SURFACE CHEMISTRY

TOPIC-3

Properties of colloids, effects of colloids, properties and Tyndall effect, Brownian movement, coagulation

VERY SHORT ANSWER QUESTIONS

1. **What is Brownian movement?**

Brownian Movement: When a colloidal solution is examined by ultra microscope, the colloidal particles are seem to be moving in a rapid zigzag motion called Brownian movement.

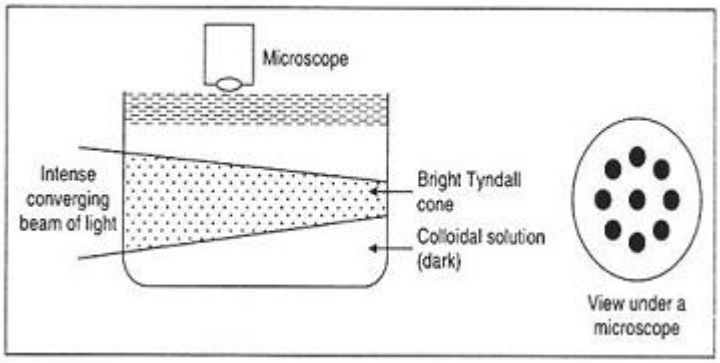
2. **What is coagulation?**

Ans: The phenomenon of colloidal substances loosing charge and coming down as precipitate on addition of an electrolyte to the colloidal solution is called as coagulation.

SHORT ANSWER QUESTIONS

1. **Explain Tyndall Effect.**

Ans: Tyndall Effect: When an intense converging beam of light is passed through a colloidal solution kept in dark, the path of the beam gets illuminated with a bluish light. This phenomenon is called Tyndall effect and the illuminated path is known as **Tyndall cone**. The phenomenon was first observed by Tyndall in 1869.



Tyndall effect

The Tyndall effect is due to the scattering of light by colloidal particles. Since the dimensions of colloidal particles are comparable to the wavelength of ultraviolet and visible radiations, they scatter these radiations and get illuminated. Tyndall observed that the zone of scattered light is much larger than the particle itself. This is why colloidal particles look like bright spots when viewed with a microscope at right angles to the beam of light as shown in figure. Thus, Tyndall effect may be defined as the scattering of

light by colloidal particles present in a colloidal solution.

Tyndall effect is not exhibited by true solutions. This is because the particles (ions or molecules) present in a true solution are too small to scatter light. Thus, Tyndall effect can be used to distinguish a colloidal solution from a true solution. The phenomenon has also been used to devise an instrument known as ultra microscope. The instrument is used for the detection of the particles of colloidal dimensions. Tyndall effect also establishes the fact that colloidal systems are heterogeneous in nature.

2. What is coagulation? Write about Hardy-Schultze law.

Ans: **Coagulation or flocculation:** The stability of a sol is due to the charge present on the colloidal particles. Due to similar charges, colloidal particles repel one another and are unable to combine together to form larger particles. However, if the charge on colloidal particles is destroyed, they are free to come nearer and grow in size. When the particles become sufficiently large, they get precipitated. This phenomenon is termed as coagulation or flocculation. The coagulation of colloidal solution can be achieved by the addition of an electrolyte. It is to be noted that a small amount of electrolyte is necessary for the stability of a sol because the ions of the electrolyte get adsorbed on colloidal particles and impart them some charge. However, when an electrolyte is added in substantial amount the positively charged ions of the electrolyte neutralize the charge on colloidal particles and compel the sol to get coagulated. Coagulation may be defined as follows.

The phenomenon involving the precipitation of a colloidal solution on addition of an electrolyte is called coagulation or flocculation.

Hardy-Schulze rule: The coagulation capacity of an electrolyte depends upon the valence of ion responsible for causing coagulation. As we have seen above, the ion responsible for causing coagulation is the one which carries charge opposite to that present on colloidal particles. For example, a positively charged sol gets coagulated by the negatively charged ions of the added electrolyte. From a study of the coagulation behavior of various electrolytes towards a particular sol, Hardy and Schulze suggested a general rule known as Hardy-Schulze rule. The rule can be stated as follows.

The greater is the valence of the oppositely charged ion of the electrolyte added to a colloidal solution, the faster is the coagulation of the colloidal solution.

3. **What is Brownian movement?**

Ans:

Brownian movement or motion, zigzag, irregular motion exhibited by minute particles of matter when suspended in a fluid. The effect has been observed in all types of colloidal suspensions—solid-in-liquid, liquid-in-liquid, gas-in-liquid, solid-in-gas, and liquid-in-gas. It is named for the botanist Robert Brown who observed (1827) the movement of plant spores floating in water. The effect, being independent of all external factors, is

ascribed to the thermal motion of the molecules of the fluid. These molecules are in constant irregular motion with a velocity proportional to the square root of the temperature. Small particles of matter suspended in the fluid are buffeted about by the molecules of the fluid. Brownian motion is observed for particles about 0.001 mm in diameter; these are small enough to share in the thermal motion, yet large enough to be seen with a microscope or ultra microscope.

LONG ANSWER QUESTIONS

1. **Explain Tyndall Effect and Brownian Movement.**

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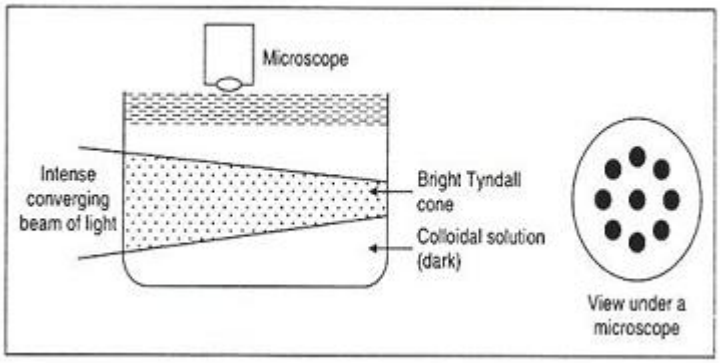

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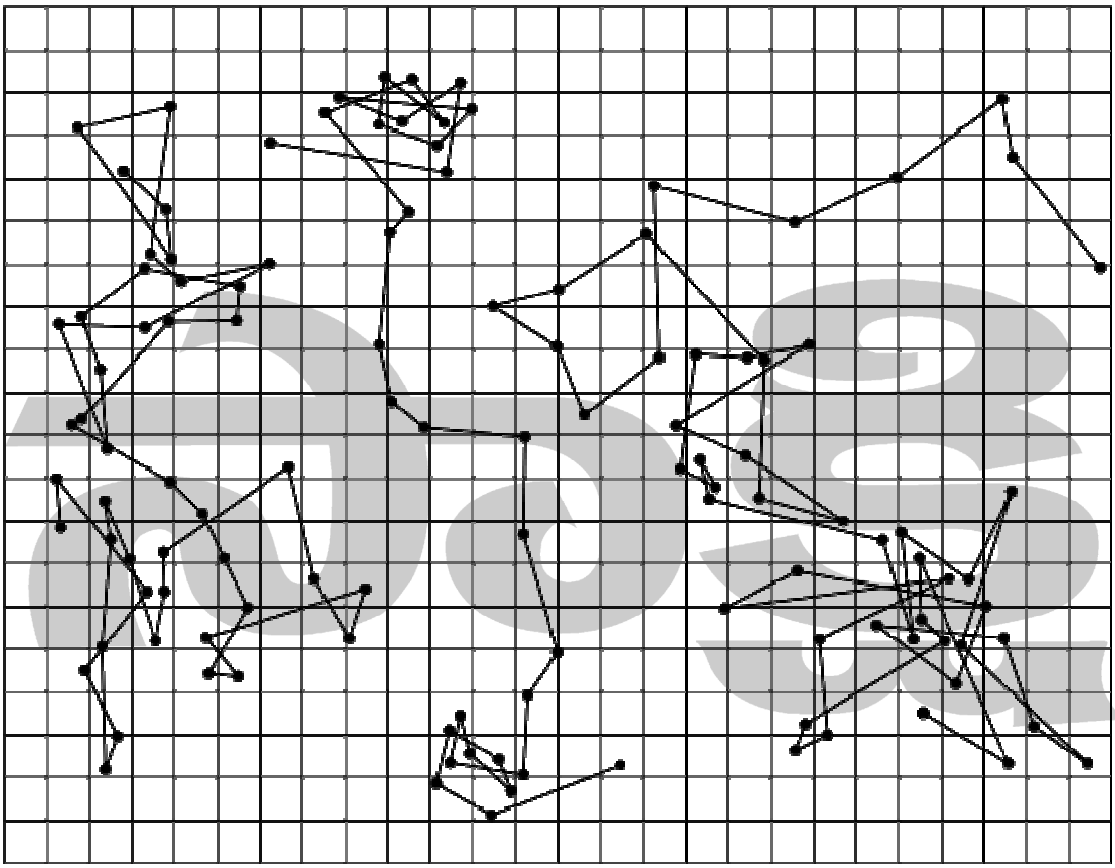

2. **What is coagulation? Explain with suitable example.**

Coagulation or flocculation: The stability of a sol is due to the charge present on the colloidal particles. Due to similar charges, colloidal particles repel one another and are unable to combine together to form larger particles. However, if the charge on colloidal particles is destroyed, they are free to come nearer and grow in size. When the particles become sufficiently large, they get precipitated. This phenomenon is termed as coagulation or flocculation. The coagulation of colloidal solution can be achieved by the addition of an electrolyte. It is to be noted that a small amount of electrolyte is necessary for the stability of a sol because the ions of the electrolyte get adsorbed on colloidal particles and impart them some charge. However, when an electrolyte is added in substantial amount the positively charged ions of the electrolyte neutralize the charge on

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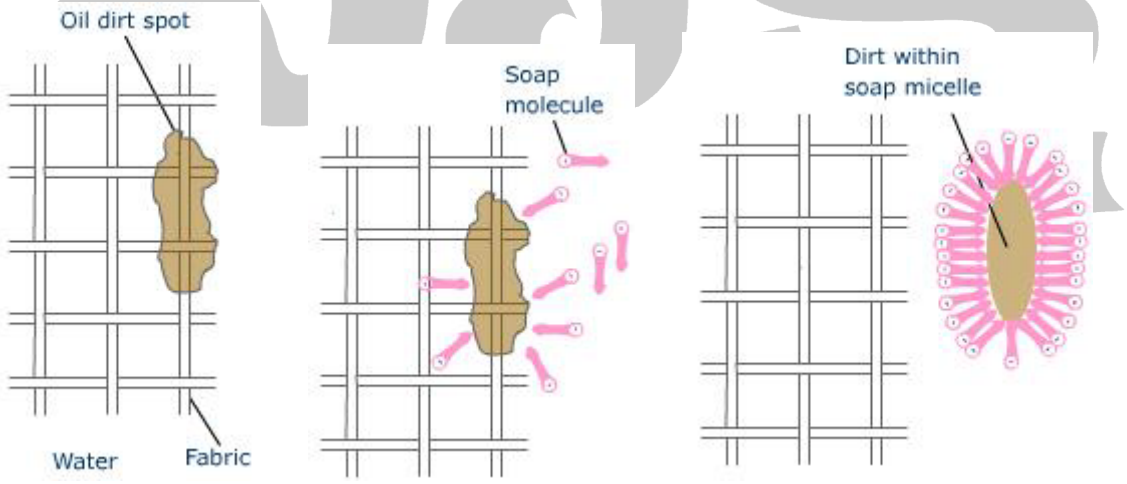
3. **Explain the phenomena of cleaning action of soap**.

Cleansing Action of Soaps

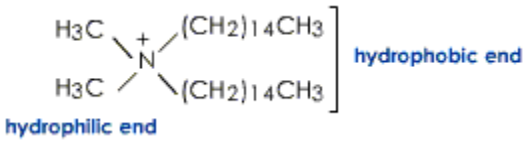
The cleaning action of soap occurs when oil and grease are absorbed into the hydrophobic centers of soap micelles and are washed away.



Cleansing action of soap

Sodium lauryl sulphate is a synthetic detergent present in laundry soaps, toothpastes and shampoos. The formula of sodium lauryl sulphate is $CH_3(CH_2)_{11}SO_4^-\ Na^+$. It has a hydrophilic sulphate group and a hydrophobic dodecyl ($C_{12}H_{25}$) group. These detergent molecules are called 'anionics' because they have negative charge at the hydrophilic end. There are detergents which are 'cationics' that is they have positive charge at the hydrophilic end.

For e.g.,



which is a quaternary ammonium compound.

Many cationic detergents have germicidal properties and are therefore used in hospital disinfectants, mouthwashes and certain eye wetting solutions.