CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

The rise velocity of single bubbles from the experiment depended mainly on the bubble diameter because the pressure, viscosity, and the surface tension were insignificant. The deviation of the rise velocity from the ideal fluid was caused by the frictional force exerted on the surface area of the single bubble. During the bubble movement, the single bubble was formed into the cylindrical shape by the parallel plates and the frictional force reduced the rise velocity of the single bubble.

The volume of the bubble formed at the orifice and the time of the bubble detachment were calculated by using mass and momentum balances of the bubble. The bubble detached when the radius of the bubble equaled the orifice-to-bubble-center-distance. Not only the acceleration of the solids around the bubble and the wake formed below to the bubble, but also the air leakage from the bubble were the important factors causing the volume of the bubble to deviate from that in an ideal fluid. The percentage of air leakage from the bubble declined when the bubble diameter increased because the large bubble with a high detachment time obtained entering air from the particulate phase to compensate for the leakage air.

The bubbles generated by increasing the air flow rate above that needed for incipient fluidization had higher rise velocity than the bubbles in the minimum fluidized state. The rise velocity of the single bubble increased with increasing air flow rate and the sizes of the bubbles varied with vertical position because of the coalescence of the bubbles. Increasing air flow rate resulted in the higher volumetric air flow rate, the bubbles presented and the bed expanded. Bubbles continued to grow and to coalesce while they rose through the bed.

The air streamlines in the fluidized bed were displayed by the results obtained by using a FORTRAN source code. The appearance of the air streamlines depended on the rise velocity of the single bubble. At the low bubble-rise velocities, there was a higher interchange of air between the bubble and the remote parts of fluidized bed. Increasing the rise velocity above the incipient interstitial air velocity, the air circulation around the bubble was occurred. Since the air circulation was decreased if the rise velocity was increased, the air within the bubble only contacted with the particles moved around the bubble near the surface area of the bubble.

For future work, it will be interesting to study the characteristics of bubbles in a three-dimensional fluidized bed. The frictional force from the wall of the column should then have a smaller effect in retarding the motion of the bubbles. The bubbles will then move in three dimensions and their behavior will nearly approach that expected in an industrial reactor. The mobility of bubbles can be recorded by the video cameras in the different directions because the bubbles will move in various dimensions and the size of the bubbles in the different directions will not be the same.