DEVELOPMENT OF PARTICLE SIZE DETERMINATION MODEL IN HIGH SHEAR MIXING WET GRANULATION

By

Cindy Kho

14110003

BACHELOR'S DEGREE

in

CHEMICAL ENGINEERING – PHARMACEUTICAL ENGINEERING

FACULTY OF LIFE SCIENCES AND TECHNOLOGY

SWISS GERMAN UNIVERSITY

EduTown BSD City

Tangerang 15339

Indonesia

August 2014

Revision after Thesis Defense on July 21, 2014

STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in this thesis.

Cindy Kho

Student Date

Approved by:

Ir. Paulus Gunawan MM.

Thesis Advisor Date

Irvan Kartawiria, S.T., M.Sc.

Thesis Co-Advisor Date

Irvan Kartawiria, S.T., M.Sc.

Dean Date

Cindy Kho

ABSTRACT

DEVELOPMENT OF PARTICLE GROWTH MODEL
IN HIGH SHEAR MIXING WET GRANULATION

By
Cindy Kho
Ir. Paulus Gunawan MM., Advisor
Irvan Kartawiria, S.T., M.Sc., Co-Advisor

SWISS GERMAN UNIVERSITY

Rapid growth rate in high shear mixing wet granulation demands better understanding of its growth kinetics in order to monitor and modify the process. This research aims to report the significance of several process variables in correlation with particle growth. Growth kinetic model was expected to be found and provide implications to granulation technology. Initial particle size, impeller speed and chopper speed was set at two levels of treatment in a binary mixture of lactose and water. The mean size of granules obtained was analyzed through laser diffraction and grid counting method. It was observed that smaller initial size produced larger granules (42.438 µm into 277.514 µm–5.5038 mm vs. 83.712 µm into 152.513 µm–4.5187 mm). Impeller speed showed different trends in correlation with energy threshold for growth (e.g. 220 rpm into 382.487 µm and 110 rpm into 446.035 µm vs. 220 rpm into 348.222 µm and 110 rpm into 152.513 µm). Higher chopper speed was effective in reducing size (e.g. 1500 rpm into 4.4861 mm vs. 750 rpm into 5.4225 mm). Particle growth was steady for granules below 2 mm, while granules above 2 mm showed relatively unsteady growth. Granule growth was extremely fast and granulation is not governed by chemical properties.

Keywords: Granulation, High shear, Growth, Binary mixture, End point

DEDICATION

To the One, who creates.

To the heart who didn't have the chance.

To the lives who didn't take the path.

To the spirits, who don't think they can.

ACKNOWLEDGEMENTS

Only through God's grace, everything is possible. I sing gratitude to Thee.

To Pak Paulus, thank you for the many lessons—in campus, in life and in the enjoyment of great food. Thank you for being kind in every way.

Dearest Pak Irvan, it was definitely fate when I first stepped to your office as a lost kid. Thank you and kudos to you, Sir, for who I am now.

Pak Leiman and Bu Erna, thank you, for the consent and express approval of me conducting this study in PT. Actavis Indonesia. To Mr. Avinash, who showed interest in my work, thank you too.

Huge pile of thanks to both Pak Ian and Kak Faldhy. For the replies to my many questions, for the assisstance in every way possible, I am really grateful.

To my friends, for the wonderful roller coaster years I spent in campus, thank you! It's a monochrome world without all of you.

Dear you, a significant other, thank you for the whole lot thrills and chills we spent together!

Papi and mami, I'm at a loss of words. Thank you for the love showered beyond measure, for the vast support and understanding. I love you both.

Soli Deo gloria.

TABLE OF CONTENTS