

Topic: Liquid-Liquid Extraction

Synthesising information from different sources

The following excerpts contain information on the topic of Liquid-Liquid Extraction. Read them carefully and:

- **Using information from all excerpts, write a paragraph of 140 words (not less than 110 and not more than 160) discussing the most important features of Liquid-Liquid Extraction.**

You must:

- **Use information from all sources.**
- **Cite your sources appropriately.**
- **Paraphrase and summarise appropriately! You must not plagiarise!**

Extract 1

Liquid-liquid extraction... with one or two solvents, can be used when distillation is impractical, especially when the mixture to be separated is temperature-sensitive. A solvent selectively dissolves only one or a fraction of the components in the feed. In a two-solvent extraction, each has its specific selectivity for the feed components. Several counter-currently arranged stages may be necessary. As with extractive distillation, additional operations are required to recover solvent from the streams leaving the extraction operation. Extraction is widely used for recovery of bioproducts from fermentation broths. If the extraction temperature and pressure are only slightly above the critical point of the solvent, the operation is termed supercritical-fluid extraction. In this region, solute solubility in the supercritical fluid can change drastically with small changes in temperature and pressure. Following extraction, the pressure of the solvent-rich product is reduced to release the solvent, which is recycled.

1. Seader, J. D.; Henley, E. J.; Roper, D. K. *Separation Process Principles: Chemical and Biochemical Operations*, (3rd ed.); Wiley: New York, 2011, p.11.

Extract 2

Extraction is a process where one or more solutes are removed from a liquid by transferring the solute(s) into a second liquid phase. The second liquid phase, the solvent, is a mass separating agent that must be recovered later. The two liquid phases must be immiscible (that is, insoluble in each other) or partially immiscible... The separation is based on different solubilities of the solute in the two phases. Since vaporization is not required, extraction can be done at low temperature and is a gentle process suitable for unstable molecules such as proteins or DNA.

2. Wankat, P. C. *Separation Process Engineering*, (3rd ed.); Prentice Hall: New Jersey, 2012, p. 510.

Extract 3

Extraction is a common laboratory and commercial unit operation. For example, in commercial penicillin manufacturing, after the fermentation broth is sent to a centrifuge to remove cell particles, the penicillin is extracted from the broth. Then the solvent and the penicillin are separated from each other by one of several techniques. In petroleum processing, aromatic hydrocarbons such as benzene, toluene, and xylenes are separated from the paraffins by extraction with a solvent such as sulfolane. The mixture of sulfolane and aromatics is sent to a distillation column, where the sulfolane is the bottoms product, and is recycled back to the extractor... As these commercial examples illustrate, the complete extraction process includes the extraction unit and the solvent recovery process... In many applications the downstream solvent recovery step (often distillation or a chemical stripping step) is more expensive than the actual extraction step.

3. King, C. J. *Separation Processes*, (2nd ed.); McGraw-Hill: New York, 1980, p. 345.