Chemical engineering - lab report example

Science, Chemistry

Chemical Engineering

Experiment quantification on Raschig Rings

ABSTRACT

In the process of bio-oxidation, gas-liquid-solid phase fluidized beds werefunctionalfor the treating wastewater which had a number ofserviceablelow density solid particles of varioussize and shape applicable as individual support. Ceramic Raschig ring has high surface area and moderate surface area as a result of its structure that is cylindrical hollow, therefore it is applicable as microorganism's solid support, in which greater rate of mass transfer isattainable. In this experimental report the characteristics ofhydro dynamic which include: material density, bulk density, porosity, surface area per unit volume will be measured and analyzed accordingly.

This is done in order to understand regime flow of gas-liquid and liquid-solid fluidization. Ceramic Raschig rings, air and water are used as the respective solid, gas and liquid phases respectively. The experiment was done in a2m-height, 100 mm ID vertical Plexiglas column. The column has 3 parts; the part of gas-liquid disengagement, test part and part of gas-liquid distribution. Measurements of Bed pressure were made to estimate the leastvelocity of liquid fluidization. By maintaining velocity of gas, the liquid velocity is altered and the influence on expansion ratio, pressure drop, and leastvelocity of liquid fluidization wascalculated for static bed height and various particle size and.

INTRODUCTION

Gas-Liquid-Solid-Phase fluidized beds are in most cases applicable in physical

processes (Murayama, 2005). For instance, process of fixed bed, where both countercurrent and concurrent liquid and gas flow are permitted, and for either of these both flow of bubble, in which the gas flow is discrete, and dribble and the liquid is the continuous phase. This way, the gas forms a continuous phase and the liquid more or less dispersed (Epstein, 2009). Three-phase fluidization can be categorized largely into 4modes.

The first mode is mode I-a; co-current gas-liquid-solid –phase fluidization withliquid as the continuous phase co-current three-phase fluidization. Second mode is mode-I-b that is featured by gas as the continuous phase. The third being mode II-a; inverse three-phase fluidization. The fourth, TCA mode II-b fluidization hascharacteristics of a contact absorber that is turbulent. Modes II-b, and II-a are attained by a flow ofliquid and gas that is countercurrent. Amongst which the most striking one is the co-current three-phase fluidization with the liquid as the continuous phase (Murayama, 2005).

The effectiveoperation and design of a Three-phase bed system that is fluidized is determined by the capability to correctly calculate the vital features of this bed system. Particularly, the mass and heat transfer, mixing of individual phases and the hydrodynamics features (Dhanuka, 2008). Understanding of leastvelocity of liquid fluidization is vital for the effective operation of three-phase fluidized beds. For this system, three-phase fluidized superficial liquid velocity is the least liquid fluidization velocity at which point the bed is fluidized for a particular velocity of gas superficial velocity (Kim, 2001). The least liquid flow rates necessary for fluidization to occur is influenced by a pressure drop plot across the bed versus the velocity

of superficial liquid at continuous rate of gas flow.

In fluidization, the pressure drop measure across the bed will remain uniform with rise in rate of liquid flow rate. Observations influence the least velocity of liquid fluidization since the velocity at which individual bed particle constantly changes location with neighboring particles or velocity at which the bed starts to expand (Epstein, 2009). The pressuredrop of the bed is given by the following equation (i).

$\Delta P = gH (\rho L \varepsilon L + \rho G \varepsilon G + \rho S \varepsilon S)$

Gas-liquid-solid-phase fluidized bed has been applied effectively in the process of bio -oxidation for wastewater treatment with various low-moderate density solid particles of different shape.

Conclusion

Pressure drop is shown to be increasing with the preliminary fixed height of three-phase bed indicating greater need of energy forgreater bed mass fluidizing. The hydrodynamic experimental report of the cylindrical particles of gas-liquid-phase fluidized shows that the least liquid volume of fluidization rises with a rise in particle reduction with a rise ingas volume. However, this volume is not influenced by the three-phase mass of bed. The increase of expansion ratio is as influenced by gas velocity and liquid increase, but reduces with size of particle increase.

Consequently, the ratio of expansion is not affected by mass of bed mass. The bed expansion and its bulk density at least condition of fluidization is considerably not as much of for greatergas volumes. On the other hand, it is nearly similar to different particle sizes and bed mass. Since the expansion ratio increases with the velocity of three-phase fluidization then, this implies

the surface area per volume of bed particles is greater.

References

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