CHAPTER 5

CONCLUSIONS

The results from this study concern data on drop size, drop size distributions and velocities of drop as follows:

5.1 Drop size

From the system studied and the particular column and distributor geometrics used in this work, it was shown that Skelland and Johnson's equation to predict drop sizes agree with this set experimental result. Two important parameters for predicting drop sizes have been found to be nozzle diameter and nozzle velocity.

The prediction of drop size from Skelland and Johnson's equation may be extended to other spray columns when there are no coalescence and breakup of drops taking place. Although this predicted equation is considered accurate enough to determine drop sizes in this work, one must be careful of use this equation when the system to be studied is changed. Skelland and Johnson used merely four systems during the study.

5.2 Drop size distribution

The drop size distribution curve obtained in this study agrees with Vedaiyan et al.[12] and Horvath et al.[3] The distribution changes from near normal monomodal to bimodal as the flow rate through the distributor nozzle increases. In this work trimodal and tetramodal behavior was found, which no other research groups have ever found previously.

Interfacial area can be calculated either from distribution curves or from Sauter mean diameter data. However the use of the mean diameter is most convenient, as it is not necessary to use size distribution curves to compute interfacial area.

The size distribution curve may be influenced by the hydrodynamics of the columns and in particular by the continuous phase entrainment. In this work we did not attempt to correlate continuous phase entrainment with drop size distribution, which is certainly interesting. It is believed that for other spray columns the behavior of the size distribution curves as found in this study will be similar when there are no coalescence and breakup of drops occuring.

5.3 Velocities of drop

Spray columns are now modelized using the diffusion model which is well known. In order to create a more appropriate model, one should gain increased understanding on the flow of both continuous and dispersed phases. Other publications have measured the recirculation of continuous phase. In this work attempts to measure the recirculation of continuous phase were made through pitot tube measurements but the velocities involved were much too small to measure. This study is basically a study of flow behavior of the dispersed phase which had never been observed previously. Among the observations made it was found that direction of drop fall tends towards the center of the column and velocity profiles of drops are parabolic in shape. This result is an indirect indication that in the column occurs a continuous phase entrainment, this deduction agrees with observations of some research groups.

Concerning the specific study of velocity profiles of drops, we attemped to correlate parabolic velocity profiles of drop using simple equations but such correlations were made on a single sized column and extention of these correlations to other spray columns has not been checked.

5.4 Schematic flow modeles

The aim of the study being to study hydrodynamic behavior of spray columns some flow models were sketched taking into consideration flow behavior observed in this study. The schematic models in figure 47 are belived to be interesting for study further.

Figure a represents the actual flow hydrodynamics in spray columns. Fibure b to e are the proposed Schematic flow models. In figure b continuous phase flow, entrained continuous phase flow and dispersed phase flow is piston. In figure c continuous phase flow, continuous phase entrainment flow is piston, and each radical position strip to dispersed phase flow is also piston. Figure d continuous phase flow, continuous phase entrainment flow is modelized as a series of stirred tanks, and each radical position strip of dispersed phase flow is also piston. Figure e the continuous phase is modelized as a series of stirred tanks, and dispersed phase is a piston flow. Such schematic flow model should be studied further for increased modelization flexibility of spray columns.

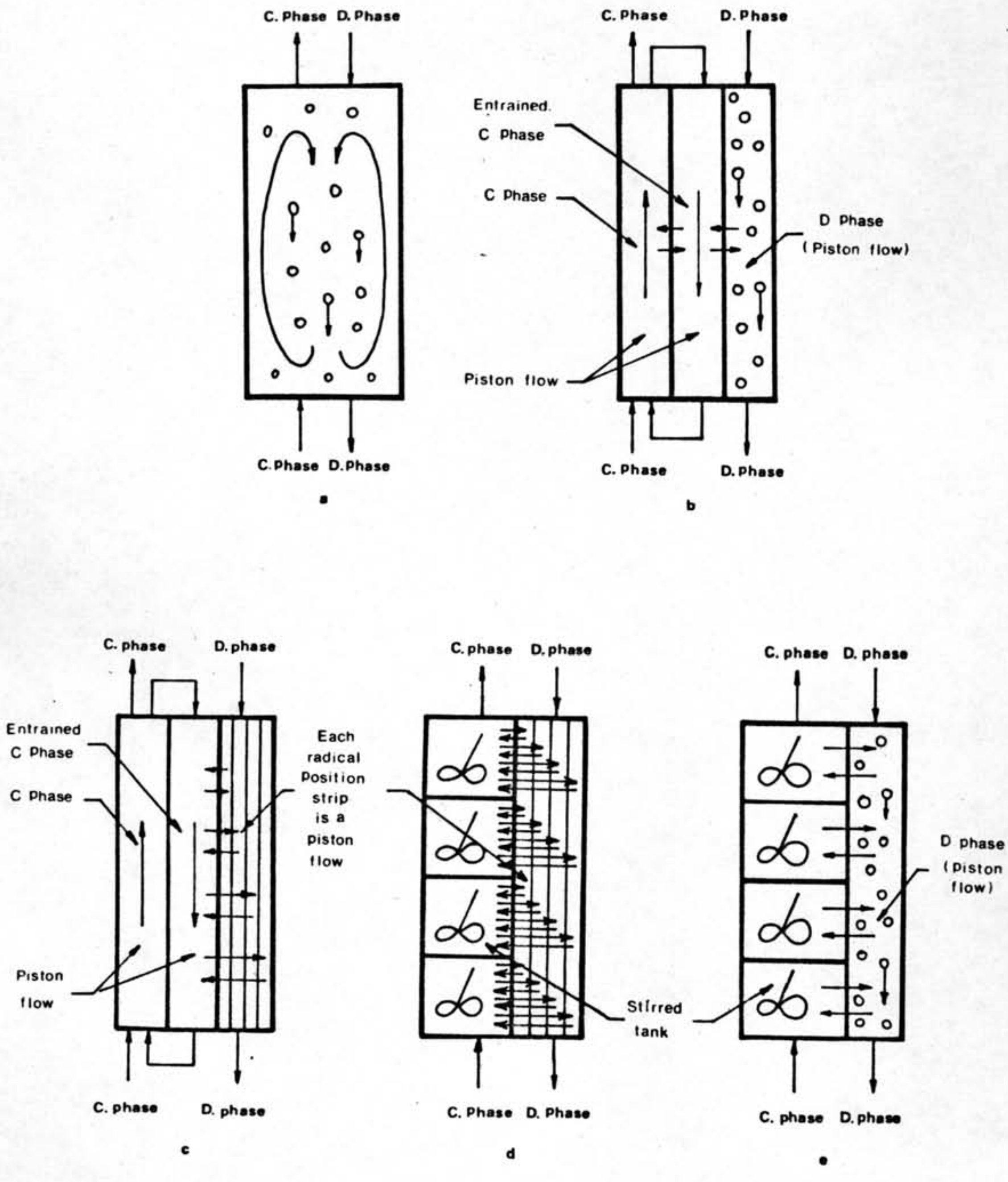

Figure 48 Schematic flow models of spray columns.