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Research Article

Study of effect of solubility of a sparingly water soluble drug in presence of surfactant

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ABSTRACT

Solubility plays an important role in dissolution and absorption of drug. Benzoic acid has less solubility in aqueous media. The aim of present study was to study the effect of solubility enhancing agents at room temperature on the solubility of benzoic acid. Sodium Lauryl Sulphate (SLS) in various concentrations were used to study the solubility of Benzoic acid in water. The solubility of benzoic acid in water is directly proportional to the concentration of the surfactant added. The solubility of benzoic acid increases with increase in concentration of surfactant.

Keywords: Solubility, Benzoic acid, SLS

Introduction:

The formulation of poorly water-soluble drugs has always been a challenging problem faced by pharmaceutical scientists and it is expected to increase because approximately 40% or more of the new chemical entities being generated through drug discovery programs are poorly water-soluble. The problem is even more intense for drug such as intraconazole and carbamazepine as they are poorly soluble in both aqueous and organic media, and for drugs having a log p (The logarithm of the ratio of the concentrations of the un-ionized solute in the solvents is called log P) value of 2. Such drugs often have an erratic absorption profile and highly variable bioavailability because their performance is dissolution rate limited and is affected by the fed / fasted state of the patient [1, 2].

When a drug is administered per-orally in solid dosage form such as tablet, capsules, or suspension it must be released from the dosage form and dissolved in the gastrointestinal fluids before it can be absorbed. The bioavailability of many poorly water-soluble drugs is limited by their dissolution rates, which are in turn controlled by surface area that they present for dissolution [2-3]. There are consecutive two processes can be identified to describe the oral absorption of drugs from solid dosage forms [4]:

• Dissolution of the drug in vivo to produce a solution and

• Transport of the dissolved drug across the gastrointestinal membrane.

Each process can be characterized by a rate constant. If the rate of dissolution of the drug is significantly slower than the rate of absorption, the dissolution of the drug becomes the rate-limiting step in the absorption process [3]. Consequently, numerous attempts have been made to modify the dissolution characteristics of

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certain drugs in an effort to attain more rapid and more complete absorption4. And the particle size of the drug in of great importance in the transport from the gastrointestinal (GI) tract to the site of action by increasing the dissolution rate in the GI tract [3-5].

A complex is a species of definite substrate-to-ligand stoichiometry that can be formed in an equilibrium process, in solution, and also in the solid state. Water-soluble ligands, such as cyclodextrins, can be used to solubilize water-insoluble substrate, such as ibuprofen [5-7].

A special form of self-aggregated complex in which the interactant is a surfactant, it is a molecule possessing both a non polar and a polar portion. A water-insoluble drug usually is affinity to non polar portion of the surfactant [7]. The solubility of poorly soluble drug can also be improved by various solubilizing materials. PEG 400 is improving the solubility of hydrochlorthiazide. Modified gum karaya (MGK), recently developed excipients was evaluated as carrier for dissolution enhancement of poorly soluble drug, nimodipine. The aqueous solubility of the antimalarial agent halofantrine is increased by the addition of caffeine and nicotinamide [8].

Weakly acidic and basic drugs may be brought into solution by the solubilization action of surface active agents. These surfactants form micelles and then solubilize substance that only soluble in a solvent. This molecule undergo solubilization in a micelle is related to the balance between the polar and non polar properties of the molecules in aqueous system. Polar molecules will tend to be absorbed on the micelle surface formed from non ionic surfactants. The aim of present study was to study the effect of solubility enhancing agents at room temperature on the solubility of benzoic acid. Sodium Lauryl Sulphate (SLS) in various concentrations were used to study the solubility of Benzoic acid in water.

Materials & Methods:

Benzoic acid, sodium hydroxide and sodium lauryl sulphate were purchased from Merck Company, Germany. Benzoic acid, sodium hydroxide and sodium lauryl sulphate was used to carry out this work. All chemicals and reagents used in this study were of analytical grade and obtained from Merck Company, Germany.

2% w/v solution of sodium lauryl sulphate was prepared. Four cleaned and dried 250ml conical flask were taken and labeled as 1, 2, 3, 4 required amount of sodium lauryl sulphate solution was added in each flask from the stock solution to get the following concentration for a total volume of 50 ml.

Table 1: Preparation of diluted solution from 2% w/v solution of sodium lauryl sulphate

Stock solution	**2% w/v solution of sodium lauryl sulphate**			
Sodium lauryl sulphate	0.00% (w/v)	0.10%(w/v)	0.40%(w/v)	0.80%(w/v)
Distilled water	50ml	50ml	50ml	50ml
Benzoic Acid	Excess amount	Excess amount	Excess amount	Excess amount

Excess amount of benzoic acid (table 1) was added in each flask. Each flask was shaken for 30 min. In a mechanical shaker and then filtered off, 10ml of filtrate was titrated against 0.05 (N) NaOH solution using Phenolphthalein as indicator.

Results & Discussion:

2 gm of sodium lauryl sulphate was added to 100ml of water to prepare 2% w/v stock solution. Then suitable concentrations of diluted solution were prepared from this stock solution (table 2).

Table 2: Preparation of different concentration of surfactant

Required Concentration (w/v)	Stock solution concentration	Volume of Stock solution (ml)	Volume of water (ml)	Total volume (ml)
0.00%	2%	0 ml	50ml	50ml
0.10%		2.5ml	47.5ml	
0.40%		10 ml	40ml	
0.80%		20 ml	30ml	

Titration volume: Strength of NaOH: 0.05 (N), Factor: 0.96

Actual Strength of NaOH: 0.05*0.96 =0.048 (N)

Table 3: Volume, strength of titrate and NaOH and concentration of Benzoic acid (gm/lit)

Volume of titrate (ml)	Volume of NaOH	Strength of titrate	Concentration of Benzoic acid (gm/lit)
10 ml	7.2 ml	0.0394	4.21
10 ml	7.7 ml	0.037	4.52
10 ml	9.4 ml	0.0451	5.51
10 ml	11.8 ml	0.0566	6.91

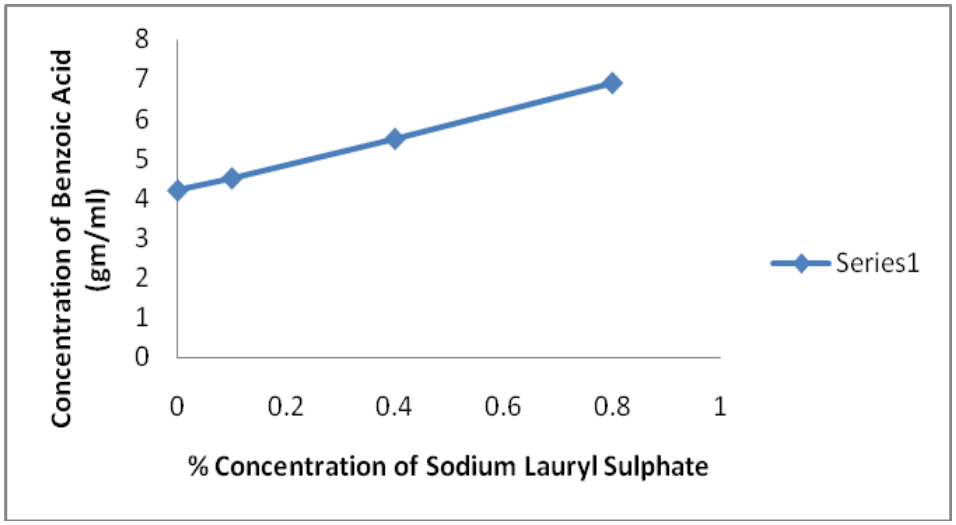

Figure 1: effect of concentration of SLS on solubility of Benzoic acid

The solubility of benzoic acid in water is directly proportional to the concentration of the surfactant added. So the graph becomes a straight line with a positive intercept. The solubility of benzoic acid increases with increase in concentration of surfactant.

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