I N T R O D U C T I O N

The term 'fluidised bed' refers to a state of suspension of a bed of granular material acted upon by a rising current of fluid, liquid or gas. The technique found its application first in Winkler gas generator and later on, in different catalytic and non-catalytic processes. Because of its inherent advantages like uniformity in bed temperature, liquid - like behaviour and effective back-mixing, investigations are still being carried out on different aspects like hydrodynamic behaviour of fluidised bed systems, mechanisms and rates of heat and mass transfer, kinetics of various chemical reactions (such as fluid bed catalytic cracking), residence time distribution and related areas of studies.

Although remarkable progress has been achieved in the investigations related to fluidised bed processes, there still remains a considerable gap in the knowledge gained in this field. In certain areas the technique is regarded more as an art rather than a science. A deep probe into the various facets is, therefore, necessary so that laboratory and pilot plant data may be made commercially useful. Again, a good deal of discrepancy exists in the informations reported in various literature. In some cases, the range of application of

correlations proposed is limited. As an example, the equation for the prediction of minimum fluidisation velocity may be cited. Most of the correlations suggested are limited to systems, comprising a single material of definite size range and shape. It is suggested that for mixture of particles of a single material, mean diameter of the particles may be taken into account. The question naturally arises, of the various mean diameters defined in literature, which particular value is to be chosen ? Also, for a binary mixture, even for particulate fluidisation, there exists some sort of segregation and so, the minimum fluidisation velocities for the two sizes would be different. For multi-component mixtures varying in sizes and/or densities, the situation is still more complicated. The size variation of materials may either be originally present, or may occur as a result of attrition,as in the case of catalytic or non-catalytic reactions. Similar difficulties are met with in predicting the expansion behaviour of a heterogeneous fluidised bed system, owing to the segregation tendency.

One important application of fluidised bed systems is in the enrichment or beneficiation of minerals by way of classification. For separating the lighter/finer particles from the heavier/coarser fractions, it is suggested in literature that the minimum fluid velocity to be employed should be equal to or greater than the terminal settling velocity, u_t. The drawback in this approach lies in the fact that for calculating u_t, free fall settling conditions of spherical particles, are taken

into account (in actual practice, hindered settling condition prevails). Also , the values of u_t, obtained by different methods as reported in literature, differ considerably and one is at a less which particular value is to be chosen. It is, therefore, more reasonable to experimentally determine the velocity of carryover of particles (elutriation velocity) and correlate it with the system properties, which will simulate the actual conditions.

In the classification of a mixture of solids according to size, density and shape, it is expected in case of an ideal behaviour that there will be complete separation of the individual components. In actual practice, it is observed that the bed acquires a retentive property and as a result, even for infinite time of separation beyond this definite bed concentration, there will be practically no further separation. Also, the rate of separation is very fast initially and falls off sharply thereafter. It is, therefore, proper to optimize the time of separation even at the cost of relatively inferior quality. In addition, an assessment of the performance characteristics of fluidised bed classifier becomes desirable.

In the present thesis an attempt has, accordingly, been made to investigate some of the aspects discussed above with an eye to its application in the design of a fluidised bed classifier.