

# Evaluation of vegetable oils to be used in reactive extraction systems as organic phase diluents

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**1. Introduction** – Sharp increases in petroleum-based manufacture costs resulted in the beginning of using fermentation technique for the production of several industrial chemicals, i.e. carboxylic acids (CAs). They can also be found in wastewaters of the productions that CAs are utilized. These cause the need for the efficient recovery of CAs from various types of aqueous solutions, which is still a challenging separation problem in industry. Several methods have been tested for the purpose; however, most could not be widely used and commercialized due to their high toxicity, high cost, difficulty in scaling-up and etc. Recently, reactive extraction is presented as a promising method for the purpose due to its low energy demand, low-cost, ease of operation and high efficiency [1]. An important feature of the technique is its availability to be used *in situ* mode. However, high toxicity of the organic phase members is the disadvantage of the technique and should be eliminated or reduced with the use of appropriate biochemicals. The candidates are also responsible to provide a suitable medium for the reaction between the extractant and target molecule to increase the recovery efficiency. Lately, vegetable oils (VOs) were proposed to be used as organic phase diluents to reduce the toxicity of the system. Moreover, they can reduce the production cost. There are some but not much examples in the literature using VOs for the purpose [2]. This study is on the evaluation of several VO types for the reactive extraction of pyruvic acid (PA) from aqueous solutions. It has a significant importance in several productions and mostly employed in the production of pharmaceuticals, amino acids and other high value added biochemicals [3].

**2. Experimental** – Almost ten different types of VOs were tested for the reactive extraction of PA. Trioctylamine (TOA) was selected as the extractant and its initial amount was altered between 0.2 and 1.0 M, likewise done for initial PA concentration. All results obtained with VOs were compared with those with 1-octanol. Effects of several parameters such as initial acid and amine concentrations, pH and temperature were investigated. Experiments and analyses were performed in duplicate.

**3. Results and Discussion** – Equilibrium studies showed that the increase in the initial concentration of TOA positively influenced the process efficiency, which is consistent with the literature. Among the oils studied, almond oil provided the highest recovery values. Aqueous pH negatively affected the extraction efficiency. Except temperature, all parameters probed were observed to affect significantly. The effect of PA concentration was negative for the extraction when 1-octanol was used. However, the influence was opposite and positive when veggie oils were used as the organic phase diluent. Extraction efficiencies with VO+TOA were about 95% while that with 1-octanol+TOA was almost 97%. Back extraction of the PA was achieved with the use of several types of back extractants. Therefore, an efficient, low-cost and environmentally-friendly recovery of PA was achieved in the present study.

**4. Conclusions** – Results exhibited that VOs can be successfully used to replace organic solvents for the reactive extraction of PA with TOA from aqueous solutions. The improvement shown in this study will enable the reactive extraction process be environmentally-friendly and low-cost for the recovery of PA.

## 5. References

- [1] A. S. Kertesz and C. J. King, *Biotechnol. Bioeng.*, **28**(2), (1986) p. 269
- [2] M. E. Marti, *SUESTD*, **5**(1), (2017) p. 26
- [3] M. E. Marti, T. Gurkan, L. K. Doraiswamy, *Ind. Eng. Chem. Res.*, **50**(23), (2011) p. 13518