



FLUIDIZED BED APPLICATION FOR COMPONENT CLEANING

**MOHD FAUZI BIN HASSIM
(2000339046)**

**A thesis submitted in partial fulfillment of the requirement for the awards of
Bachelor Engineering (Hons) (Mechanical)
Faculty of Mechanical Engineering
Universiti Teknologi MARA (UiTM)**

NOVEMBER 2005

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the Most Gracious who has given me the strength and ability to complete this project and report. All perfect prices belong to Allah S.W.T Lord of the Universe. May his blessing belong upon the prophet Muhammad S.A.W and members of his family and companions.

I would like to take this opportunity to express our appreciation especially to my dear project advisor Mr. Wan Ahmad Najmi bin Wan Mohamed for his guidance, ideas, support and patient while the making of this project. He is helpful and always pleasure to share ideas in solving any problem. Thanks a lot for his tolerance and support in make this assignment made and successful.

Beside that I also like to thank other persons that have helping me to make this project accomplished successful. Especially the all the technicians Mr. Fadzly, Mr. Johari, Mr. Adam, Mr. Farid and many more. Not forget my friends which were very supportive and cooperative in making this project eased and succeed. Thank you.

ABSTRACT

Cleaning process of metal parts becomes an imperative process in the industry and our daily life. For the example, the cleanliness of the machinery component is important to increase its efficiency instead of avoiding it from breakdown. The lubricant used on the machine would transfer as the machine was operating. Additionally, the dust and soil from the environment made it worse.

The conventional method of cleaning metal parts is harmful to the operator and the environment as well. This is because the conventional cleaning process will use chemical solvents. Therefore, the cleaning of metal parts using the principle of fluidized bed is introduced, which has been used for combustion and heat treatment. This cleaning method is new technology and still in development.

This project involved research about the basic fluidized bed principle and this information was then used and innovated for cleaning purposes. Moreover, this project needed the fabrication of a fluidized bed lab scale reactor that is designed to determine the characteristics of this phenomenon. After that, it would be used to clean small metal parts. The lab scale reactor would be the model for further study of this cleaning method and to make a larger cleaning reactor.

Consequently, this project has achieved several of its objectives in determining the bed behavior of the particles without heat supplied and the distribution of temperature without any load. These informations are important for further research using this unit. The results and the discussion of this principle and the fluidized bed scale lab reactor can be gained from this report.

TABLE OF CONTENTS

| CONTENTS | PAGE |
|---|--------------------------|
| ACKNOWLEDGEMENT | i |
| ABSTRACT | ii |
| TABLE OF CONTENTS | iii |
| LIST OF TABLES | v |
| LIST OF FIGURE | v |
| LIST OF ABBREVIATIONS | vi |
| CHAPTER I | INTRODUCTION |
| 1.1 Environmental issue | 2 |
| 1.2 Fluidization Beds Combustion | 3 |
| 1.3 Fluidized Bed Heat Treatment | 4 |
| 1.4 Objectives | 5 |
| 1.5 Methodology | |
| 1.6 Scope | |
| 1.7 Significant of Project | 6 |
| 1.8 Thesis Outline | 7 |
| CHAPTER II | LITERATURE REVIEW |
| 2.1 Introduction | 8 |
| 2.2 Fluidized Particle | 10 |
| 2.2.1 Group A | 10 |
| 2.2.2 Group B | 11 |
| 2.2.3 Group C | 12 |
| 2.2.4 Group D | 13 |
| 2.3 Bed Height | 14 |
| 2.4 Bubble behavior | 14 |
| 2.5 Measurement of Minimum Fluidization Velocity | 15 |
| 2.6 Heat Transfer | 17 |
| 2.7 Relationship between parameters | 19 |
| 2.7.1 Relationship between bed height, bed pressure drop and superficial velocity | 19 |
| 2.7.2 The Effect of Temperature on Bed Pressure Drop | 20 |
| 2.7.3 Relationship between Minimum Fluidization Velocity and Mean Particle Size | 20 |
| 2.8 Detail process of Fluidization of Bed | 21 |
| CHAPTER III | DESIGN |
| 3.1 Introduction | 23 |
| 3.2 Overall Design Objective | 24 |

| | |
|-------------------------------------|----|
| 3.3 Fluidized Bed Lab Scale Reactor | 25 |
| 3.4 The Mechanism of the Cleaning | 26 |
| 3.5 Design of components | 27 |
| 3.5.1 Main tube with flanges | 27 |
| 3.5.2 Distributor | 34 |
| 3.5.3 Upper Cover | 35 |
| 3.5.4 Frame | 36 |
| 3.5.5 Piping | 36 |
| Drawing | 37 |

CHAPTER IV

EXPERIMENTS AND RESULTS

| | |
|---|----|
| 4.1 Introduction | 43 |
| 4.2 Testing | 44 |
| 4.2.1 Introduction | 44 |
| 4.2.2 Procedure | 44 |
| 4.2.3 Result from observation | 45 |
| 4.2.4 Discussion | 47 |
| 4.2.5 Conclusion | 47 |
| 4.3 Fluidizing behavior without heat supply | 48 |
| 4.3.1 Introduction | 48 |
| 4.3.2 Procedure | 48 |
| 4.3.3 Result | 49 |
| 4.3.4 Discussion | 55 |
| 4.3.5 Conclusion | 59 |
| 4.4 The distribution of temperature of the heat gun nozzle and the reactor by heating without air flow. | 61 |
| 4.5 Cleaning components with heat | 64 |

| | | |
|------------------|-------------------|----|
| CHAPTER V | CONCLUSION | 70 |
|------------------|-------------------|----|

| | | |
|-------------------|-----------------------|----|
| CHAPTER VI | RECOMMENDATION | 73 |
|-------------------|-----------------------|----|

| | |
|------------|----|
| REFERENCES | 76 |
|------------|----|

| | |
|----------|----|
| APPENDIX | 78 |
|----------|----|