

STUDIES ON HYDRODYNAMICS, MIXING TIME AND RESIDENCE TIME DISTRIBUTION BEHAVIOUR OF EXTERNAL LOOP AIRLIFT REACTOR

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ABSTRACT: Mixing is one of the important unit operations in chemical and allied industries. Airlift reactors are known to be efficient contactors for processes involving gases, liquids and solids. Airlift reactors are mostly used in biological processes, aerobic waste water treatment, fermentation processes. In the present work focused on investigation of hydrodynamics and mixing index behavior (i.e., gas holdup, residence time distribution) in an external-loop airlift reactor and a stimulus-response tracer technique were used in the measurements. The geometry of External loop airlift reactor of column diameter 100mm and height 1000mm. Pressure drop, Gas hold-up, Mixing time, Residence time distribution have been measured for various electrolytes and solvents with various concentrations have been studied. In addition, the effects of superficial gas velocities on the gas holdup and RTD were also investigated. Comparisons made on both electrolytes and solvents by graphically.

Keywords: external loop airlift reactor, electrolytes, solvents, gas holdup, pressure drop, mixing time, residence time distribution

INTRODUCTION

The airlift reactor (ALR) is a multiphase reactor which is used in gas-liquid or gas-liquid-solid pneumatic contacting devices that are characterized by fluid circulation. It is also defined as a cyclic pattern through channels built specifically for this purpose.. Recent literature reveals that 80% of losses in process is due to improper mixing. Mixing can be achieved in two ways one with moving parts and another without moving parts. Batch and flow reactors come under the first category. The second category includes bubble column, fluidized bed and air lift reactor. The main difference between ALRs and bubble columns (which are also pneumatically agitated) lies in the type of fluid flow, which depends on the geometry of the system. This class of reactor is very attractive for use in the chemical process industry and biotechnology due to their design flexibility, low power requirement, and less pressure drop with further advantages of good mass and heat transfer. The rate of liquid circulation depends on gas flow rate. Two basic classes of the gas lift are distinguished: (i) the internal-loop gas lift reactor (IL-ALR) and (ii) the external-loop gas lift reactor (EL-ALR). The External loop airlift reactor has greater flexibility (Weiland and Onken, 1981) and its performance could be manipulated better by controlling parameters for the individual sections. EL-ALR is selected in this study. Gas holdup is an important hydrodynamic parameter in the reactor. It affects to mass and heat transfer in the system. Gas holdup measurements usually provide overall average information, i.e.

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