Experiment

Aim

To prepare a colloidal solution of Arsenious sulfide, [As_2S_3].

Theory

Arsenious sulfide, As_2S_3 is a lyophobic colloid. It is obtained by the hydrolysis of arsenious oxide (As_2O_3) with boiling distilled water, followed by passing H_2S gas through the solution obtained.

$$As_2O_3 + 3H_2O \xrightarrow{\text{Boil}} 2As(OH)_3$$

$$2As(OH)_3 + 3H_2S \longrightarrow As_2S_3 + 6H_2O$$

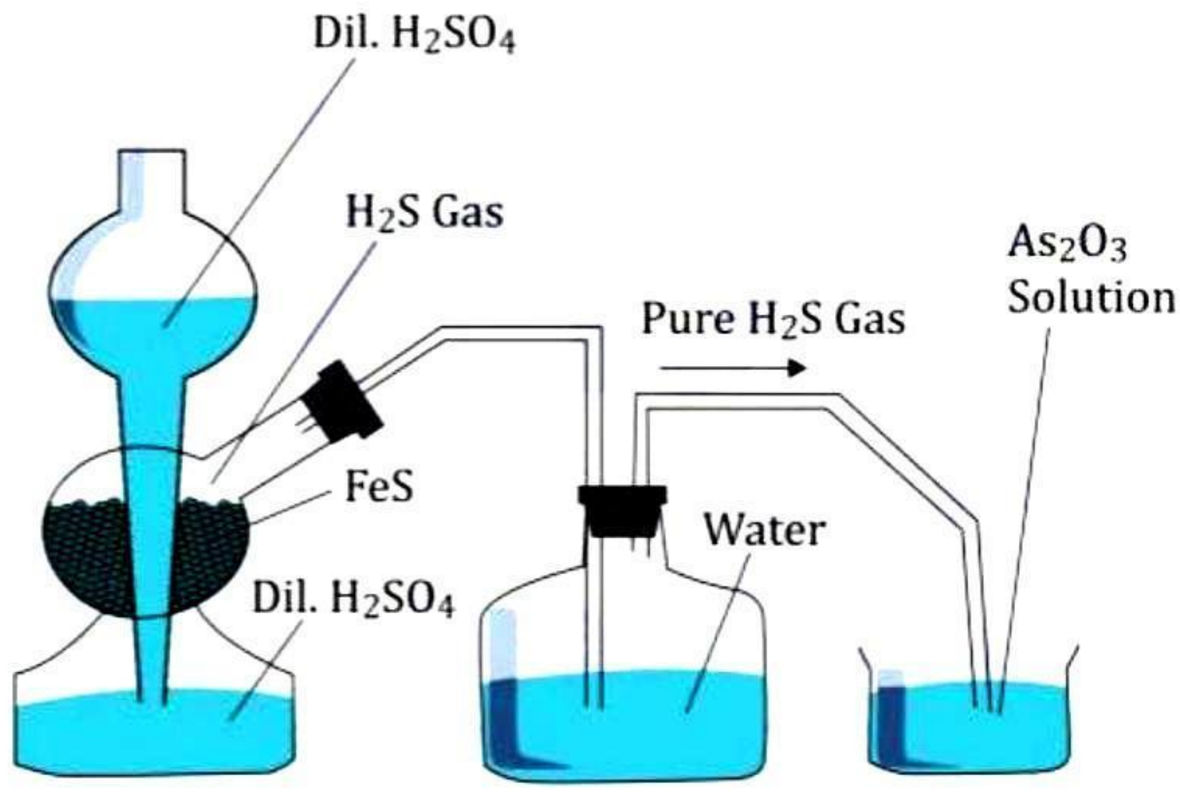
In the colloidal solution of arsenious sulphide, each particle is surrounded by HS^- ions, produced by the dissociation of H_2S. This sulphide ion layer is further surrounded by the counter ion layer of H^+ ions.

Material required

Conical flasks (250 ml), beaker (250 ml), round-bottom flask (500 ml), glass-rod, funnel, glass tubing, tripod stand, wire-gauze, iron stand with clamp, burner, etc. Solid arsenious oxide, H_2S gas filter paper and distilled water.

Procedure

1. Clean a conical flask (250 ml) by the use of a steaming-out process.
2. To this cleaned flask, add 1.5 g of As_2O_3 solid and add 100 ml of distilled water.
3. Boil the solution for about 10 minutes (Fig. 3.).
4. Filter the above hot solution through fluted filter paper and receive the filtrate in another beaker.
5. Pass a slow current of H_2S into As_2O_3 solution as shown in Fig. 3. The solution develops a yellow colour due to the formation of As_2O_3. Continue passing H_2S till the intensity of colour does not change further.
6. Expel excess of H_2S gas from the sol by boiling the sol till the escaping gas does not turn lead acetate paper black.
7. Filter the solution through fluted-filter



Preparation of As_2S_3
Fig.3.

paper and collect the bright yellow filtrate in a dry conical flask and cork it. Label it as "Arsenious Sulphide Sol".

Result

A yellow colour sol of arsenious sulphide is obtained.

Precautions

1. Use a cleaned apparatus since As_2S_3 sol is affected by even traces of impurities.

2. Handle arsenious oxide with care since it is highly poisonous. Wash your hands immediately every time after handling this chemical. While doing this experiment do not eat or drink anything.

VIVA VOCE

Q 1. What is a colloidal solution?

Ans. A colloidal solution is a heterogeneous mixture in which the particle size of the dispersed phase ranges from 1 to 1000 nanometers, making it intermediate between true solutions and suspensions.

Q 2. Why is it important to use distilled water for preparing colloidal solutions?

Ans. Distilled water is free from impurities and ions, which can affect the stability and properties of colloids. Using distilled water ensures the purity of the colloidal solution.

Q 3. What is the significance of the Tyndall effect in colloidal solutions?

Ans. The Tyndall effect is the scattering of light by colloidal particles. It is used to distinguish between true solutions and colloidal solutions. If a beam of light passing through a colloidal solution is visible due to scattering, it indicates the presence of colloidal particles.

Q 4. Describe the process of preparing a colloidal solution of Arsenious sulfide (As_2S_3).

Ans. The colloidal solution of arsenious sulfide can be prepared by adding a small amount of arsenious sulfide to a large quantity of water with the help of a peptizing agent like hydrochloric acid (HCl) or hydrogen sulfide (H_2S). The mixture is then stirred vigorously to break down the larger particles into smaller colloidal particles.

Q 5. Why is a peptizing agent added during the preparation of colloidal solutions?

Ans. A peptizing agent is added to prevent the coagulation of colloidal particles and to keep them dispersed uniformly in the solution. It helps in stabilizing the colloidal particles by providing charge and preventing them from aggregating.

Q 6. How can you distinguish between a true solution and a colloidal solution of Arsenious sulfide?

Ans. A true solution of Arsenious sulfide would not exhibit the Tyndall effect, whereas a colloidal solution would show the scattering of light due to the presence of colloidal particles.

Q 7. What factors influence the stability of colloidal solutions?

Ans. Factors such as particle size, charge on particles, nature of dispersing medium, and presence of electrolytes can influence the stability of colloidal solutions.

Q 8. What are the applications of colloidal solutions?

Ans. Colloidal solutions have various applications in industries such as medicine (drug delivery systems), food (stabilizers, emulsifiers), cosmetics, photography, and water purification.