



CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This work demonstrates for the first time that the cloud point extraction (CPE) can be scaled up from batch experiments in laboratory scale to continuous operation in a pilot scale, multistage, differential extractor. In batch experiments, the CPE of volatile aromatic solutes: benzene; toluene; and ethylbenzene, from polluted water were carried out at equilibrium condition in laboratory scale. It was found that an increase in operating temperature, added electrolyte (NaCl) concentration and degree of alkylation of aromatic solutes can enhance the solute concentration in the coacervate phase and solute partition ratio with less coacervate volume. The partition ratio of benzene, toluene, and ethylbenzene are 29.4, 65.1, and 162.4 while 77.9, 89.1, and 94.8 % of these solutes are extracted in the coacervate phase at 50 °C, respectively.

The CPE was subsequently scaled up to operate continuously in a multistage, differential rotating disc contactor. Toluene and ethylbenzene were used as the aromatic solutes. The solute concentration in the coacervate phase and the solute partition ratio increase as operating temperature, rotation speed of rotor disc, added electrolyte concentration, wastewater/surfactant solution flowrate ratio and degree of alkylation of the aromatic solutes increase. With the addition of 0.6 M NaCl, 95.0 % of toluene was extracted in the coacervate phase and as high as 282 of toluene partition ratio was obtained even at the lowest operating temperature studied here, which was 40 °C. The number of transfer unit (NTU) was found to be equal to 2.75, which is equivalent to 2.75 batch extractors in the continuous column. The overall volumetric mass transfer coefficient (K_a) and the NTU in the RDC increase with increasing operating temperature and rotation speed of the rotor disc. However, the surfactant partition ratio obtained from continuous operation was substantially high compared to that obtained from batch experiment.

RECOMMENDATIONS

In order to reduce entrainment of coacervate droplets in the rotating disc contactor, it is recommended that the surfactant solution is fed at a lower position in the column. Moreover, a phase splitter may be used to collect the dilute phase stream. The entrained coacervate droplets will settle down at the bottom of the phase splitter. Thus, the dilute phase with less entrained coacervate droplets will leave the system as the effluent treated water.

It is interesting for further investigation to study other parameters such as column height, compartment height between stators, the number of rotor discs, feed location, and recycling of the dilute phase. In addition, the CPE may be applied with various types of solutes and mixed-solute systems. Furthermore, a vacuum stripper unit for surfactant recovery may be combined to the CPE unit as an integrated process.