وزارة التعليم العالي والبحث العلمي
جامعة المعقل
قسم هندسة النفط
مختبر الكيمياء العامة

EXPERIMENT (4)

Liquid-liquid Extraction

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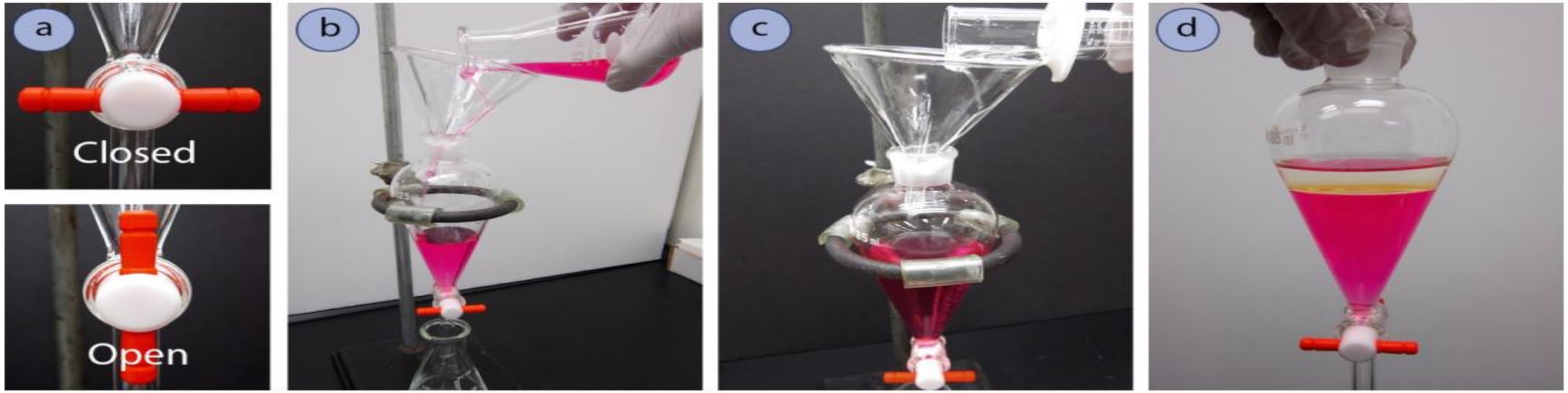
Background:

Extraction is the process of transferring a substance to a solvent. It is useful for separating mixtures of compounds and removing impurities from products. The extractions that you will do for most labs involve colorless substances. Under these circumstances, it is impossible to see in which layer your desired substance resides. Before you begin any extraction procedures for those labs it will be beneficial to try it first with a colored substance, such as iodine, so you can visually see what happens in an extraction. In this lab, you and a partner will use two different organic solvents to extract iodine from water and compare your results. Further, you will compare the efficiency of a single, large volume extraction to the efficiency of three smaller volume extractions.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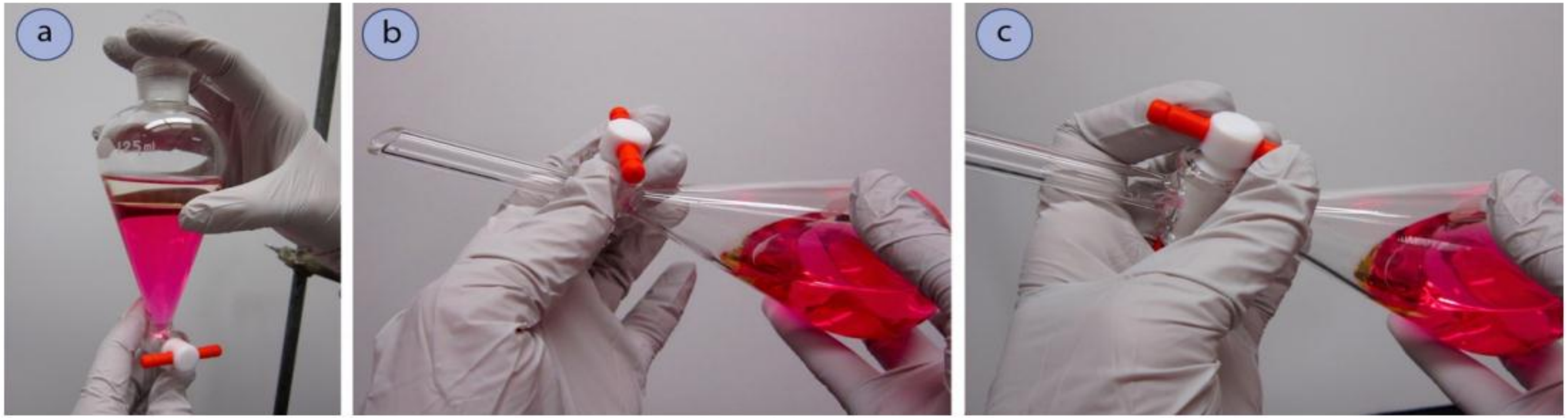
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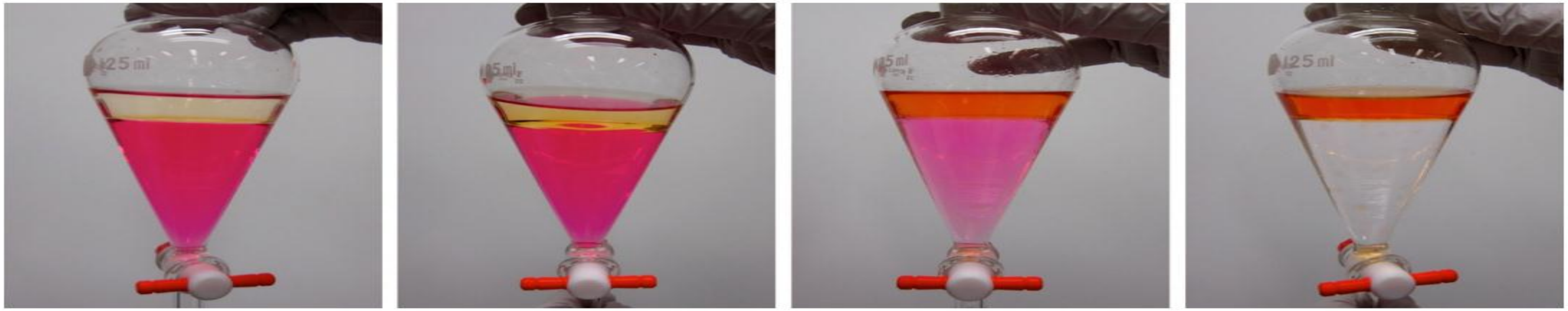

The distribution ratio (D) or partition coefficient :
Is equal to the concentration of a solute in the organic phase divided by its concentration in the aqueous phase.

The distribution ratio can be a function of:

- Temperature.
- The concentration of chemical species in the system.
- A large number of other parameters.

Choice of solvents

No single criterion can be used to assess the suitability of a solvent for a particular application and the final choice is invariably a compromise between competing requirements. Thus not only should the solvent be selective for the solute being extracted but it should also possess other desirable features such as low cost, low solubility in the feed-phase and good recoverability as well as being noncorrosive and noninflammable. Furthermore, interfacial tension between the two phases should not be so low that subsequent phase disengagement becomes difficult and the density difference between the phases should be large enough to maintain countercurrent flow of the phases under the influence of gravity.

Of these factors, the first to be considered is the selectivity of the solvent, or the ease with which it extracts the desired solute from the feed stream.

Selectivity : can be defined as the ability of the solvent to pick up the desired component in the feed as compared to other component.

The desired properties of solvents are **:**

1. A high distribution coefficient.
2. Good selectivity towards solute.
3. Little or no miscibility with feed solution.
4. The solvent should be easily recoverable for recycle.
5. Other factors affecting solvent selection are boiling point, density, interfacial tension, viscosity, corrosiveness, flammability, toxicity, stability, compatibility, compatibility with products, availability and cost.

Phase Equilibria

The first step in the design of any extraction process is the determination of the equilibrium relationships between the feed solution and the proposed solvent. This enables the suitability of the solvent to be assessed in terms of its selectivity, as well as the calculation of the numbers of extraction stages required for any set of flow conditions and degree of separation.

At a certain temperature, the ratio of concentrations of a solute in each solvent in always constant. And **this ratio is called the distribution coefficient,** K. when solvent(1) and solvent (2) are immiscible liquids.

$$K = \frac{concentration\ in\ solvent_2}{concentration\ in\ solvent_1}$$