CHAPTER VI

CONCLUSION

From the results of this work, mass transfer correlation for solid - liquid systems in standard configuration can be expressed as

$$Sh_P = rRe_P^{1.21} Sc^{0.50}, \qquad 1.04\times10^{4} < Re_P < 7.7\times10^{4}$$
$$\text{and} \quad 411 < Sc < 14{,}318$$

Density group is not significant. It means that the difference in density between solid and liquid does not appear to influence mass transfer of low flux solid - liquid pair in standard configuration. Range of density group in this work is between -0.0219 to 0.4104. The constant r depends on solid - liquid systems. Although r in each system is different, the exponent of Reynolds number and Schmidt number are the same for every systems. The 0.5 power on the Schmidt number agree with many correlations. The exponent of the Schmidt number is closed to the value of 1/2 predicted by the surface renewal theory.

In this work the correlations obtained are as follows

The system of benzoic acid coated on various materials - water

$$Sh_P = 1.90\times10^{-6}\ Re_P^{1.21}\ Sc^{0.50}$$

$$4\times10^{4} < Re_P < 7.7\times10^{4}$$

$$411 < Sc < 1{,}032$$

The system of benzoic acid coated on various materials - 13 wt % sucrose solution

$$Sh_P = 3.00\times10^{-6}\ Re_P^{1.21}\ Sc^{0.50}$$

$$3\times10^{4} < Re_P < 5\times10^{4}$$

$$1{,}210 < Sc < 1{,}516$$

The system of benzoic acid coated on various materials - 20 wt % sucrose solution

$$Sh_P = 3.57\times10^{-8}\ Re_P^{1.21}\ Sc^{0.50}$$

$$2.2\times10^{4} < Re_P < 4.5\times10^{4}$$

$$1{,}539 < Sc < 3{,}043$$

The system of benzoic acid coated on various materials - 35.5 wt % sucrose solution

$$Sh_P = 6.48\times10^{-6}\ Re_P^{1.21}\ Sc^{0.50}$$

$$1.04\times10^{4} < Re_P < 2.2\times10^{4}$$

$$7{,}072 < Sc < 14{,}318$$

The discrepancies between our results and those of other workers indicate that mass transfer rate is probably a close function of the geometrical characteristics of the system studied.

Since this work is aimed to study only the low flux mass transfer, so the substance with low solubility is needed. Sometimes the solubility data of the substance at the temperatures studied are not available, To obtain the values, experiments or extrapolations are necessary, which could cause some errors in the overall calculations. Data of the physical properties of the substance are also important. In this work there is no data for density of sucrose solution at the temperatures under consideration. Most data for densities of sucrose solutions are reported at 20 °C. Therefore experiments had to be performed and using a POLYFIT PROGRAM to obtain necessary data. Because of lack of data on diffusivities as a function of temperature other low flux materials mass transfer studies are limited to only one type of solid material. However there are several empirical equations available which could be used to predict the diffusivities data.

This work is to contribute to the continuing studies of mass transfer of low flux solid - liquid pair. The results obtained are important in contributing to the deeper understanding the influence of the physico-chemical properties of the system. Further work is needed not only in low mass transfer processes but also the study of high flux mass transfer.

The results obtained would contribute significantly to the understanding in the designing of chemical reactors that are widely used in the chimecal and petrochemical industries.