# WET GRANULATION OF UREA IN A FLUIDIZED BED

By

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**DEDICATED**

**TO**

**MY PARENTS**

# CERTIFICATE

This is to certify that the thesis entitled, **'WET GRANULATION OF UREA IN A FLUIDIZED BED'** being submitted by **Mrs. Papiya Roy** to the Indian Institute of Technology, Delhi for award of Doctor of Philosophy is a record of bonafide research work carried out by her under our guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology, Delhi.

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

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## ABSTRACT

Granulation is a process by which fine particles are combined to form coarse particles. It is widely used in various industries like pharmaceuticals, detergent, agricultural products, food, agrochemical etc. Granulation process is used to improve the density of material, improve flowability, reduce dustiness and co-mixing of materials which will segregate and form cake. Granulation process can be classified into different types like pan, drum, fluidized bed granulation etc.

In fluidized bed top spray granulation, particles are fluidized by supplying air from the bottom and get well mixed. Then a binder solution is sprayed from the top and mix with the particles and form wet granules. As solvent part evaporates from the binder solution by the supplying of air to the mixture, the particles undergo various relative displacements with respect from one another and form dry granules.

This work presents the wet granulation study carried out on urea particles in laboratory batch fluidized bed granulator. Experiments were conducted in fluidized bed of 2.54 cm i.d. with a top spray of saturated urea solution prepared at room temperature. The influence of process related and operating variables like initial particle size, moisture content, inlet air temperature, operating velocity is studied on final granule size, granulation time. The final granule property like density, crushing strength, granulation time has been also studied.

Identification of granulation endpoint is important to prevent the granules from breakage due to collision between particle-particle and particle-granulator wall. The effect of above stated variables on granulation time has also been studied. A simple model has been developed to

estimate the required granulation time and the resultant ratio of size of granules to size of initial particle size were developed and validated

A population balance model has been done for the present experiments. Population balance equation is a mathematical framework which is often applied to systems to describe how the particle size distribution changes with time. The experimental data were used to fit the model parameters of the urea granulation in fluidized bed

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