Aerated Extraction Column for Reactive Extraction from Fermentation Broth

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1. Introduction

The foreseeable feedstock change in chemical industry towards renewable resources will lead to an increased application of bio-reactions for obtaining the product. The challenge in an overall process with a biotechnological step is the primary recovery of the product, because typically the product is obtained at low concentration in an aqueous environment. Here solvent or reactive extraction are options for first downstream steps.

2. Extraction Design

In extraction from fermentation broths, different challenges have to be mastered. First of all, the extraction equilibrium has to allow efficient and selective removal of the desired product. Reactive selectivity may be especially promising. As shown in Figure 1 for the example extraction of a diamine with D2EHPA, two main parameters are the extractant concentration and pH. Both parameters simultaneously influence the phase separation after extraction. Thus, in overall process optimization a feasible parameter window has to be found. For the example case

- good extraction selectivity is determined by the extraction equilibrium, typically mainly determined by the extractant, where here a sufficiently high pH is required [1]
- re-extraction should be possible with as little as possible salt production by base and acid titration between extraction and re-extraction, which is determined by the extractant, which in the example requires low extractant concentration

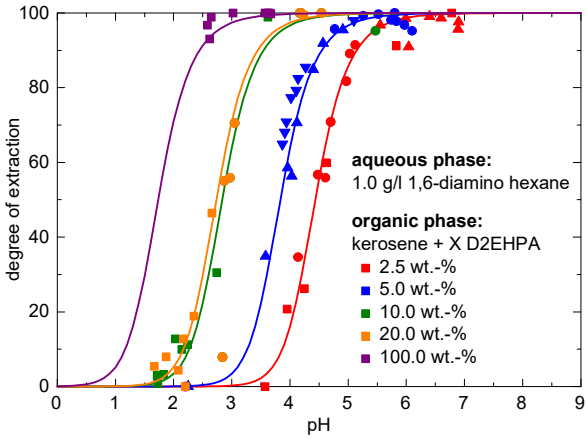

Figure 1. Degree of extraction as basis for design

- high capacity for the product is on the other hand reached with high extractant concentration
- good coalescence is achieved for low extractant concentrations
- low crud-formation tendency induced by biomass strongly depends on extractant concentration and pH
- for in-situ extraction further limitations e.g. on feasible pH range may apply.

3. Results and Discussion

The process designed fulfilling all these requirements has been validated in an extraction column. As an additional challenge during in-situ extraction, constant sufficient oxygen supply is required. This has been achieved with an aerated extraction column with biomass present, which has been built and operated, which thus is run with a four-phase system. Even for this challenging material system, the column performance can be well described with drop-based column simulations up to and including the flooding point.

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