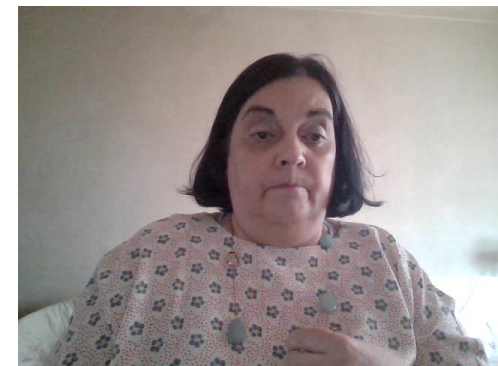
Processed (roasted) red pepper with aqueous phase of vegetable origin.



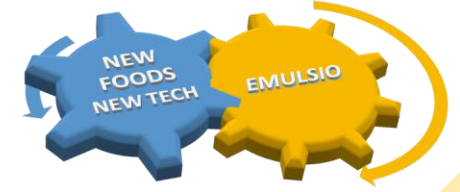
Processed (braised) yellow pepper with aqueous phase of vegetable origin.



Processed *Shiitake mushroom* with aqueous phase of vegetable origin or with aqueous phase enriched with whey protein concentrates, obtained from ultrafiltration of goat cheese whey.



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians

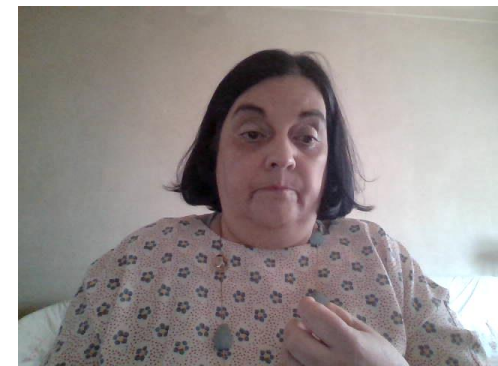


They must be kept under refrigeration conditions at 5 °C.

The methodology used for food emulsions prototyping process development included a technological essay associated with analytical and sensory evaluation.

Physicochemical, microbiological and proximal analysis were carried out for all final prototypes verifying their stability and safety.

Prototypes were subjected to food pairing & food design.



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians

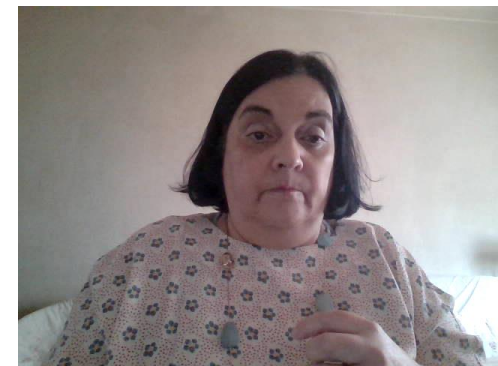


METODOLOGY - Technological Process on laboratory scale

Main ingredients of the w / o emulsion:

- **Aqueous phase** - vegetable origin or whey protein concentrates (pasteurized); acidity regulator, lemon juice.
- **Lipid phase** - blend of sunflower oil, coconut fat or cocoa butter and soy lecithin.

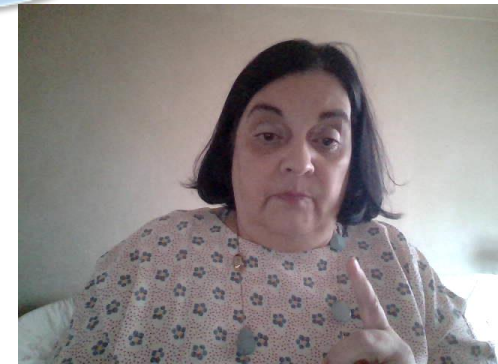
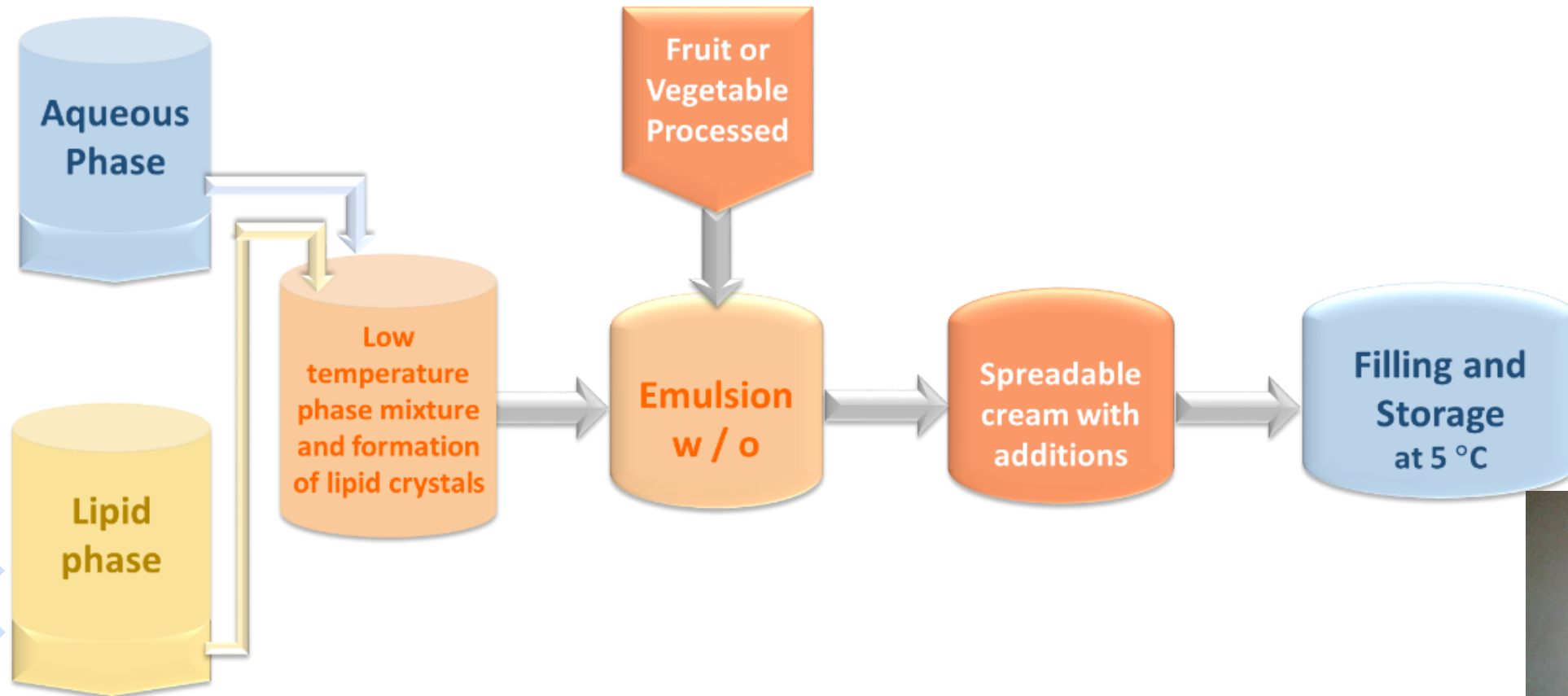
Laboratory technological process included five steps.



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



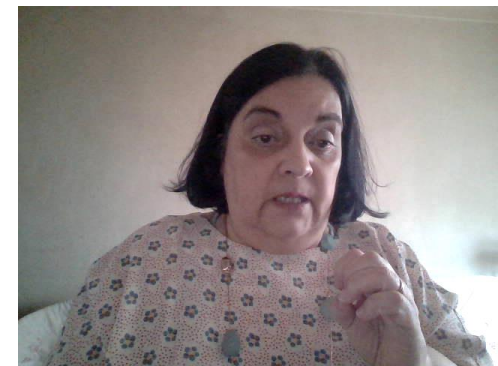
METODOLOGY - Technological Process on laboratory scale



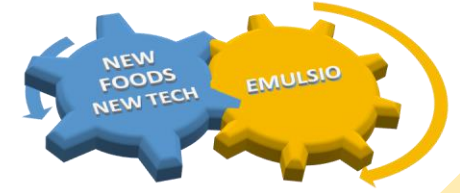
Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



METODOLOGY – Prototype Strawberry Spreadable Cream



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians

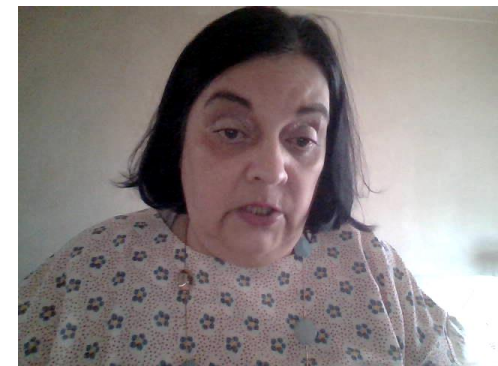


Food pairing & food design - Strawberry Spreadable Cream

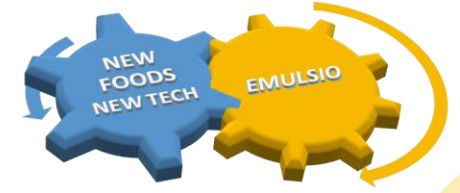


Dessert:

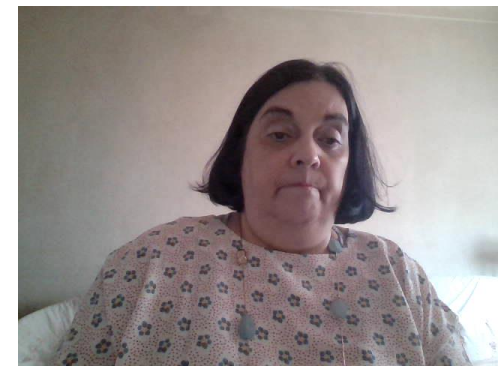
- Strawberry spreadable cream;
- White chocolate cream;
- Strawberry;
- Shavings of dark chocolate
- Green caramel leaf.



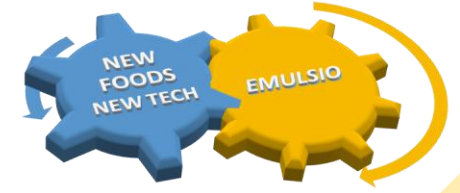
Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



METODOLOGY – Prototype Red pepper Spreadable Cream



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



Food pairing & food design - Red pepper spreadable cream

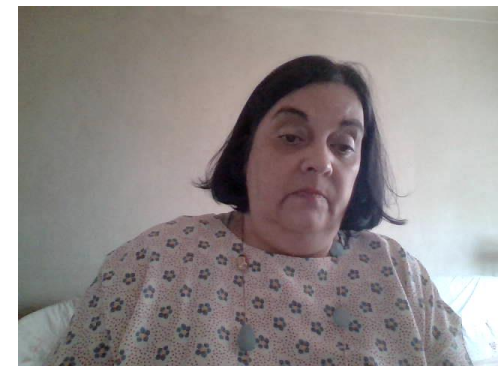


Cooked rice with Red pepper (roasted) spreadable cream.



Couvert - Dip with

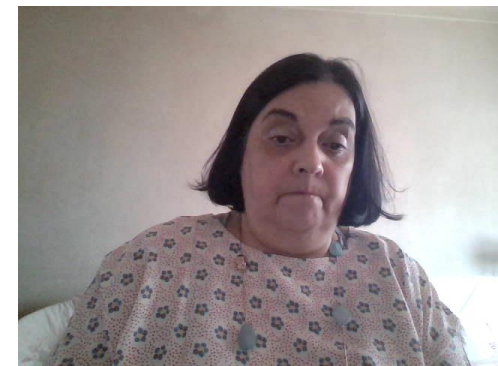
- **Red pepper spreadable cream;**
- **Real crab meat;**
- **In ciabatta bread.**



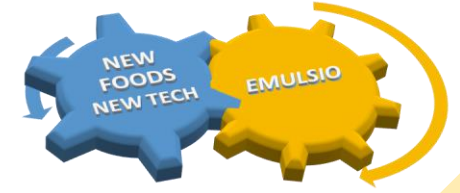
Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



METODOLOGY – Prototype Yellow pepper Spreadable Cream



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians



Food pairing & food design Yellow pepper spreadable cream

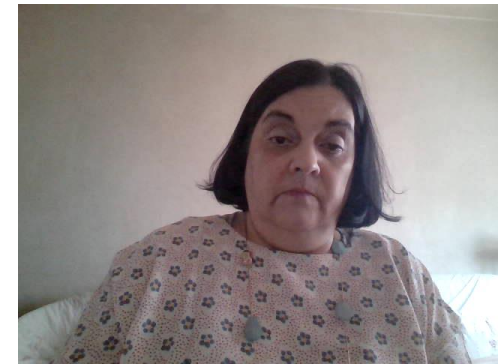


Cooked rice with yellow pepper (braised) spreadable cream.



Fish

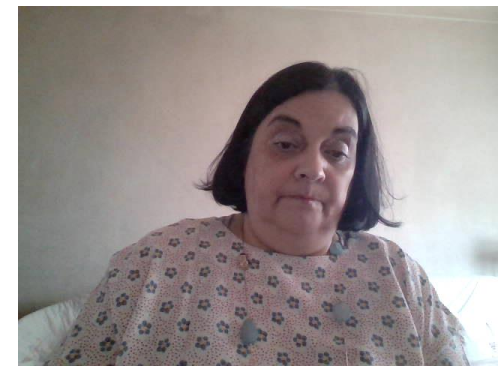
Loin of fresh cod cooked at low temperature in Yellow pepper spreadable cream; with broad bean puree and dill.



Emulsio Line- Innovative spreadable creams of vegetal origin or lactovegetarians



METODOLOGY — Prototype Shiitake mushroom Spreadable Cream



Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians

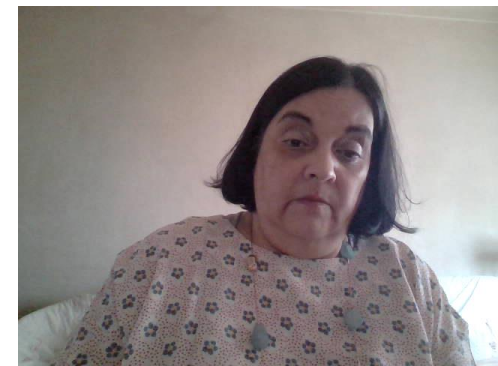


Food pairing & food design - Shiitake mushroom Spreadable

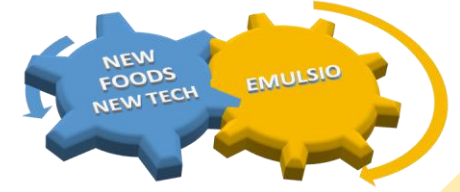


Fettuccine:

- **Shiitake mushroom spreadable cream;**
- **nuts and basil.**

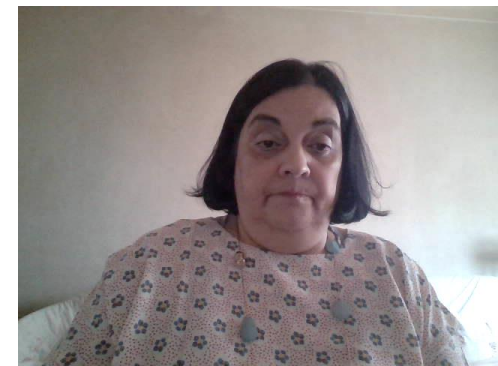


Emulsio Line - Innovative spreadable creams of vegetal origin or lactovegetarians

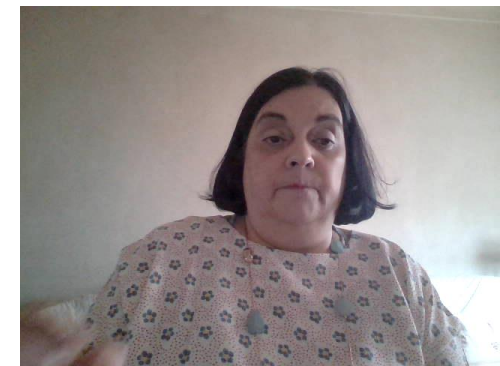


Final Thoughts

- ❖ **These were innovative products, so it was very difficult to establish analogy with reference values for nutritional and even microbiological evaluation.**
- ❖ **No pathogenic microorganisms were detected, reinforcing the need to guarantee good manufacturing practices.**
- ❖ **As these prototypes combine a vegetable spreadable cream with healthy processed vegetables, it may be an asset in the nutritional point of view.**
- ❖ **Food pairing showed that prototypes alone had a very pleasant taste, good spreadability and were suitable for gastronomic applications.**



Emulsio Line - Teams





New Food New Tech

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Food analysis
Chemical analysis
chemical imaging
Surveillance





Thank you!!!!

