LIQUID-LIQUID INTERFACESTHEORY AND METHODS pdf

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Liquid-Liquid Interfaces: Theory and Methods is a well-written, informative, one-stop resource that will save you time and energy in your search for the latest information on liquid-liquid interfaces.

This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. May Learn how and when to remove this template message In solvent extraction, a distribution ratio is often quoted as a measure of how well-extracted a species is. The distribution ratio Kd is equal to the concentration of a solute in the organic phase divided by its concentration in the aqueous phase. Depending on the system, the distribution ratio can be a function of temperature, the concentration of chemical species in the system, and a large number of other parameters. Sometimes, the distribution ratio is referred to as the partition coefficient , which is often expressed as the logarithm. Note that a distribution ratio for uranium and neptunium between two inorganic solids zirconolite and perovskite has been reported. The more polar solutes dissolve preferentially in the more polar solvent, and the less polar solutes in the less polar solvent. In this experiment, the nonpolar halogens preferentially dissolve in the non-polar mineral oil. Solutes may exist in more than one form in any particular phase, which would mean that the partition coefficient Kd and distribution ratio D will have different values. This is an important distinction to make as whilst the partition coefficient has a fixed value for the partitioning of a solute between two phases, the distribution ratio changes with differing conditions in the solvent. This quantitative measure is known as the distribution ratio or distribution coefficient. For instance, if a process is fed with a mixture of 1: Slopes of graphs[edit] The easy way to work out the extraction mechanism is to draw graphs and measure the slopes. If for an extraction system the D value is proportional to the square of the concentration of a reagent Z then the slope of the graph of log10 D against log10 [[Z]] will be two. Measures of success[edit] Success of liquidâ€"liquid extraction is measured through separation factors and decontamination factors. The best way to understand the success of an extraction column is through the liquidâ€"liquid equilibrium LLE data set. The data set can then be converted into a curve to determine the steady state partitioning behavior of the solute between the two phases. The y-axis is the concentration of solute in the extract solvent phase, and the x-axis is the concentration of the solute in the raffinate phase. From here, one can determine steps for optimization of the process. Please help improve this article by adding citations to reliable sources. May Learn how and when to remove this template message Batchwise single stage extractions[edit] This is commonly used on the small scale in chemical labs. It is normal to use a separating funnel. Dispersive liquidâ€"liquid microextraction DLLME [edit] A process used to extract small amounts of organic compounds from water samples. The resulting solution is then centrifuged to separate the organic and aqueous layers. This process is useful in extraction organic compounds such as organochloride and organophsophorus pesticides, as well as substituted benzene compounds from water samples. This process is valuable in the extraction of proteins and specifically phosphoprotein and phosphopeptide phosphatases. The two phases would then be separated. The acetic acid can then be scrubbed removed from the organic phase by shaking the organic extract with sodium bicarbonate. The acetic acid reacts with the sodium bicarbonate to form sodium acetate , carbon dioxide , and water. Caffeine can also be extracted from coffee beans and tea leaves using a direct organic extraction. The beans or leaves can be soaked in ethyl acetate which favorably dissolves the caffeine, leaving a majority of the coffee or tea flavor remaining in the initial sample. These are commonly used in industry for the processing of metals such as the lanthanides ; because the separation factors between the lanthanides are so small many extraction stages are needed. Hence, in this way, even if the separation between two metals in each stage is small, the overall system can have a higher decontamination factor. Multistage countercurrent arrays have been used for the separation of lanthanides. It is often the case that the process will have a section for scrubbing unwanted metals from the organic phase, and finally a stripping section to obtain the metal back from the organic phase. Mixerâ€"settlers[edit] Battery of mixer-settlers counter currently interconnected. Each mixer-settler unit provides a single stage of extraction. A mixer settler consists of a first stage that mixes the phases together followed by a quiescent settling stage that allows the phases to separate by gravity.

Mixer-settlers are used when a process requires longer residence times and when the solutions are easily separated by gravity. They require a large facility footprint, but do not require much headspace, and need limited remote maintenance capability for occasional replacement of mixing motors. Colven, ; Davidson, [11] 4 stage battery of mixer-settlers for counter-current extraction. Centrifugal extractors[edit] Centrifugal extractors mix and separate in one unit. Two liquids will be intensively mixed between the spinning rotor and the stationary housing at speeds up to RPM. This develops great surfaces for an ideal mass transfer from the aqueous phase into the organic phase. At â€" g, both phases will be separated again. Centrifugal extractors minimize the solvent in the process, optimize the product load in the solvent and extract the aqueous phase completely. Counter current and cross current extractions are easily established. This is the simplest type of solvent extraction. When a solvent is extracted, two immiscible liquids are shaken together. Some solutes that do not at first sight appear to undergo a reaction during the extraction process do not have distribution ratio that is independent of concentration. A classic example is the extraction of carboxylic acids HA into nonpolar media such as benzene. Here, it is often the case that the carboxylic acid will form a dimer in the organic layer so the distribution ratio will change as a function of the acid concentration measured in either phase. May Learn how and when to remove this template message Using solvent extraction it is possible to extract uranium , plutonium , thorium and many rare earth elements from acid solutions in a selective way by using the right choice of organic extracting solvent and diluent. One solvent used for this purpose is the organophosphate tributyl phosphate TBP. The PUREX process that is commonly used in nuclear reprocessing uses a mixture of tri-n-butyl phosphate and an inert hydrocarbon kerosene , the uranium VI are extracted from strong nitric acid and are back-extracted stripped using weak nitric acid. An organic soluble uranium complex [UO2 TBP 2 NO3 2] is formed, then the organic layer bearing the uranium is brought into contact with a dilute nitric acid solution; the equilibrium is shifted away from the organic soluble uranium complex and towards the free TBP and uranyl nitrate in dilute nitric acid. The plutonium IV forms a similar complex to the uranium VI , but it is possible to strip the plutonium in more than one way; a reducing agent that converts the plutonium to the trivalent oxidation state can be added. Another method is to simply use dilute nitric acid as a stripping agent for the plutonium. Here, when an ion is transferred from the aqueous phase to the organic phase, another ion is transferred in the other direction to maintain the charge balance. This additional ion is often a hydrogen ion ; for ion exchange mechanisms, the distribution ratio is often a function of pH. An example of an ion exchange extraction would be the extraction of americium by a combination of terpyridine and a carboxylic acid in tert- butyl benzene. A non- polar diluent favours the formation of uncharged non-polar metal complexes. At both high- and low-nitric acid concentrations, the metal distribution ratio is higher than it is for an intermediate nitric acid concentration. Ion pair extraction[edit] It is possible by careful choice of counterion to extract a metal. For instance, if the nitrate concentration is high, it is possible to extract americium as an anionic nitrate complex if the mixture contains a lipophilic quaternary ammonium salt. This is a charged species that transfers another ion to the organic phase. The ion reacts and then forms another ion, which is then transferred back to the aqueous phase. For instance, the The chloride anion is then transferred to the aqueous phase. The transfer energies of the anions contribute to that given out by the reaction. In a Polymerâ€"polymer system, both phases are generated by a dissolved polymer. The heavy phase will generally be a polysaccharide , and the light phase is generally Polyethylene glycol PEG. Traditionally, the polysaccharide used is dextran. However, dextran is relatively expensive, and research has been exploring using less expensive polysaccharides to generate the heavy phase. If the target compound being separated is a protein or enzyme, it is possible to incorporate a ligand to the target into one of the polymer phases. This, as well as the absence of solvents or other denaturing agents, makes polymerâ€"polymer extractions an attractive option for purifying proteins. The two phases of a polymerâ€"polymer system often have very similar densities, and very low surface tension between them. Because of this, demixing a polymerâ€"polymer system is often much more difficult than demixing a solvent extraction. Methods to improve the demixing include centrifugation , and application of an electric field. Aqueous two-phase systems can also be generated by generating the heavy phase with a concentrated salt solution. The polymer phase used is generally still PEG. Since polymerâ€"salt systems demix readily they are easier to use. However, at high salt concentrations,

proteins generally either denature, or precipitate from solution. Thus, polymerâ€"salt systems are not as useful for purifying proteins. Ionic liquids are ionic compounds with low melting points. While they are not technically aqueous, recent research has experimented with using them in an extraction that does not use organic solvents. March Learn how and when to remove this template message DNA purification: The ability to purify DNA from a sample is important for many modern biotechnology processes. However, samples often contain nucleases that degrade the target DNA before it can be purified. It has been shown that DNA fragments will partition into the light phase of a polymerâ€"salt separation system. If ligands known to bind and deactivate nucleases are incorporated into the polymer phase, the nucleases will then partition into the heavy phase and be deactivated. Thus, this polymerâ€"salt system is a useful tool for purifying DNA from a sample while simultaneously protecting it from nucleases. The PEGâ€"NaCl system has been shown to be effective at partitioning small molecules, such as peptides and nucleic acids. These compounds are often flavorants or odorants. The system could then be used by the food industry to isolate or eliminate particular flavors. Caffeine extraction used to be done using liquidâ€"liquid extraction, specifically direct and indirect liquidâ€"liquid extraction Swiss Water Method , but has since moved towards super-critical CO2 as it is cheaper and can be done on a commercial scale. Often there are chemical species present or necessary at one stage of sample processing that will interfere with the analysis.

2: Liquidâ€“liquid extraction - Wikipedia

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methods for reversible reactions where the Nernst equa- tion is used as a boundary condition for the resolution of Fick's diffusion equation can be directly transposed.

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9: Liquid-Liquid InterfacesTheory and Methods - CRC Press Book

interfaces, and in particular liquid interfaces (vapor/ liquid, liquid/liquid, liquid/solid) with traditional spec- normal methods cannot. To complement the.

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