



IIT KHARAGPUR



NPTEL ONLINE
CERTIFICATION COURSES

Dairy and Food Process and Products Technology

PROF. TRIDIB KUMAR GOSWAMI

AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT

IIT KHARAGPUR

Lecture 16

Definition of raw Milk: The lacteal secretion, practically free from colostrum, obtained by the complete milking of healthy COW.

The term MILK is also used for white colour, non animal beverages resembling milk in colour and texture such as soy milk, almond milk, coconut milk etc.

Physico-chemical properties and structure of milk and milk constituents

• What is milk?

- Milk is the normal secretion of the mammary gland of mammals providing good nourishment for the young.
- Sources – cow, buffalo, goat, sheep, camel, mare, etc.

• Constituents of milk:-

• Source	Water	Fat	Protein	Lactose	Ash
• Buffalo	82.14	7.44	4.78	4.81	0.83
• Cow	87.27	3.66	3.47	3.66	0.69
• Goat	84.14	6.00	4.03	6.00	5.02
• Human	87.47	3.76	2.14	3.76	0.31

Thank You!!





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Lecture 17

Milk Fraction Terms

Plasma: milk – fat = skim milk

Serum: plasma - casein micelles = whey

Solids-not-fat (SNF): proteins, lactose, minerals, acids, enzymes, vitamins. It is the total solids content minus the fat content

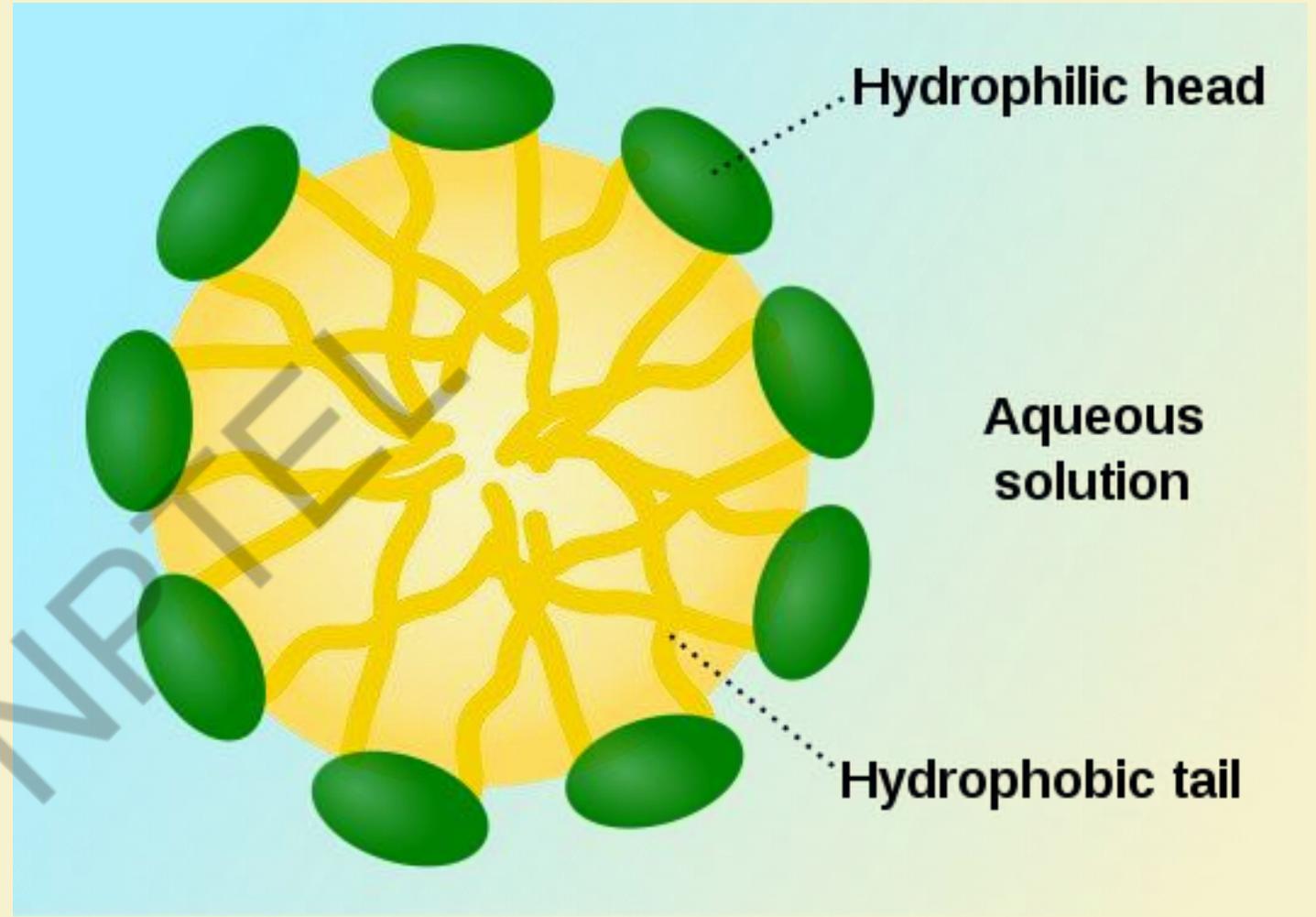
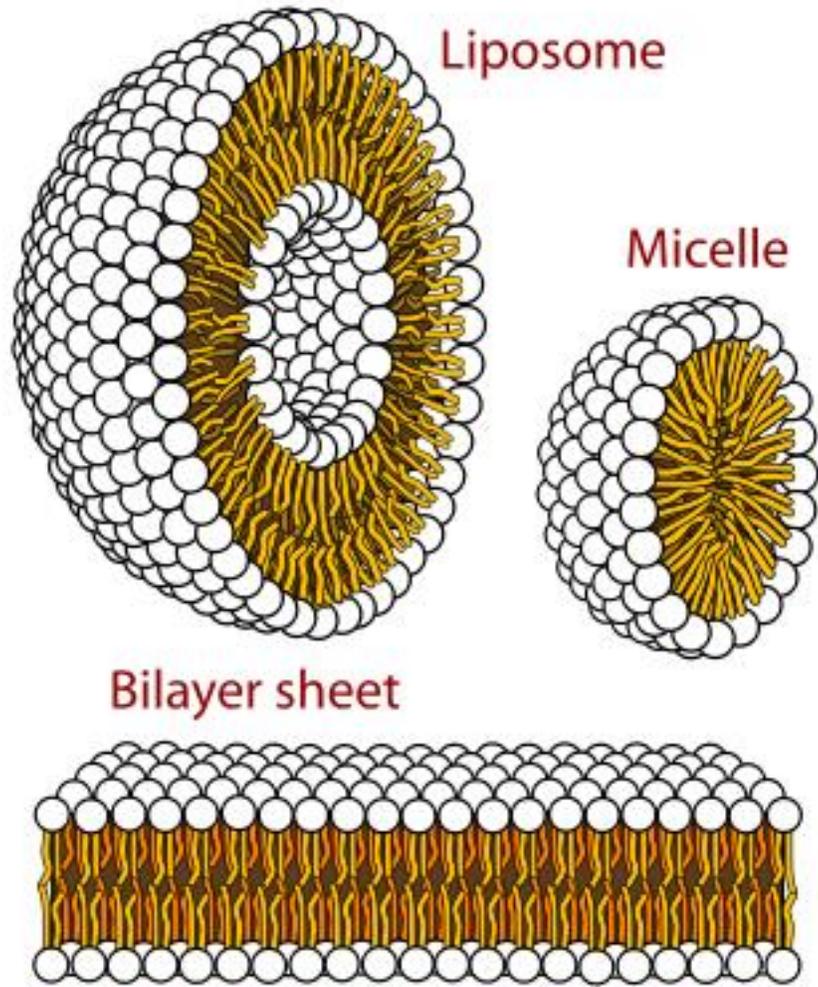
Total Milk Solids = fat + SNF

When **casein** molecules are manufactured by a mammal, they are manufactured in water (cow's milk is 88% water). As the **casein** molecules are formed, they begin folding up into a spherical **micelle** structure so that the **casein** proteins can remain suspended indefinitely in the milk water.

MICELLE: An aggregate of molecules in a colloidal solution.

An electrically charged particle formed by an aggregate of molecules and occurring in certain colloidal electrolyte solutions

IUPAC Definition: **Particle of colloidal dimensions that exists in equilibrium with the molecules or ions in solution from which it is formed**



■ General characteristics of milk:-

– colour –

■ bluish white to almost golden yellow depending upon the breed, fat and solids present, nature of feed consumed.

■ Large quantities – opaque;

■ Thin layer – transparent.

■ Fat removed / Low fat and solid milk – bluish tint.

■ Taste: –

– No pronounced taste, but slightly sweet.

– Freshly drawn milk has a characteristic odour, which is volatile, disappears when milk is exposed to air.

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Lecture 18

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- **Acidity:**–
 - **amphoteric reaction is observed with fresh milk – turns blue litmus red and red litmus turns blue.**
 - With phenolphthalein indicator fresh milk shows an acid reaction, if titrated against standard alkali,
 - **acidity varies between .10 to 0.26% as lactic acid.**
 - Fresh milk pH -6.5.
- **on heating – near the boiling pt.**
 - **a tough film forms on the surface.**
 - Prolonged boiling results in a brown shade of colour and a change in taste.

- **Acidification** :-
- **results in precipitation of soft, white, jelly-like mass, known as curd with separation of nearly clear fluid or whey.**
- **If a portion of the fresh milk is allowed to stand undisturbed for a few hours**
 - **a layer forms on the surface, known as cream, due to the gathering of the fat globules,**
 - **which can be examined under compound microscope, wherein immense numbers of glistening, spherical bodies of varying sizes will be seen.**

- If the fresh milk is allowed to remain at ordinary temperatures of 15 – 21 °C for 24 hours or longer
- it will have a pronounced acid taste.



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Lecture 19

■ Constituents of milk:-

- **water** :- 80 – 90%
- Small amount of water are hydrated or bound chemically to lactose, salt and protein
- **water activity of milk is very high to the tune of 0.993**
- **removal of water, as usual, increases shelf life – powdered milk**
- **raw milk should not be diluted with addition of water by rule.**

–Fat :-

– commonly known as butter fat → 2.5 – 6.0.

– Protected by a membrane (FGM)

– Made up of approx. 98% triglycerides, 0.2 to 1% phospholipids, 0.2 to 0.4% sterols.

– Phospholipids and proteins are mostly associated the FGM

– Table, or light, or coffee, or **single cream** → 18 – 25%.

– Light whipping → not less than 30%,

– **Heavy whipping** → not less than 36%,

– plastic or extra heavy cream → 65 to 80%,

- **butter** -> 82.5%,
- butter oil or dry butter -> 98 – 99.5%,
- **cheddar cheese** -> 30 to 40%,
- ice cream -> 8 – 20%,
- **Evaporated milk** -> 8%,
- whole milk -> 26%.

- **Exists in milk in the form of minute globules**

- in a true emulsion of oil-in – water in the dispersed phase.
- **Each globule of fat is surrounded by a very thin film of protein, or the serum of milk, concentrated on the surface and held in place by surface attraction or adsorption.**
- The concentrated layer surrounding the fat globule is composed of certain protein and fat-like substances, especially lecithin.

Milk fat contains traces of fatty acids, vitamins A, D, E, and K and enzymes

More than 400 different fatty acids of which predominant are

- ❖ **Myristic acid (C14 : 0)**
- ❖ **Palmitic acid (C16 : 0)**
- ❖ **Stearic acid (C18 : 0)**
- ❖ **Oleic acid (C18 : 1)**

Lipids, proteins, cerebrosides, nucleic acids, enzymes, trace elements (minerals), and some bound water stabilize and prevent fat globules from coalescence during milk processing and handling.

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Lecture 20

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Fats or lipids:-

Lipids are insoluble in water but soluble in nonpolar solvents such as chloroform, carbon disulphide, benzene, hexane, ether etc. The characteristic insolubility of lipids in water is, in several cases, due to the presence in them of one or more fatty acids which contain long aliphatic hydrocarbon chains. Lipids are widely distributed in nature. They rarely occur in an organism in the free state, but are more usually combined with proteins (lipoproteins) or carbohydrates (lipopolysaccharides or glycolipids).

Classification:- Two groups – simple and compound. Simple lipids are fatty acids, fats which are esters of fatty acids with glycerol (triglycerides) and waxes, which are esters of fatty acids with long chain monohydroxy alcohols. All other lipids are compound lipids such as phosphoglycerides (phospholipids or phosphatides), steroids, carotenoids, and lipids functioning as vitamins or hormones.

Foods generally contain any or all of these lipids. Our main interest is on fats (acylglycerols or triglycerides) and phospholipids. Fat – all triglycerides regardless of whether they are normally nonliquid or liquid at room temp. All FATS are LIPIDS but all LIPIDS are not FATS.

Thank You!!

