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Thermal Effects on the Solubility Enhancement of Immiscible Synthetic Drugs through Sodium Dodecyl Sulphate Aqueous Medium

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Abstract: ***An important property of micelles in pharmacy is their ability to increase the solubility of immiscible organic compounds in water thus increasing their bioavailability, minimize their quick degradation and loss. The proposed work mainly involves the "Thermal studies in this micellar solution of surfactant – sodium dodecyl sulphate in aqueous medium. This work is mainly useful in determining the availability of SDS as drug carrier for a number of poorly soluble organic drugs in water.***

Keywords: Cmc, Micelle. Surfactant, SDS

1. Introduction

The study of micelles mainly starts with the knowledge of surfactants. The term surfactant is derived from the word surface active agents. They are organic compounds which are amphiphillic in nature i.e. they contain both hydrophilic and hydrophobic groups thus they are soluble in organic solvents as well asin water **(M.Vlachy et al.2008).** Surfactants are known to form micelles which have attracted much attention from scientists. When the surfactant molecule is added to water, the non- polar part (tails) of surfactant clump into the center of a ball like structure called micelle. The polar part (head) however presents itself for interaction with water on the outside of micelle. **(D.P.Tieleman et al. 2000).**A micelle is an aggregate of molecules dispersed in a liquid. A typical micelle forms an aggregate with the head region in contact with the surrounding, sequestering the tail region in the micelle Centre. This type of micelle is known as normal phase micelle. **(J.Shanthalakshmi et al. 2001).**These micelles have different shapes like spherical, rod like ellipsoid and cylindrical depending upon the conditions and composition of the system. The concentration of a surfactant molecule at which micelles appear is called critical micelle concentration (CMC).The occurrence of CMC results from a delicate balance of intermolecular forces. Micelles have an anisotropic distribution of water in their structure. The concentration of water decreases from surface to the core i.e. completely hydrophobic at the core. These aggregates show an interfacial region separating the polar aqueous phase from hydrocarbon like interior. As a consequence, micellar solution consists of special medium in which hydrophobic, amphiphillic or ionic compounds may be solubilized. Poor aqueous solubility is a major obstacle in the development of therapeutic agents. Some of the approaches to enhance poor solubility of drugs include the use of co-solvents **(M.A.Etman etal.2001 and S.H.Yalkowsky et al.1999).**Selection of salt form **(A.B.Neilsen et al. 2005 and P.M. Bhatt et al. 2005).**Preparation of solid dispersions **(Neelam Seedhar and Mamta Kanojia. 2008).** Micellar solubilisation is a widely used alternative for the dissolution of poorly soluble drugs. **(C.O.Rangel et al.2005).**Depending upon the hydrophobicity the drug can be solubilized in the inner core of micelle, on the surface of micelle or at an intermediate location in the palisade layer. Thus by knowing the structure and properties of micelles the solubility of poorly soluble drugs can be enhanced.

2. Materials and Methods

Surfactants and chemicals were purchased from Himedia laboratories Mumbai and Merck chemicals. A number of parameters were investigated such as CMC of sodium dodecyl sulphate under ordinary room temperature and also at different temperatures, were measured. Effect of insoluble organic drugs on the micellar solution of sodium dodecyl sulphate in aqueous medium was found. These parameters were measured using a simple conductometric technique.

Chemicals used:

a) Sodium dodecyl sulphate
b) Insoluble drugs like Acetyl salicylic acid

Apparatus:

1) Conductivity meter: (Digital direct reading systronics type) used for conductivity measurements .This conductivity meter should be calibrated with KCl solution of appropriate concentration range.
2) Thermostat: For maintaining the temperature settings constant throughout the experiment a thermostat set at 30^0C to 45^0C with automatic temperature control ± 0.1^0C at the required temperature is used.

Preparation of solutions: A stock solution of SDS 0.1M is prepared using double distilled water by direct weighing the chemical in digital electronic balance. From this stock solution a number of solutions with desired concentration were prepared. Then these solutions were used for further investigation. The effect of temperature and effect of insoluble antidiabetic and analgesic drugs was found that can be explained through these tables and charts.

Effect of Temperature:

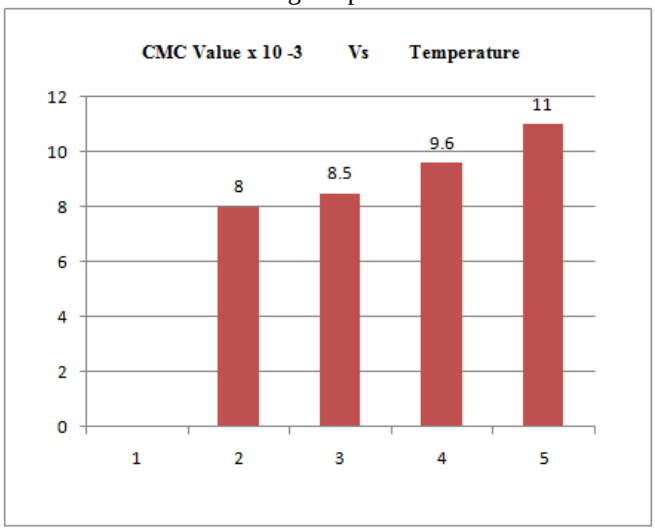
Solutions of SDS with different Molar concentrations ranging from 2 x 10 -3 to 14 x 10 -3 were prepared. Then the conductivity of these solutions was measured by using direct digital conductivity meter of known cell constant at room temperature. Then this procedure is repeated at different temperatures. Desired temperature is kept constant with the help of digital thermostatic water bath. The CMC value was measured by plotting a graph between equivalent conductivity x 10^{-3} and $\sqrt{C}$ x 10^{2} . The break point obtained in the graph corresponding to the molar concentration of SDS was taken as CMC of SDS at that temperature which is expressed in Moles / lit. Table: I shows the effect of temperature on the CMC value of SDS and Chart I shows the variation of CMC of SDS with increasing temperature.

3. Figures and Tables

Table 1: Variation of CMC Value of SDS with the increasing temperature

S. No.	Temperature in Kelvin	CMC Value x 10 -3
1	303	8
2	308	8.5
3	313	9.6
4	318	11

Chart – I: Variation of CMC value of SDS with increasing temperature



4. Results and Discussion

A systematic study on the critical micelle concentration of SDS was made. Thermal effects and effects of different poorly soluble antidiabetic and analgesic drugs were found. Results obtained are shown in the form of chart - I. It was observed that the CMC value of SDS increases with the increase in temperature. The increase in the CMC value with temperature indicates that the increase in temperature does not favour the formation of micelle. An increase in CMC value with temperature indicates that the CMC value can be reached early at a lower temperature i.e. micelle formation can be achieved at a lower temperature and thus solubilisation of drugs can also be enhanced in the micellar system of SDS at a low temperature. Thus the oral absorption of hydrophobic drugs can be significantly improved by using this micellar and micro emulsions system at low temperature.

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