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Effect of surfactant on two immiscible liquid by mansingh survismeter

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Abstract

Mansingh survismeter provide an alternative and advantageous way for the analysis of the various liquid. As the innovations keep going on for betterment in experimental techniques for reducing the consumptions of the time, efforts and materials used in, hence two different survismeters type I and II are developed for academic, and research and development laboratories**.** The present paper deals with the investigation of effect of surfactants on two immiscible liquid using this appataus.

Keywords: Mansingh survismeter, surfactants, liquid

Introduction

Physical properties of the liquid system are play an momentous role in development of formulation and analysis of the different component.Surface tension (c) and viscosity (g) is very important properties of a liquid system. For centuries surface tension (c) and viscosity (g) data have been measured with individual instruments consuming much time and materials. Mansingh survismeter provide an alternative and advantageous way for the analysis of the various liquid. As the innovations keep going on for betterment in experimental techniques for reducing the consumptions of the time, efforts and materials used in, hence two different survismeters type I and II are developed for academic, and research and development laboratories.

Surface tension (c) and viscosity (g) is very important properties of a liquid system. For centuries surface tension (c) and viscosity (g) and interfacial tension data have been measured with individual instruments like Stalagmometer, Ostwald viscometer and Pendeant-drop method respectively which are consuming much time and materials. Literature review revel that there is no way which reduce the time and materials for analysis of above properties for liquid. The present study is reflect the effect of different surfactant on two immiscible by new Mansingh survismeter and to save the time and materials.

The aim of present work was to reduce the time and material by using the Mansingh Survismeter for the analysis of liquid and to provide a simple and accurate way for the analysis of liquid systems which reduce the analysis time for above properties which will be helpful the analysis of liquid system.

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Fig.-1 Svurvismeter

Material and Methods

Selection of surfactants

Selection of liquid system - Toluene, also known as methylbenzene, or Toluol, is a clear water-insoluble liquid with the typical smell of paint thinners, reminiscent of the related compound benzene. It is an aromatic hydrocarbon that is widely used as an industrial feedstock and as a solvent. Like other solvents, toluene is also used as an inhalant drug for its intoxicating properties; however this causes severe neurological harm.[1][2]

Selection of surfactant – Three surfactant (PEG 400, Tween 20, Tween 80) are used for characterization of toluene with respect to water.

- **PEG 400** - PEG 400 (Polyethylene Glycol 400) is a low molecular weight grade of Polyethylene glycol. It is a clear, colorless, viscous liquid. Due in part to its low toxicity, PEG 400 is widely used in a variety of pharmaceutical formulations. PEG 400 is strongly hydrophilic. The partition coefficient of polyethylene glycol 414 between hexane and water is 0.000015 ($\log P = -4.8$), indicating that when polyethylene glycol 414 is mixed with water and hexane, there are only 1.5 parts of polyethylene glycol 414 in the hexane layer per 100,000 parts of polyethylene glycol 414 in the water layer.[1] PEG 400 is soluble in water, acetone, alcohols, benzene, glycerin, glycols, aromatic hydrocarbons and is slightly soluble in aliphatic hydrocarbons.
- **Polysorbate 20** - Polysorbate 20 (commercially also known as Tween 20) is a polysorbate surfactant whose stability and relative non-toxicity allows it to be used as a detergent and emulsifier in a number of domestic, scientific, and pharmacological applications. It is a polyoxyethylene derivative of sorbitan monolaurate, and is distinguished from the other members in the Tween range by the length of the polyoxyethylene chain and the fatty acid ester moiety. The commercial product contains a range of chemical species.[1] In the biological sciences, Tween 20 has a broad range of applications. For example, it is used: to stabilize purified protein derivative (PPD) solution used in skin testing for tuberculosis exposure as a washing agent in immunoassays, such as Western blots and ELISAs. It helps

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prevent non-specific antibody binding. as a solubilizing agent of membrane proteins for lysing mammalian cells, at a concentration of 0.05% to 0.5% v/v. can be dissolved in Tris-Buffered Saline or Phosphate buffered saline at dilutions of 0.05% to 0.5% v/v and used as a washing solution for immunoassays. anonymous(b)

- **Tween 80**- Polysorbate 80 (commercially also known as Tween 80, a registered trademark of ICI Americas, Inc.)[2] is a nonionic surfactant and emulsifier derived from polyethoxylated sorbitan and oleic acid, and is often used in foods. Polysorbate 80 is a viscous, water-soluble yellow liquid. The hydrophilic groups in this compound are polyethers also known as polyoxyethylene groups which are polymers of ethylene oxide. In the nomenclature of polysorbates, the numeric designation following polysorbate refers to the lipophilic group, in this case the oleic acid (see polysorbate for more detail). Polysorbate 80 is often used in ice cream to prevent milk proteins from completely coating the fat droplets. This allows them to join together in chains and nets, to hold air in the mixture, and provide a firmer texture, holding its shape as the ice cream melts. anonymous (e)

Determination of Viscosity

The viscosity of liquid was determined by the following formula

$$\eta = \eta_o(t/t_o X\ \rho/\ \rho_o)$$

where-

η = Viscosity	η_o = Viscosity of water
t_o = Water Flow time	t = Liquid Flow time
ρ = Density of liquid	ρ_o = Density of wate

Viscosity for PEG 400-

$\eta = \eta_o(t/t_o X\ \rho/\ \rho_o)$

η= 0.8904(1.18/1.14X0.924/0.9327)

η=0.913

Viscosity for Tweem 20-

$\eta = \eta_o(t/t_o X\ \rho/\ \rho_o)$

η= 0.8904(1.19/1.14X0.925/0.9327)

η=0.9217

Viscosity for Tweem 80-

$\eta = \eta_o(t/t_o X\ \rho/\ \rho_o)$

η= 0.8904(1.21/1.14X0.9307/0.9327)

η=0.943

Determination of Interfacial tension

The Interfacial tension of liquid was determined by the following formula

$$\gamma_{IFT} = [(n_{HDL in\ air}/\ n_{HDL\ in\ LDL})(\ \rho_{HDL} - \rho_{LDL}/\ \rho_{HDL})]\ \gamma_{HDL}$$

Where-

γ_{IFT} = Interfacial tension	ρ_{HDL}= density of high density liquid
ρ_{LDL}= density of low density liquid	γ_{HDL}= Surface tension high density liquid

$n_{HDL\ in\ LDL}$ = No. of drops of high density liquid in low density liquid

Interfacial tension for PEG 400-

$\gamma_{IFT} = [(n_{HDL in\ air}/\ n_{HDL\ in\ LDL})(\ \rho_{HDL} - \rho_{LDL}/\ \rho_{HDL})]\ \gamma_{HDL}$

γ_{IFT} = [(66/22)(0.9327− 0.924/0.9327)] 58.46

γ_{IFT} = 1.635

Interfacial tension for Tween 20 -

$\gamma_{IFT} = [(n_{HDL in\ air}/\ n_{HDL\ in\ LDL})(\ \rho_{HDL} - \rho_{LDL}/\ \rho_{HDL})]\ \gamma_{HDL}$

γ_{IFT} = [(105/78)(0.9327− 0.925/0.9327)] 67.066

γ_{IFT} = 0.7452

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Interfacial tension for Tween 80 -

$\gamma_{IFT} = [(n_{HDL in air}/ n_{HDL in LDL})(\rho_{HDL} - \rho_{LDL}/ \rho_{HDL})] \gamma_{HDL}$

$\gamma_{IFT} = [(93/63)(0.9327- 0.9307/0.9327)] 53.184$

$\gamma_{IFT} = 0.1683$

Determination of Surface tension

The Surface tension of liquid was determined by the following formula

$$\gamma_{(S.T.)}= (n_0/n \text{ X } \rho/ \rho_0) \gamma_0$$

Where -

$\gamma_{(S.T.)}$ = Surface tension

n = No. of drops of liquid

ρ = Density of liquid

n_0 = No. of drops of water

ρ_0 = Density of water

γ_0 = Surface tension of water

Surface tension for PEG 400 –

$\gamma_{(S.T.)}= (n_0/n \text{ X } \rho/ \rho_0) \gamma_0$

$\gamma_{(S.T.)}= (114/121 \text{ X } 0.9240/ 0.9327) 72$

$\gamma_{(S.T.)}= 58.460$

Surface tension for Tween20 –

$\gamma_{(S.T.)}= (n_0/n \text{ X } \rho/ \rho_0) \gamma_0$

$\gamma_{(S.T.)}= (114/124 \text{ X } 0.925/ 0.9327) 72$

$\gamma_{(S.T.)}= 65.6470$

Surface tension for Tween80 –

$\gamma_{(S.T.)}= (n_0/n \text{ X } \rho/ \rho_0) \gamma_0$

$\gamma_{(S.T.)}= (114/154 \text{ X } 0.9307/ 0.9327) 72$

$\gamma_{(S.T.)}= 53.184$

Result and conclusion

Surface tension and viscosity is very imperative properties of a liquid system. For centuries surface tension (c) and viscosity (g) and interfacial tension data have been determined with individual instruments like Stalagmometer, Ostwald viscometer and Pendeant-drop method respectively which are consuming much time and materials.[2] Mansigh survismetr is proved a better way for measurement of various liquid properties with less time and low cost and which give precise result in a simple order. The data obtained here are high significant or choosing type of surfactant fhor the study of mutual miscibility of immiscible solvents. Further the viscosity data predict type of liquid like Newtonian or non-Newtonian. IFT is a biophysically important to quickly exchange drugs and similar together molecules to interfacial solvents. Surismeter does not require any other infrastructure except electricity to run a thermostat for experimental temperature and save time user's time as well as cost. [11]

Table-1 Result of various physical parameter of different surfactant

Sr.no.	System	t, sec.	d n	ρ	η	γ	Na	Nt	IFT
1	Toluene	0	0	0.8267	3.388	28.40	0	0	0
2	Water	1.14	114	0.9327	0.8904	72	69	25	9.2102
3	PEG 400	1.18	121	0.924	0.8904	58.46	66	22	1.635
4	Tween20	1.19	124	0.925	0.9217	65.647	105	78	0.7425
5	Tween80	1-21	154	0.9307	0.943	53.184	93	63	0.1683

Both toluene and water immiscible phases when mixed together develop an energetic interface that remains tense due to individual surface. Physics of a tense interface does equilibrate tensional forces to have an optimized surface force which is denoted to as Interfacial Tension. The IFT between water and toluene with addition of surfactant: PEG400, Tween 20 , Tween 80 critically decrease to 1.635,0.7425,0.1683 for PEG400, Tween 20 , Tween 80

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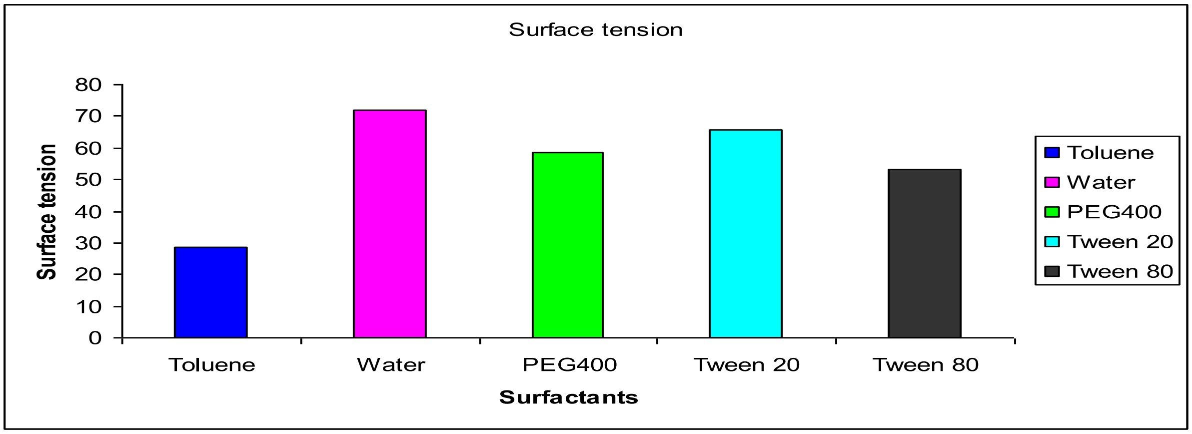
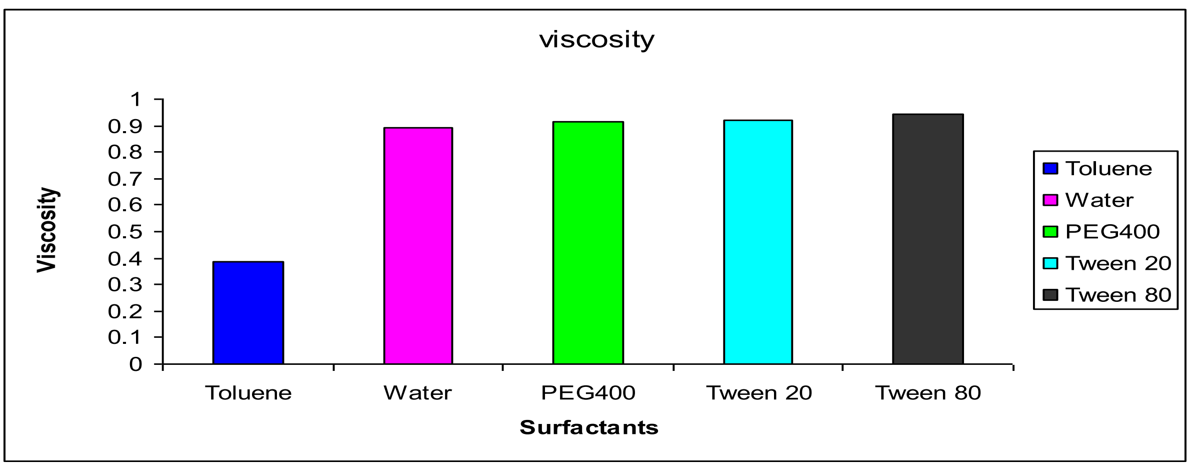
respectively and Surface Tension also found to reduce from 72 to 58.46, 65.647, 53.183 for PEG 400, Tween 20 , Tween 80 respectively at room temperature. [3]

Graph -1 Surface tension v/s Surfactant – In this column graph shows effect of surfactants on SurfaceTension



Graph -2 Viscosity v/s Surfactant - In this column graph shows effect of surfactants on Viscosity



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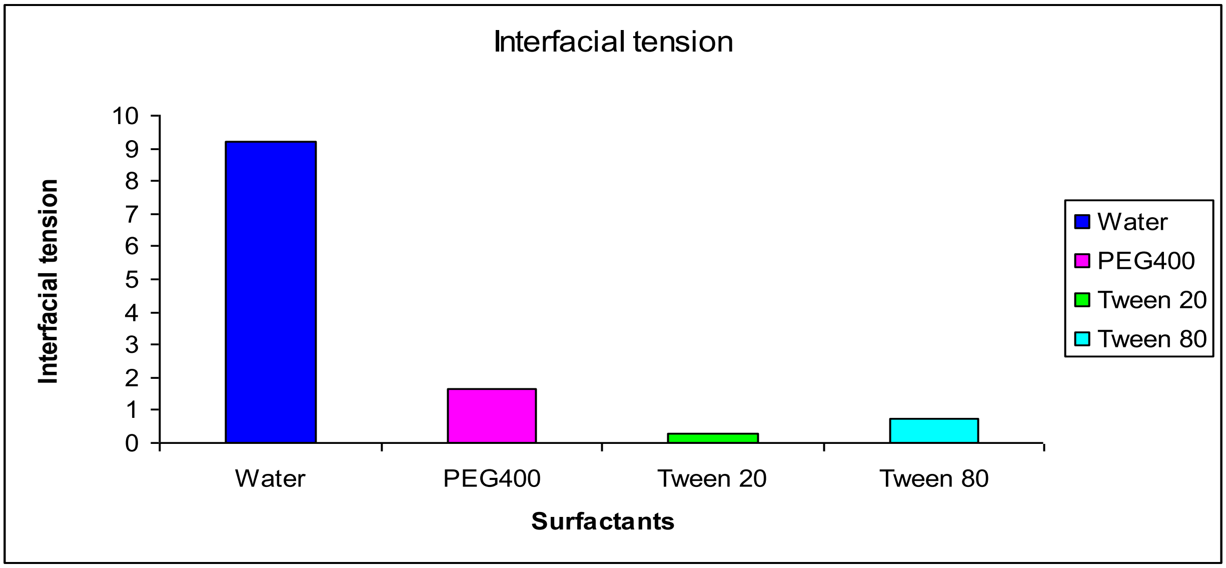
Graph -3 Interfacial tension v/s Surfactant- In this column graph shows effect of surfactants on Interfacial tension



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References

1. Anonymous(a)http://web.mit.edu/nnf/education/wettability/interfacial.html accessed on 3/09/09
2. Anonymous(b) http://en.wikipedia.org/wiki/Polysorbate_20 accessed on 3/09/09
3. Anonymous(c) http://en.wikipedia.org/wiki/Surface_tension accessed on 15/09/09
4. Anonymous (d)http://en.wikipedia.org/wiki/Viscosity accessed on 20/09/09
5. Anonymous (e)http://en.wikipedia.org/wiki/Polysorbate_80 accessed on 7/10/09
6. Anonymous(f)http://www.ncbi.nlm.nih.gov/pubmed/16571362 accessed on 13/11/09
7. Agrawal S.P. and Khanna Rajesh A. "Text book of physical pharmacy", " Edition Second", "Published by CBS Publication and Distribution, New Delhi.
8. Jain N.K. and Sharma S.N. " A text book of professional pharmacy", Fourth Edition 1998,reprint 2005, Published by Vallabh prakashan, Pitampura, Delhi.
9. Lachman, leon & Lieberman, Herbert "The theory and practice of industrial pharmacy", Special Indian Edition -2009, Published by CBS Publisher and distributors Pvt. Ltd. New Delhi.
10. Martin Alfred, Bustamant, Pilar and chun " A text book of physical pharmacy", Fourth edition, reprint 2001, Published by Lippincott willims and wilkins wolterns kluwer company.
11. Man Singh "Survismeter — Type I and II for surface tension, viscosity measurements of liquids for academic, and research and development studies Chemistry Research Lab, Deshbandhu College, University of Delhi, New Delhi-110019, India Received 19 August 2005; received in revised form 11 February 2006; accepted 13 February 2006.