



CHAPTER-(1)

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Pure aromatics e.g. benzene, toluene and xylenes are the important starting materials for the varieties of petrochemical synthesis. After formation of aromatics by catalytic reforming process¹, it is necessary to adopt an efficient technique/methodology to separate the aromatics from the other products of catalytic reforming like paraffins. Distillation would be uneconomical because of closeness of boiling points of aromatics and paraffins. Solvent extraction then becomes the next preferable choice which at present is the most widely used unit operation for the separation of aromatics from paraffins. The newer solvents like Dimethyl formamide (Dmf) and Dimethyl sulfoxide (Dmso) appear to be more attractive than the conventional glycol solvents for the liquid-liquid extraction of aromatics due to their important advantages like having low viscosity, non-toxicity, low interfacial tension and high solubility for aromatics.

However, very limited information ^{2,3} is available in the literature regarding quaternary liquid-liquid phase equilibrium data for the systems involving aromatics + aliphatics + mixed solvents (Dmf+W)/(Dmso+W) at different temperatures and also the effect of different parameters like molecular weight of aromatics & paraffins and the addition of anti solvent water on the values of selectivity and distribution capacity of these newer solvents. Further, if these equilibrium properties of a four component system consisting of aromatics + aliphatics + solvent + water could be derived from those of component ternaries, much of the experimental work could be avoided.

It is known that the values of extraction capacity (%A_E) and selectivity (%P_E) of a given solvent can be altered considerably by changing the values of temperature of extraction and also by addition of anti solvent. However very little information is available in the literature about "Extraction capacity and selectivity of newer solvents like Dimethyl sulphoxide (Dmso) and Dimethyl Formamide (Dmf) for liquid liquid extraction of aromatics"

Hence, quaternary liquid - liquid phase equilibrium data could be obtained in the case of liquid - liquid extraction of aromatics at different temperatures and different antisolvent concentration values for the following systems consisting of solutes- Benzene/Toluene/Xylene, non solutes Hexane/Heptane/Octane and mixed solvents- (Dmf+W)/(Dmso+W).

- (1) Benzene + Hexane + Dmf + Water.
- (2) Toluene + Hexane + Dmf + Water.
- (3) Xylene + Hexane + Dmf + Water.
- (4) Benzene + Heptane + Dmf + Water.
- (5) Benzene + Octane + Dmf + Water.
- (6) Benzene + Hexane + Dmso + Water.
- (7) Toluene + Hexane + Dmso + Water.
- (8) Xylene + Hexane + Dmso + Water.
- (9) Benzene + Heptane + Dmso + Water.
- (10) Benzene + Octane + Dmso + Water.

Further, the available information in the literature ^{4,5} indicates that liquid-liquid extraction of aromatics could be carried out in packed columns, York - Scheibel columns and R.D.C. columns. In the case of systems involving aromatics+aliphatics+Dmf/Dmso, the value of interfacial tension is very low of the order of 0.30 dynes/cm. hence, the values of effective interfacial area and consequently the rates of extraction of aromatics are likely to be high even in the case of a packed column. Hence, it appears that a packed column ⁶ could be used conveniently for the liquid-liquid extraction of aromatics using newer solvents like Dmf and Dmso.

However, practically no information is available in the literature regarding the hold-up of the dispersed phase, number of transfer units like NTU_{od} and NTU_{oc}, height of transfer units like HTU_{od} and HTU_{oc}, mass transfer coefficients like K_{od,a} and K_{oc,a}, % recovery of aromatics, % purity of extract and yield of aromatics. Further, the effect of variables like continuous and dispersed phase flow rates, solvent to feed ratio on all the above parameters using Dmf/Dmso as solvents for the extraction of aromatics is also not available in the literature.

Hence Liquid-liquid extraction of aromatics can be performed conveniently in a Packed column using a feed –mixture of aromatics +aliphatics as dispesed phase and a mixted solvent containing either Dmf+W or Dmso+W as continuous phase. Solvent to feed ratio can also be varied along with variation in dispersed phase flow rates as well as continuous phase flow rates. Hence "Mass Transfer Data"on liquid-liquid extraction of aromatic could be obtained under different sets of conditions.

Hence, Research work on "Liquid-liquid extraction of aromatics" (B-T-X) could be under taken : -

(1) To obtain quaternary liquid - liquid phase equilibrium data for liquid - liquid extraction of aromatics using solvent - Dimethyl formamide (Dmf) under different sets of conditions.

(2)To obtain quaternary liquid - liquid phase equilibrium data for liquid - liquid extraction of aromatics using solvent - Dimethyl sulphoxide (Dmso) under different sets of conditions

(3)To compare and evaluate the performance of these newer solvents (Dmf and Dmso) with the conventional solvents (DEG and TEG) in terms distribution capacity, and selectivity.

(4) To formulate a mathematical model for predicting the quaternary liquid - liquid phase equilibrium data for these two solvents under consideration from the respective component ternaries of these solvents.

(5)To perform liquid - liquid extraction of aromatics in a packed column under different sets of conditions and to obtain the data on hold up, number of transfer unit, height of transfer unit, overall mass transfer coefficients etc. using these solvents (Dmso and Dmf).

(6) To perform liquid - liquid extraction of aromatics using these solvents in a stage wise manner also in order to increase overall percentage recovery of aromatics.

(7) To compare performance/suitability of these newer solvents with that of conventional solvents for liquid - liquid extraction of aromatics in a packed column.