CHAPTER I

INTRODUCTION

In liquid-liquid extraction columns and in solid-liquid extraction columns the behavior of the dispersed phase has been shown to be generally non-uniform along the height of the column (1). This is generally due to the influence of turbulence in the continuous phase, to gravity which influences drop velocities in a column, and to the influence of the behavior of the coalescence zone such as the rate of coalescence (or settling) of the dispersed phase particles.

The equation describing the behavior of drops of size $l + dl$ is given by

$$\frac{\partial P(z,l)}{\partial t} = -\frac{\partial (P(z,l)Ud(z,l))}{\partial z} + \frac{\partial}{\partial z} D(z) \frac{\partial P(z,l)}{\partial z}$$

where $P(z,l)$ is the probability of a point at level z to belong to a drop of diameter l, and $Ud(z,l)$ is the real drop velocity of a drop of size l at position z in the column.

The boundary conditions at $z = 0$ and $z = L$ may be expressed as

for $z = 0$ $$\frac{Qd\ f(l)}{A} = P(0,l)Ud(0,l) - D(0)\frac{\partial P(0,l)}{\partial z}$$

for $z = L$ $$P(L,l)Ud(L,l) - P(L,l)Ud^{*}(l) = D(L)\frac{\partial P(L,l)}{\partial z}$$

where A is the cross sectional area of the column and $U_d^*(1)$ is the velocity of coalescence at the z = L interface.

In such a model based on a liquid-liquid model developed by Casamatta (1) the dispersion coefficient D represents dispersion in the continuous phase but this same coefficient influences the droplets without the need for a separate dispersion coefficient for the dispersed phase.

Thus hold up will generally not be rigorously uniform along a column. However if the holdup were to be made uniform throughout the column by for example rearranging column geometry then one can have a uniformly dispersed phase along the axis leading to an optimal rate of mass transfer. This is possible because rearranging the geometry of a column changes the axial dispersion coefficient of the continuous phase for each section of column. Thus for such a computer aided extraction column design to be made there is a need to find relationships between axial dispersion coefficients in the continuous phase of the column of interest with respect to inside column geometry.

The present study aims to develop a simple method to measure axial dispersion coefficients in the continuous phase of a disk and ring pulsed column section.