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Determination of percentage composition of sodium chloride phenol-water system using Critical solution temperature (CST) method: A brief review

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Abstract
Liquid water and phenol show limited miscibility below 70°C miscibility temperatures of several water-phenol mixtures of known composition has been measured. An extension of the experiment will be to measure the effect of a third component on the water-phenol critical point. The surface- active agents concentrate at the surface of a solution or at the interface between two immiscible liquids. When Nacl is added to the phenol-water system, the solution immediately gives turbidity.

Keywords: Phenol water system, Critical solution temperature (CST), Sodium chloride

1. Introduction

Phenol is a starting material In the manufacture of plastics and drugs, Used an antiseptic beginning in the 1860.Phenol also known as carbolic acid, hydroxybenzene and phenyl alcohol, is produced at mostly from isopropyl Benzene (cumene). Two partially miscible liquids may become completely miscible at a higher temperature since solubility Increases with temperature generally. This miscibility temperature is different for different compositions of the mixture [1].

The highest miscibility temperature is called the critical solution temperature or CST. The water-phenol phase diagram contains a solid Phase at high percent phenol, near and somewhat above room temperature. At room temperature, a tube contains two liquid phases, one denser than the other. The tube is heated in a water bath until the two phases merge. When NaCl is added to the phenol-water system, the solution immediately shows turbidity. The temperature at which they merge is the “clearing temperature,” also known as the “cloud” Temperature, and lies on the liquid-liquid coexistence line [2]. By using several sample tubes, one obtains several the coexistence line. We will fit a curve through those Points, differentiate the curve to find its maximum, and use the Maximum as the critical temperature. When phenol and water are missile together, two layers form which are the upper layer is a solution of water in phenol and the lower layer is a solution of phenol in water.

The first part of the experiment use tubes that contain known masses of water and phenol, from the masses the mole fraction xphenol can be calculated. At room temperature, a tube contains two liquid phases, one denser than the other. The tube is heated in a water bath until the two phases merge. The origin of the effect is the tendency of water molecules to Associate with ions, hydrating them In that way, simple ions reduce the tendency of water to solvents Phenol. The inverted U-shaped curve can be regarded as made up of two halves, the one to the left being the solubility curve of phenol in water and the other the solubility curve of water in phenol. Many substances that we use every day contain partially Miscible liquids like phenol-water in which, the Components of a system might not be miscible over the Entire concentration range, say A, is added To component B, gradually, after a certain composition the System separates in two phases, one of which is a solution Of A in B and the other is a solution of B in A. But increasing the temperature leads to a state of complete Miscibility. The region outside this curve contains systems having but one Liquid phase. Starting at the point a, equivalent to a system containing 100% water at 50 °C, adding known increments of phenol to a fixed weight of water, the whole being maintained at 50 °C.The concentration of phenol and water at which this occurs Is 11% by weight of phenol in water. The second phase, which separates out on the bottom, shows it to contain 63% by weight of phenol in water. At the Same time, the amount of the water-rich phase (A) decreases.

Once the total concentration of phenol Exceeds 63% at 50°C, a single phenol-rich liquid phase is formed.

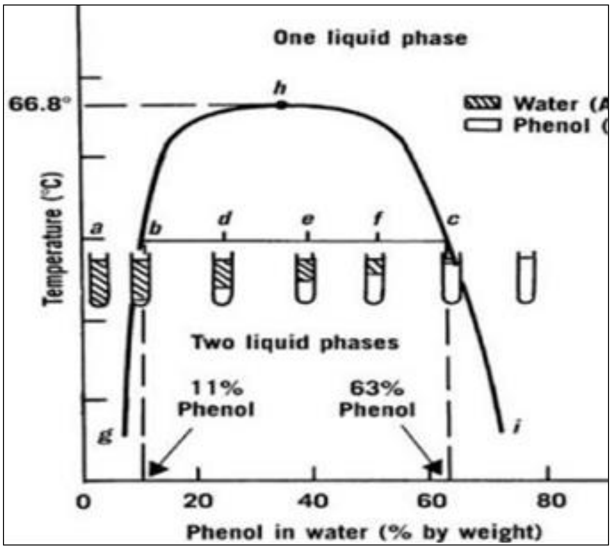

Fig 1: Graph of phenol in water vs Temperature (Martin)

2. Critical solution temperature

Liquid pairs do not give Homogeneous solutions at all compositions. Such liquid pairs are said to be partially miscible Liquids. However, due to increased solubility with increase or decrease of temperature, these May become completely miscible. We can explain such a system of liquids using phenol and Water. When a very small amount of phenol added to water at room temperature, it dissolves complete to give a single liquid phase.

However, when the addition of phenol is continued, a point is reached when phenol does not dissolve any more. At this point, two Phases, i.e., two liquid layers are formed one consisting of water saturated with phenol and the other containing phenol saturated with water. It has been experimentally found that at constant temperature, the composition of the two Layers, although different from each other, remains constant as long as the two phases are Present.

The addition of small amounts of phenol or water changes the volume of the two layers and not their compositions. As the temperature is increased, the behaviour remains the same except that the mutual solubility of the two phase's increases. The temperature corresponding to the point B, i.e., the Temperature at which the solubility becomes complete is called the critical solution temperature or the consulate temperature. Since the mutual solubility of phenol and water increases with rise in temperature, the critical solution temperature (CST) lies well above the room Temperature. There are some liquid pairs for which mutual solubility's Decrease with rise in temperature. As the temperature is decreased, the mutual solubility's Increase and below the convolute temperature, the two liquids become miscible in all Proportions Such systems possess lower convolute temperatures.

Effect of sodium chloride on phenol-water system

The sodium chloride is act as an impurity in phenol water system The effect of an impurity (sodium chloride) on the CST the phenol-water system.It effect the solubility of phenol and water sodium chloride is soluble in water but it is not soluble in phenol so the high temperature given to the phenol water system and note the point of solubility. The miscibility temperature for a mixture of phenol and the NaCl solution is also determined by phenol water system.

2.1 Procedure for phenol water system

Take a glass test tube and a Thermometer (range upto 100 °C and readability of 0.1 °C and aluminum stirrer. Measure 5 mL of 80% phenol into the test tube.

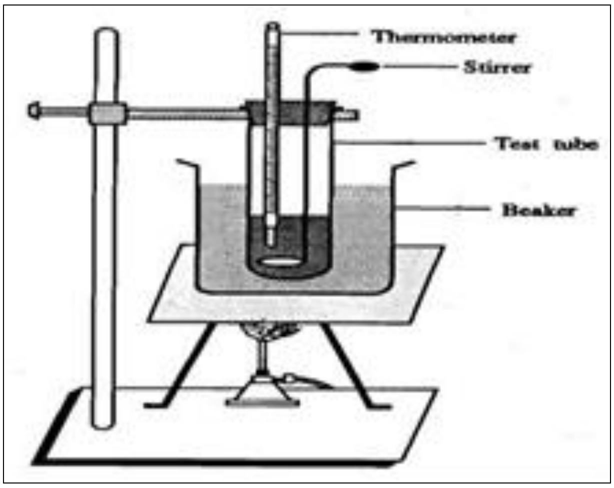

Fig 2: Phenol water system

Add 0.5 mL water into the tube containing phenol. Check appearance of the Solution Hold a thermometer and Stirrer in the tube and heat slowly on a water bath, stirring continually. Note the Temperature at which turbidity just disappears. Take out from the water bath and allow the tube to cool slowly while stirring. Note the temperature which turbidity reappears. Then add another 0.5 or 1 mL more of water into the tube and repeat the experiment. Continue like this till a total of 30 mL water is added. Plot the average miscibility Temperatures against percentage of phenol on a graph Paper. The maximum point in the curve is the Phenol-water system. Add small amount of Nacl in phenol water system then heat as per required temperature.

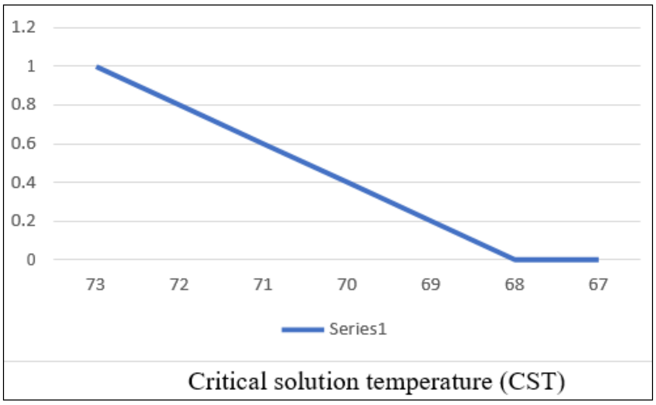

Fig 3: Graph of concentration vs Critical solution temperature (CST)

3. Application

It increase the bioavailability of drugs. The phenol water system exhibits an upper critical solution temperature, Used for testing the purity of the mixture. Phenol water system help to increase the solubility of different immiscible drugs in pharmaceutical industry. Make the relationship between temperature and solubility of phenol and water. Stability of some drugs increased if formulated in solubilized Form. Vitamin A is more resistant to auto-oxidation in solubilized System than in oil. Preparation of aqueous products of poorly soluble drugs. Insoluble and soluble drugs can be formulated together [3].

Reference

1. Patrick Sinko J. Martin's Physical Pharmacy and Pharmaceutical Science, edition-5th, 231.
2. Singh, Man "Upper critical solution temperatures for immiscible solvent systems with halide
3. Salts, carboxylic acids, surfactants and polynuclear aromatic compounds and benzene Derivatives," Journal of Chemical Thermodynamics, 39, 240-246, 2007.
4. Guru Prasad Mohanta, Prabal Kumar Manna, physical pharmacy practical text, Pharma Book Syndicate, Hyderabad, 2006, 38.