EXPERIMENTAL AND MODELING STUDY OF FLUIDIZED BED GRANULATION

U. VENGATESON

DEPARTMENT OF CHEMICAL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
HAUZ KHAS, NEW DELHI – 110016, INDIA

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by

U. VENGATESON

DEPARTMENT OF CHEMICAL ENGINEERING

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CERTIFICATE

This is to certify that the thesis entitled **"EXPERIMENTAL AND MODELING STUDY OF FLUIDIZED BED GRANULATION"**, being submitted by U.VENGATESON to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Chemical Engineering, is a record of bonafide research work carried out by him. U. Vengateson has worked under my guidance and supervision and has fulfilled the requirements for the submission of the thesis.

The results contained in this thesis have not been submitted in part or in full to any other university or institute for the award of any degree or diploma.

Ratan Mohan

RATAN MOHAN
Associate Professor
Department of Chemical Engineering
I.I.T., Delhi

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U. Vengateson

U. VENGATESON
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ABSTRACT

Study of fluidized bed granulation has seen increased interest in the past decade because of some inherent advantages of the fluid bed operation and for its suitability to produce granules of certain powders such as detergents, foods, agrochemicals and pharmaceuticals. In this work three powders – wheat flour, rice powder and marble powder – have been taken as the test materials and experimental and modeling studies were conducted on them. The effect of process parameters like binder flow rate, fluidizing air velocity, inlet air temperature and bed load on the granule growth rate of these powders were determined, using water and aqueous PEG solution as binder. Results obtained showed similarity with those reported in literature for other powders, there of course being quantitative differences as the systems of this study are different. Typical results are — increase of granule growth rate, i.e. bigger granules with increased binder flow rate whereas increase in fluidizing air velocity, increased inlet air temperature and bed load, reduce granule size. Modeling of the granulation process has also been done, using the discretized population balance equation of Hounslow et al. and obtaining required coalescence kernels from the experimental data. Simulation results showed good agreement with experimental data for D_{sv} variation with granulation time. However, simulation results for the cumulative size distribution were less satisfactory, especially in the marble powder case. It was possible to link the coalescence kernel to at least two of the process variables – binder flow rate and fluidizing air velocity – through a scaling factor $\left\lceil \frac{q_b}{\rho_p u_s} \right\rceil$ to have model of some predictive capability. However similar attempt using Stokes number did not yield good results.

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