

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

CONTENTS

CERTIFICATE	i
ACKNOWLEDGEMENT	ii
ABSTRACT	iii
LIST OF FIGURES	ix
LIST OF TABLES	xvi
NOTATIONS	xvii

CHAPTER 1 INTRODUCTION

1.1 Types of Granules	1
1.2 Types of Granulation Process	2
1.3 Purpose of granulation and its application	2
1.4 Mechanism of granulation	3
1.5 Fluidized Bed Granulation	7
1.6 Scope and objective of the work	10
1.7 Outline of the thesis	11

CHAPTER 2 LITERATURE REVIEW

2.1 Fluidized Bed Wet Granulation	13
2.2 Principle of Fluidization	14
2.2.1 Geldart's Classification	15
2.2.2 Bubble Size, Rise Velocity and Bubble Holdup	16
2.2.3 Mixing of Particles	17
2.2.3.1 Attrition and Breakage	17
2.2.4 Heat and Mass Transfer in fluidized Beds	19
2.3 Wet Granulation	20
2.3.1 Effect of Binder	21
2.3.1.1 Concentration	22
2.3.1.2 Viscosity	23
2.3.1.3 Surface Tension	25
2.3.1.4 Interaction with Bed Material	26

2.3.2	Effect of Particle Properties	27
2.3.2.1	Initial particle size fed to the Granulator	27
2.3.2.2	Particle structure-shape factor, Particle Morphology	28
2.3.2.3	Particle Porosity	29
2.3.3	Effect of liquid-particle interaction	29
2.3.3.1	Droplet size	29
2.3.3.2	Atomizer location	29
2.3.3.3	Atomizer velocity	30
2.3.3.4	Different modes of binder addition	30
2.3.4	Equipment related Variables	31
2.4	Maximum moisture content required for wet granulation conditions for granulation	32
2.5	Operating Variables	35
2.5.1	Effect of operating gas velocity on granule growth	35
2.5.2	Bed and inlet air temperature	36
2.5.3	Effect of bed height on granule growth	37
2.6	End point detection of granulation process	38
2.7	Mechanism of Granulation Process	39
2.8	Population balance modeling: Expressions for coalescence kernels	42
2.8.1	Coalescence Kernel	42
2.9	Summery	44
CHAPTER 3 EXPERIMENTAL SETUP AND RESULT DISCUSSION		
3.1	Experimental Facility	46
3.1.1	Measurements	47
3.1.2	Determination of minimum fluidization velocity	49
3.1.3	Binder solution for Wet Granulation	52

3.1.4 Experimental Plan	53
3.2 Experimental Technique	55
3.2.1 Identification of Granulation Time	55
3.2.2 Properties of the Granules	58
3.3 Effect of variables on the Granulation	62
3.3.1 Effect of operating variables on final granule size	63
3.3.1.1 Effect of Moisture content	63
3.3.1.2 Effect of Operating gas velocity	66
3.3.1.3 Effect of Initial Particle size	69
3.3.1.4 Effect of Operating temperature	72
3.3.2 Effect of operating variables on time for granulation	75
3.3.2.1 Effect of moisture content on granulation time	78
3.3.2.2 Effect of operating gas velocity on granulation time	78
3.3.2.3 Effect of initial particle size on granulation time	81
3.3.2.4 Effect of inlet air temperature on granulation time	82
3.4 Dissolution rate	85
3.5 Model development	86
3.5.1 Granulation time	86
3.5.2 Size of granules	88
3.6 Conclusions	91

CHAPTER 4 POPULATION BALANCE STUDIES

4.1 Introduction	92
4.2 Coalescence kernel	98
4.2.1 Characteristic of two-stage kernels	98
4.3 Numerical Solution	100
4.4 Results and discussion	102
4.4.1 Comparison of model simulations and experimental data	102
4.4.2 Comparison of final granule size	108

4.4.3 Estimation of best values of k_1t_1	109
4.4.4 Effect of operating variables on k_1t_1	115
4.4.4.1 Effect of moisture content on k_1t_1	115
4.4.4.2 Effect of operating velocity on k_1t_1	118
4.4.4.3 Effect of inlet temperature on k_1t_1	121
4.4.4.4 Effect of initial particle size on k_1t_1	124
4.5 Conclusions	127
 CHAPTER 5 CONCLUSION	128
5.1 Summary of Conclusions	128
5.2 Recommendation for future work	129
BIBLIOGRAPHY	130
AUTHOR'S BIODATA	142