MILK

5th IYNT 2017
Team Indonesia
Labsky

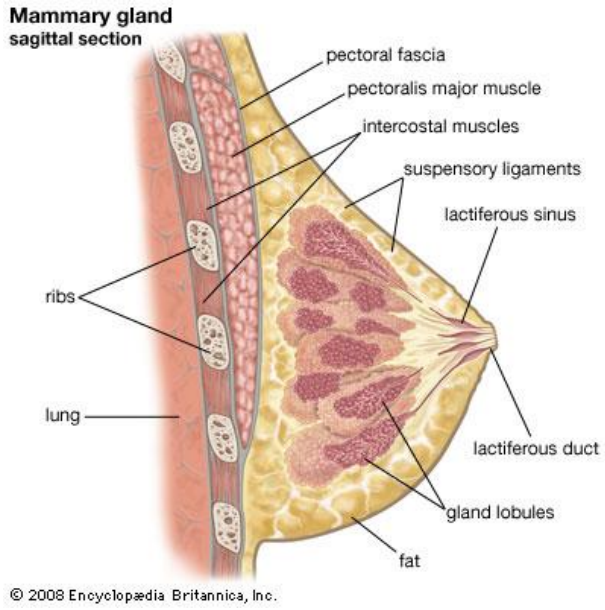
PROBLEM

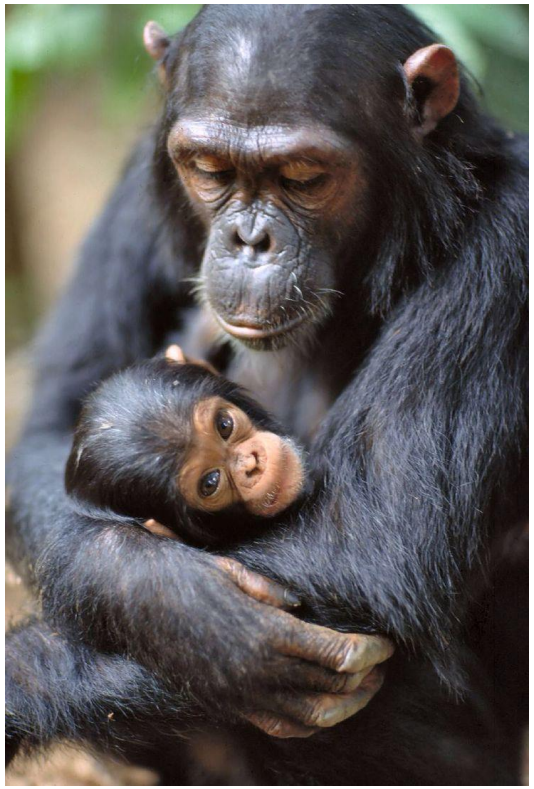
Develop simple methods allowing determination of some of the important properties of milk. Suggest an investigation requiring comparison of various milk samples.

INTRODUCTION

What is milk?

- Pale liquid
- From mammary glands
- Is a main source of nutrition
- 2 types: processed & unprocessed





PHYSICAL PROPERTIES

1. Density

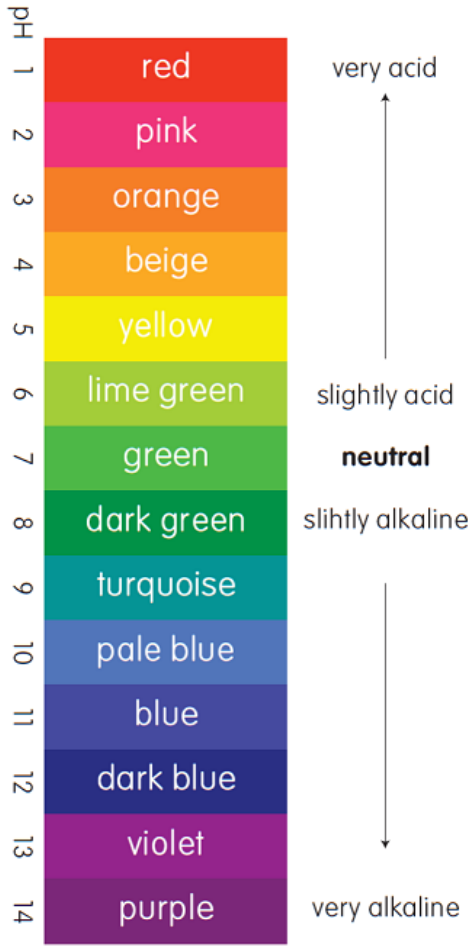
Relationship between mass and volume of substance

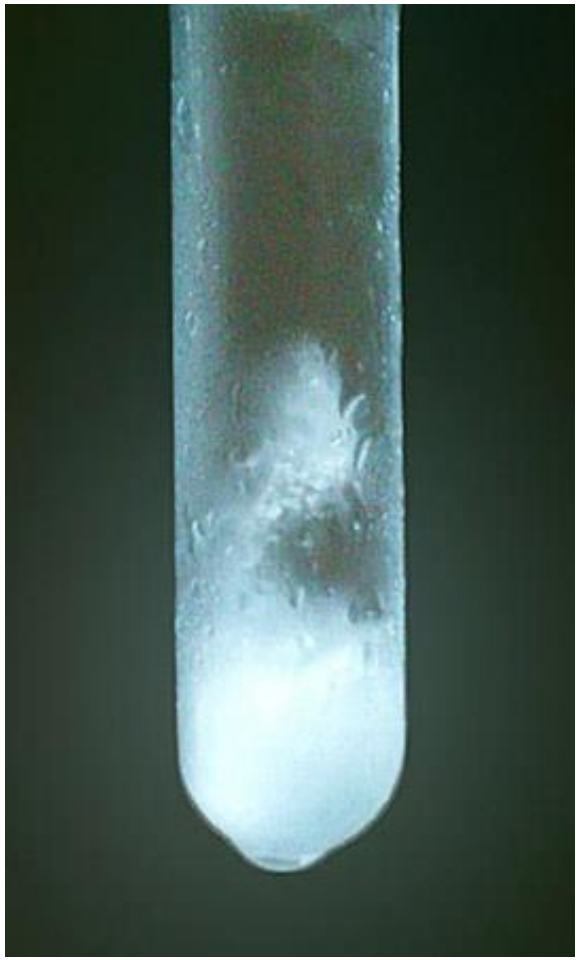
2. pH value

Hydrogen ion concentration, acid - alkaline

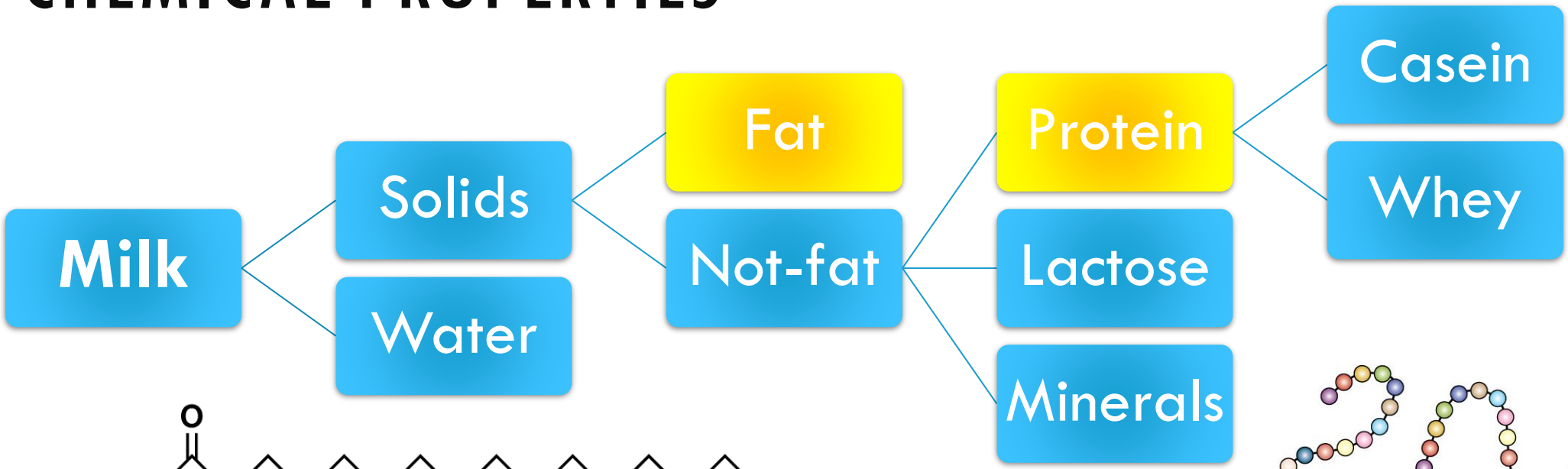
3. Freezing point

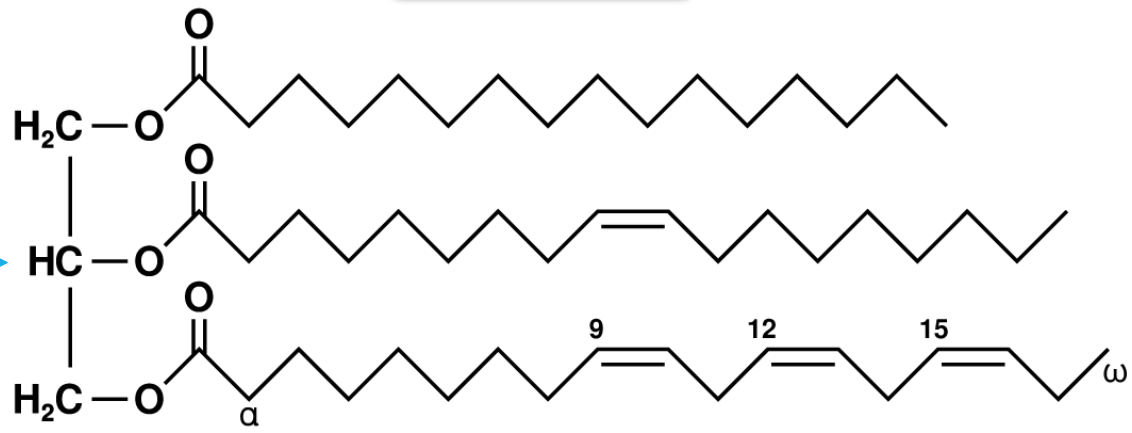
Temperature when liquid turns to solid, = melting point





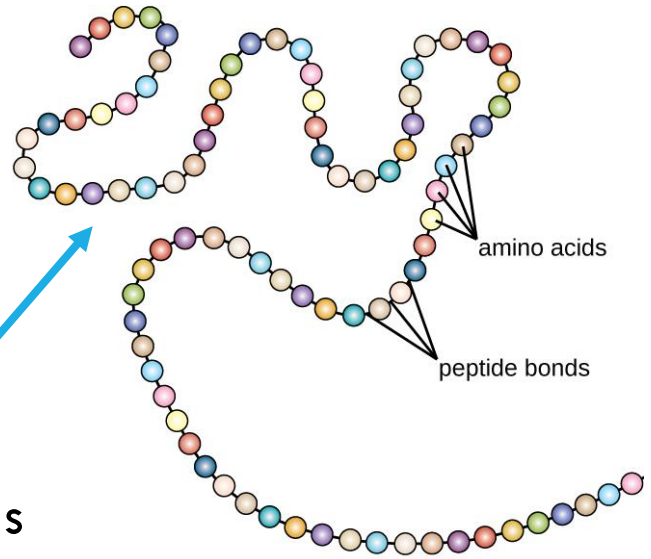
CHEMICAL PROPERTIES





Triglycerides: 3 fatty acids attached to the backbone

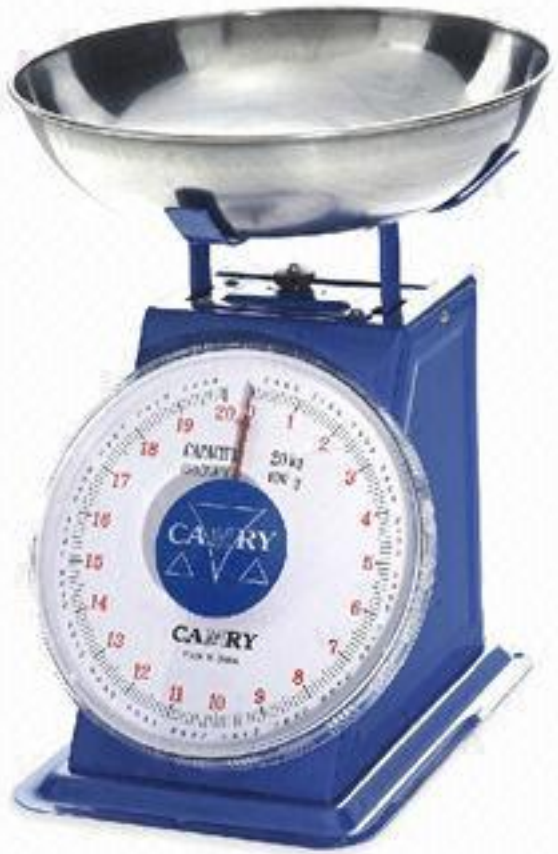
Chains of amino acids connected by peptide bonds



METHOD – DENSITY

Mass/Volume=Density
30 g /30 ml = 1 g/cm3

Empty container

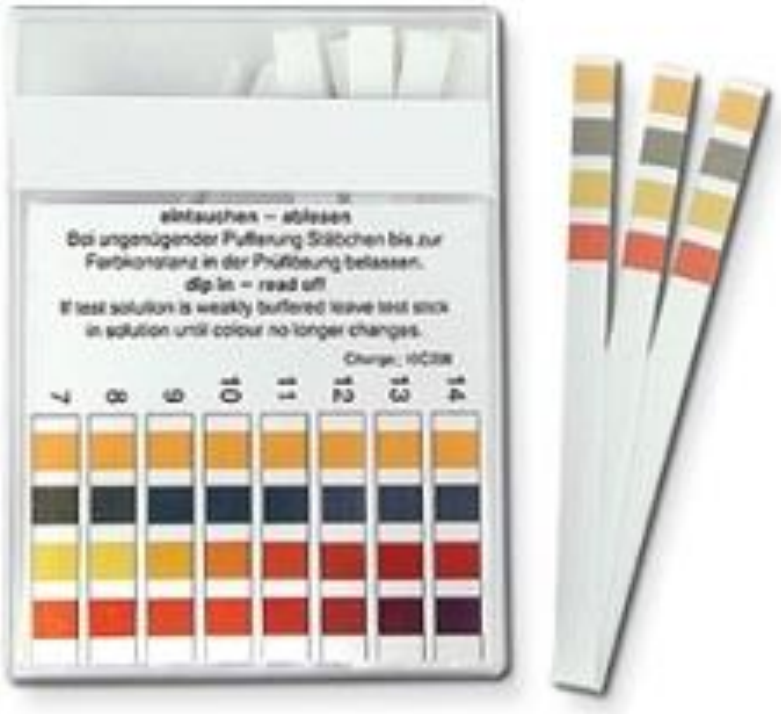


Filled container

METHOD – PH VALUE

Scale 0-14

Colors correspond



pH strips

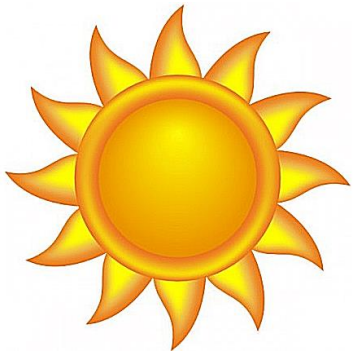
- Immerse in liquid for 10 min
- Match color with scale

METHOD – FREEZING POINT

Freezing
=
Melting

Freezing

SAME TEMPERATURE

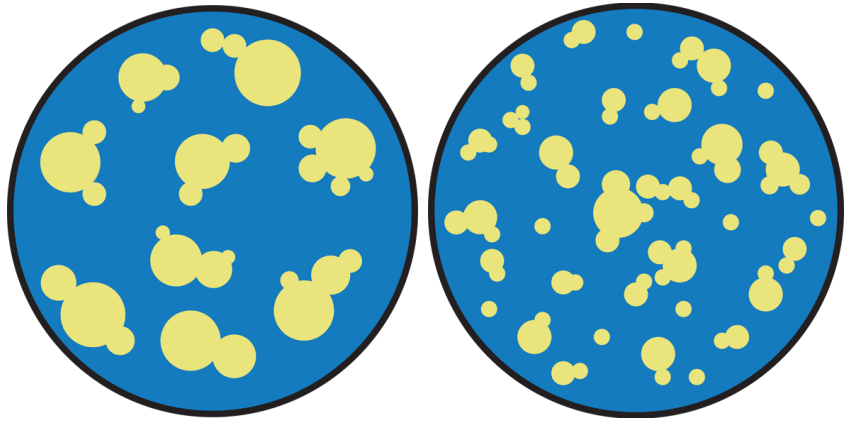


Melting

METHOD – FAT

- Gerber method
- Fat separated from milk

1. Centrifuge
2. Sulfuric acid and amyl alcohol
3. Butyrometer



METHOD – PROTEIN

- Kjeldahl method (nitrogen %)
- Protein % = Nitrogen% x Conversion factors (dairy = 6.38)

I. Degradation

Milk + Sulfuric acid + catalyst = Separated Ammonium ions

II. Distillation

Ammonium ions + alkali = Ammonia gas + acid = Ammonium ions

III. Back-Titration

Left back acid + alkali = Ammonia (NH_3)

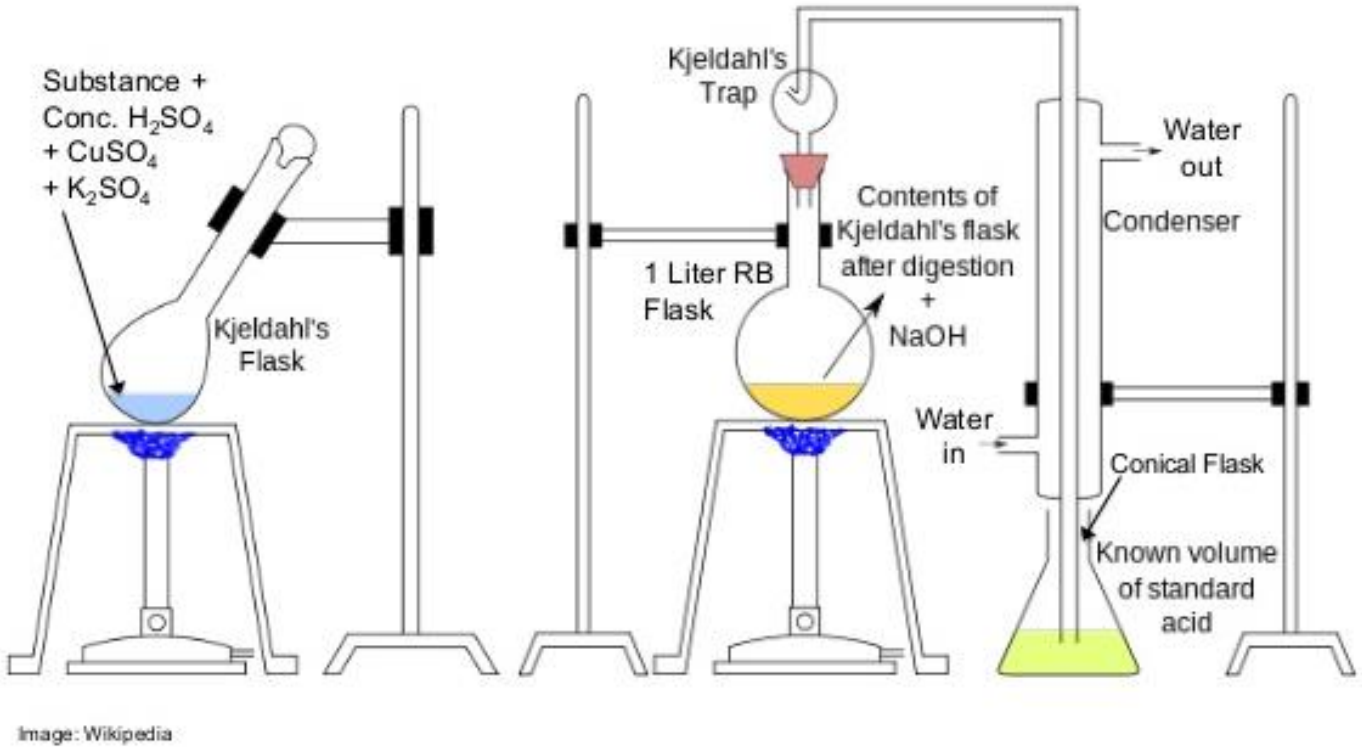
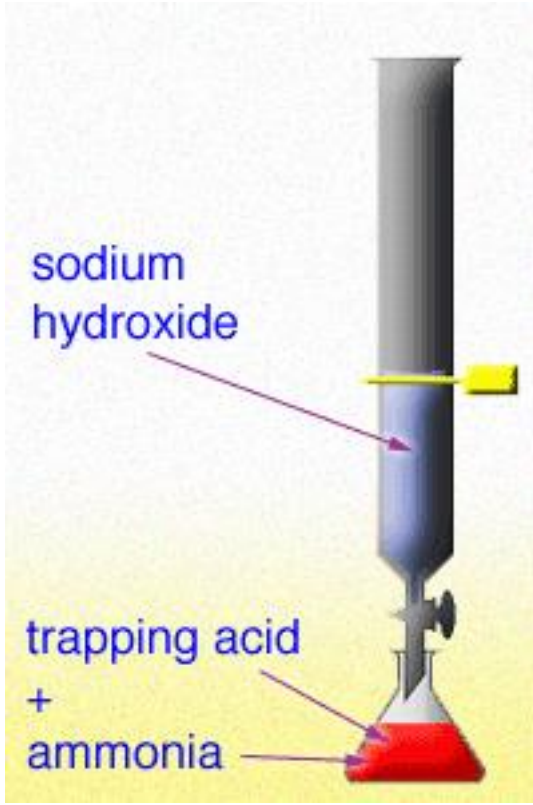


Image: Wikipedia



CHEMICAL REACTION

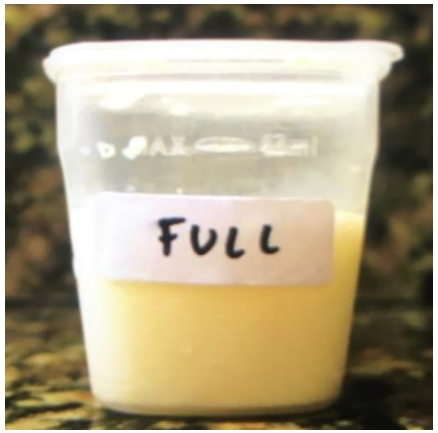
I. Degradation: Sample + H_2SO_4 → $(NH_4)_2SO_4(aq) + CO_2(g) + SO_2(g) + H_2O(g)$

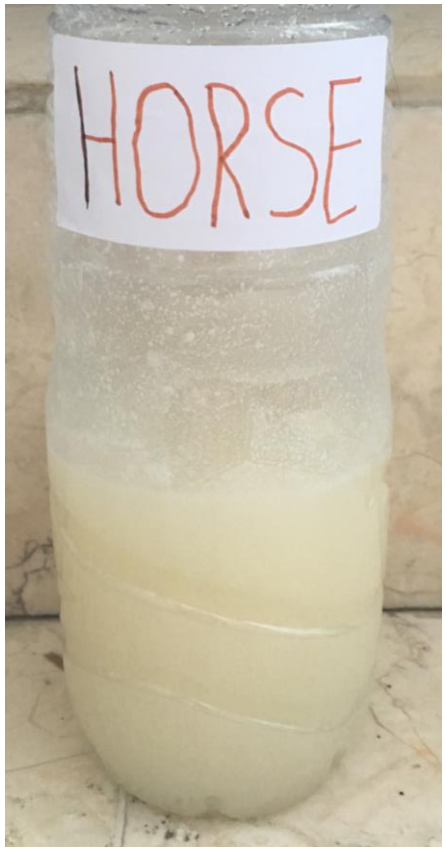
II. Ammonia ions→gas: $(NH_4)_2SO_4(aq) + 2NaOH \rightarrow Na_2SO_4(aq) + 2H_2O(l) + 2NH_3(g)$

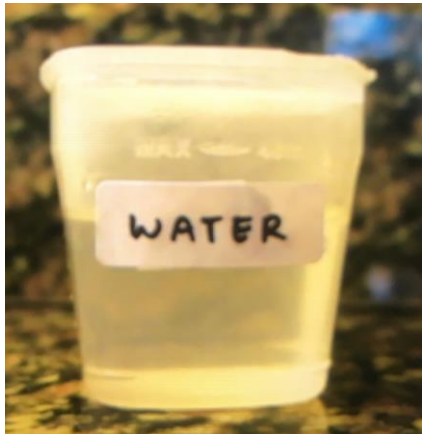
III. Ammonia gas→ions: $B(OH)_3 + H_2O + NH_3 \rightarrow NH_4^+ + B(OH)_4^-$

IV. Back-Titration: $B(OH)_3 + H_2O + Na_2CO_3 \rightarrow NaHCO_3(aq) + NaB(OH)_4(aq) + CO_2(g) + H_2O$

SAMPLES







RESULTS

SAMPLE	PROPERTIES				
	Density	pH	Freezing point	Fat	Protein
Fresh	1 g/cm3	6.5	0°C	3.75%	3.05%
Full cream	1 g/cm3	6.5	0°C	3.00%	3.14%
Low fat	1 g/cm3	6.5	0°C	1.15%	3.28%
Skimmed	1 g/cm3	6.5	0°C	<0.05%	3.34%
Horse	1 g/cm3	7	-0.5°C	0.15%	0.56%
Human	1 g/cm3	7	0°C	0.38%	1.27%
Water	1 g/cm3	7	0°C	0%	0%

CONCLUSION

- Density same across all samples (1 g/cm3)
- Processed milk more acidic than natural milk (pH 6.5)
- Horse milk freezes slower (-0.5˚C)
- Fresh milk has highest fat content (3.75%)
- Skimmed milk has highest protein content, lowest fat content (3.34%, <0.05%)
- Horse milk has lowest protein content (0.56%)
- Higher fat and protein contents in processed milk

ACKNOWLEDGEMENT

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SOURCES

"Milk." *Wikipedia*. Wikimedia Foundation, 06 June 2017. Web.

"THE CHEMISTRY OF MILK." *Dairy Processing Handbook*. N.p., 17 Mar. 2016. Web.

"Home." *Physical Properties of Milk | Food Science*. N.p., n.d. Web.

FSSAI. "Manual of Methods of Analysis of Foods: Milk and Milk Products." *Food Safety and Standards Authority of India*. N.p. 2015. PDF file.

PT INDOLAKTO. 25 Sept. 2013. WI PENETAPAN KADAR LEMAK SUSU SEGAR (METODE GERBER).

PT INDOLAKTO. 25 Sept. 2013. WI ANALISA NITROGEN (TOTAL) IN MILK.

AgriMoon Team. "Determination of Fat in Milk by Gerber Method." *AgriMoon.Com*. N.p., 28 Nov. 2015. Web.

Agriculture and Consumer Protection Department. "CHAPTER 2: METHODS OF FOOD ANALYSIS." *FAO CORPORATE DOCUMENT REPOSITORY*. N.p., 2003. Web.

"Milk Facts." *Milk Fat | MilkFacts.info*. N.p., n.d. Web.

Ghosh, Manik, Dr. "Estimation of Nitrogen : Kjeldahl Method." *YouTube*. YouTube, 21 May 2016. Web.

Hurley, Walter L. "Milk Composition Freezing Point." *Milk Composition & Synthesis Resource Library*. University of Illinois, 2010. Web.

Thank You!