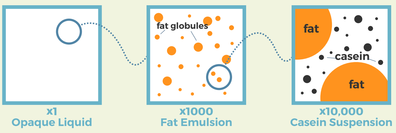
As an introduction to cheese science...

MILK CHEMISTRY

The components of milk and their basic chemistry

MILK BASICS

Simply, milk is an emulsion with fat particles (globules) and proteins dispersed in an aqueous (watery) environment.

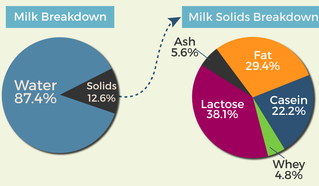


x1
Opaque Liquid

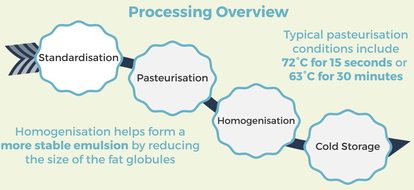
x1000
Fat Emulsion

x10,000
Casein Suspension

Milk is composed of water, sugar, fat, protein, and minerals*



Processing Overview

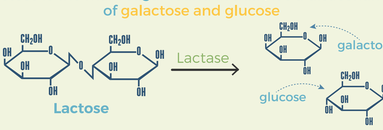


Typical pasteurisation conditions include **72˚C for 15 seconds** or **63˚C for 30 minutes**

Homogenisation helps form a **more stable emulsion** by reducing the size of the fat globules

MILK SUGAR

Lactose is the main sugar found in milk; it's a disaccharide of galactose and glucose

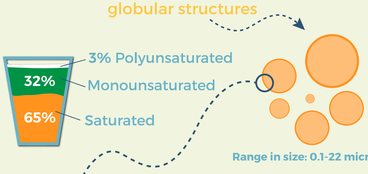


Lactose

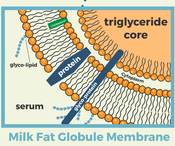
Those who are lactose intolerant lack the lactase enzyme and do not break down lactose.
Instead, it is fermented by colonic bacteria

MILKFAT

Most of the fat in milk is saturated, and is found in globular structures



Range in size: 0.1-22 microns



Milk Fat Globule Membrane

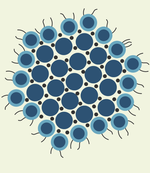
Milk fat globules are made up of a phospholipid tri-layer, in the form of a bilayer and monolayer. The membranes contain other lipids, sugars, proteins, etc.

MILK PROTEIN

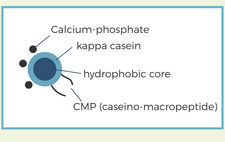
Milk contains two main types of proteins:
casein (~80%) and whey (~20%)

Casein

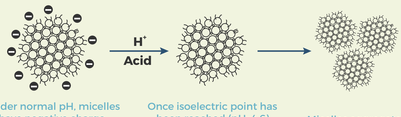
Casein micelle



Casein sub-micelle



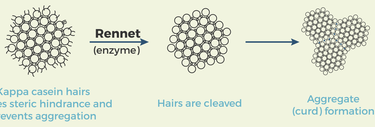
Casein proteins will aggregate under two main conditions: acid addition and enzyme addition



Under normal pH, micelles have negative charge and repel each other

Once isoelectric point has been reached (pH=4.6), net charge is zero

Micelles aggregate



Kappa casein hairs casues steric hindrance and prevents aggregation

Hairs are cleaved

Aggregate (curd) formation

Whey

Whey proteins are globular proteins that denature when exposed to high heat.

Native whey protein

Heat denatures protein

Aggregation induced

Sources:

*All numbers and figures are estimates and schematic views

A.K. Smith and B.E. Campbell. Microstructure of Milk Components in Structure of Dairy Products. 2007. Blackwell Publishing Ltd.

Fox, P.F & McSweeney, P.L.H. Advanced Dairy Chemistry. 2003. Springer Science

Kailasapathy, Kasipathy. Chemical Composition, Physical and Functional Properties of Milk and Milk Ingredients in Dairy Processing & Quality Assurance. 2008. John Wiley & Sons, Inc.

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