DESIGN AND DEVELOPMENT OF RECYCLE PLASTIC WALL PANEL MACHINE

Submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment to the requirements for the degree of Bachelor of Manufacturing Engineering.

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……

(PM DR RAJA IZAMSHAH BIN RAJA ABDULLAH)

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ABSTRACT

At present, there are many products that have been produced using materials such as plastics. All societies need to be aware of such a thing as it will have a significant impact on the environment. Plastics can also be categorized according to the type of plastic itself, for example HDPE, LDPE, PVC and PET. The samples of plastic products are bottles, shelves, bottle caps, bowls and more. In fact there is a saying that a total of 2.5 million plastic containers have been discharged just in the environment. This will lead to increased environmental pollution in terms of plastic itself. To ensure the environment and daily life cycle in good condition, we need to take action that plastic waste can be used as a new item such as wall panel. By recycling, it can be maintained for future use besides maintaining the environment. The reason why plastic is easy to recycle is that the plastic properties are light, inexpensive and easily available. The products that can use plastic waste are wall panels. The current wall panels are using Thermal Pressure Machine but there is a problem that is less efficient in terms of time, quality and cost. One of the factors in the plastic material is less material to recycle is the existing machine is now experiencing technological problems it's itself. The ideal process used to produce plastic products is injection molding, extrusion, rolling and hot pressing machines. By using the Deployment Quality Function (QFD) method, we are able to know the demand from customers and thus satisfy the customers' desire for ease of use in the industrial sector. Pugh selection method is also used to choose the best design to produce this wall panel machine. CAD is used to produce design in terms of geometry to see the design of the machine itself.

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ABSTRAK

Pada masa ini, terdapat banyak produk yang telah dihasilkan dengan menggunakan bahan seperti plastik. Segenap masyarakat perlu peka tentang hal sebegini kerana ia akan memberi kesan yang uruk dalam persekitaran alam sekitar. Plastik juga boleh dikategorikan mengikut jenis plastik itu sendiri contohnya HDPE, LDPE, PVC and PET.Antara contoh barang yang telah dihasilkan menggunakan plastik adalah botol, rak, penutup botol, mangkuk dan banyak lagi. Dalam fakta ada mengatakan bahawa sebanyak 2.5 million bekas botol plastik telah dibunag begitu sahaja di persekitaran. Hal sebegini akan menyebabkan peningkatan pencemaran alam sekitar dari segi plastik itu sendiri. Untuk memastikan persekitaran dan kitaran hidup seharian dalam keadaan yang elok, kita perlu mengambil tindakan bahawa bahan buangan plastik boleh dijadikan barang yang baru seperti panel dinding. Dengan cara kitar semula, ia dapat dikekalkan untuk penggunaan pada masa akan datang selain menjaga alam sekitar. Antara sebab plastik mudah untuk dikitar semula adalah kerana ciri-ciri plastik itu sendiri iaitu ringan, murah dan mudah didapati.Produk yang boleh menggunakan bahan buangan plastik ialah panel dinding. Pembuatan wall panel pada masa sekarang adalah dengan menggunakan cara Mesin Tekanan Panas tetapi ia terdapat masalah iaitu kurang efisyen dari segi masa, kualiti dan kos.Salah satu faktor bahan plastik kurang menjadi bahan untuk dikitar semula adalah mesin yang sedia ada sekarang mengalami masalah dari segi teknologi itu sendiri. Proses yang sesuai digunakan untuk menghasilkan produk plastik ialah pengacuan suntikan, penyemperitan, rolling dan mesin tekan panas. Dengan menggunakan cara Fungsi Kualiti Deployment (QFD), kita dapat mengetahui permintaan dari pelanggan dan seterusnya dapat memenuhi kemahuan pelanggan untuk memudahkan penggunaannya di sektor industri.Kaedah pemilihan Pugh juga digunakan untuk memilih rekabentuk yang terbaik

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untuk menghasilkan mesin wall panel ini. CAD digunakan untuk menghasil rekabentuk dari segi geometri untuk melihat reka bentuk mesin itu sendiri.

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DEDICATION

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TABLE OF CONTENT

Abstract	I
Abstrak	II
Dedication	III
Acknowledgement	IV
Table of Contents	V- VII
List if Tables	VIII
List of Figures	IX
List of Abbreviations	X
List of Symbol	XI

CHAPTER 1: INTRODUCTION

1.1. Background of study	1-2
1.2. Problem statement	3
1.3. Objective	4
1.4. Scope	5
1.5. Organization of the report	5

CHAPTER 2 : LITERATURE REVIEW

2.1. Introduction of recycle plastic	6
2.1.1. Plastic	6
2.1.2. Effect of recycle plastic	6
2.2. Category of plastic	7

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2.2.1. PET 7-8
2.2.2. HDPE 8-9
2.2.3. Energy and prices of virgin plastic 10
2.3. Plastic recycling process 11
2.3.1. Collection 11
2.3.2. Sorting 11
2.3.3. Crash 11
2.3.4. Cleaning 11
2.4. Types of process involve in plastic 12
2.4.1. Extrusion process 12
2.4.1.1. Type of Extrusion 13
2.4.1.1.1. Sheet/film extrusion 13
2.4.1.1.2. Blow film extrusion 14
2.4.1.1.3. Tubing extrusion 14
2.4.1.2. Advantage of extrusion 15
2.4.1.3. Challenge in extrusion 16
2.4.2. Rolling process 16
2.4.2.1. Advantage of rolling 16
2.4.2.2. Defect in rolling 17
2.4.3. Injection molding 17
2.4.3.1. Advantage of Injection molding 17
2.4.3.2. Disadvantage if Injection molding 18
2.4.4. Compression molding 19
2.4.4.1. Benefits of Compression Molding 19
2.4.5. Summarization of process 20
2.5. Quality Function Diagram 20-22
2.6. Concept Development and Concept selection 23
2.6.1. Concept Screening 23
2.6.2. Concept Scoring 24
2.6.3. Pugh Method 25

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CHAPTER 3 : METHODOLOGY

3.1. Project Planning 26

3.1.1. Project Flowchart 27

3.1.2. Gantt Chart 28

3.2. Product specification 29

3.2.1. Quality function diagram 29-30

3.3. Selection criteria identification 30

3.3.1. Prepare Reference 31

3.3.2. Conduct survey 31

3.3.3. Gather data and analyse into graphical form 31

3.3.4. Determine list of criteria for concept selection 31

3.4. Design concepts generation 32

3.5. Concept selection using Pugh method 32

3.5.1. Concept screening 32

3.5.1.1. Prepare selection matrix 33

3.5.1.2. Rate the concepts 34

3.5.1.3. Rank the concepts 34

3.5.1.4. Combine and improve the concepts 34-35

3.5.1.5. Select one or more concepts 35

3.5.1.6. Reflect on the results process 35

3.5.2. Concept scoring 35

3.5.2.1. Preparation the Selection matrix 36

3.5.2.2. Rate the concepts 37

3.5.2.3. Rank the concepts 37

3.5.2.4. Combine and improve the concepts 37

3.5.2.5. Select one or more concepts 38

3.5.2.6. Reflect on the results process 38

3.6. Prototyping building of the product 39

3.6.1. Technical drawing 39

3.6.2. Bill of materials 39

3.6.3. Fabrication planning 39

3.7. Pocess involve 39

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CHAPTER 4: RESULT AND DISCUSSION

4.1. Design Specification 41

4.1.1. Easy To Handle 41

4.1.2. Have Part Of Melting The Plastic 42

4.1.3. Included Part That Easy To Make Product Into Sheet 42

4.1.4. Have Cooling Process 42

4.1.5. Element of Continuous Machine 42

4.1.6. Easy To Place 42

4.1.7. Determine List of Criteria For Concept Selection 42

4.1.8. Design Concept Generation 43-44

4.2. Product Mission Statement 44-45

4.3. Quality Function Diagram 45-46

4.3.1. Determine Demand Quality (Whats) 46

4.3.2. Determine The Rating of The Design Specification or Requirement 46-47

4.3.3. Determine Quality Characteristics (Hows) or Engineering Requirement 47

4.3.4. Determine Direction of Improvement 47

4.3.5. Construct Relationship Matrix 48

4.3.6. Construct Correlation Matrix 48

4.3.7. Determine Absolute Importance 48

4.4. Concept Selection Method 49

4.4.1. Concept Screening Phase 49-50

4.4.2. Concept Scoring Phase 50-51

4.4.3. Discussion of Concept Selection Method 51

4.5. Prototype Building of Wall Panel Machine 51

4.5.1. Isometric Drawing 52

4.5.2. Exploded View Drawing 53

4.5.3. Cost of Manufacturing Wall Panel Machine 54

4.5.4. Bill of Material 54-56

4.5.5. Project Procedure 56-57

4.5.6. Machining Process In Fabricate The Wall Panel Machine 57-58

4.6. Heating Element In Wall Panel Machine 59-60

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4.7. Discussion of The Final Wall Panel Machine 61

CHAPTER 5: CONCLUSION

5.1. Conclusion 62

5.2. Future Work and Recommendation 63

REFERENCE XII

APPENDICES XIV

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LIST OF TABLES

2.1. Properties of PET 7

2.2. Properties of HDPE 9

2.3. Energy and Prices of virgin plastic 10

2.4. Summarization of the Process 20

2.5 Four phase of QFD 22

3.1. Gantt chart of project planning semester 1 28

3.2. Gantt chart of project planning semester 2 28

3.3. Screening concept 33

3.4. Rate of concept 34

3.5. Scoring concept 36

3.6 Finer scale for concept rating 37

4.1. Design Concept Generation 43

4.2. Product Mission Statement 44

4.3. Scale Of The Importance Of The Requirement 47

4.4. Direction Of Improvement Symbols 47

4.5. Value Of Numeric In Relationship 48

4.6. Symbols Of Correlation Matrix 48

4.7. Concept Screening Concept 49

4.8. Concept Scoring Phase In Wall Panel Machine 50

4.9. Budget To Fabricate The Wall Panel Machine 54

4.10. Bill Of Material In Wall Panel Machine 55

4.11. Machining Process That Involve In Fabricate 57

4.12. Heating Element In Wall Panel Machine 59

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LIST OF FIGURES

1.1	Product of Wall Panel	2
1.2	Landfills of Plastic	4
2.1.	Extrusion Process	12
2.2.	Sheet Extrusion	13
2.3.	Blow Extrusion	14
2.4.	Tubing Extrusion	15
2.5.	Four Phase of QFD	23
2.6.	Table of screening concept	24
2.7.	Table of Scoring Concept	24
2.8.	Pugh Method	25
3.1	Project Flowchart	27
3.2	Quality Function Diagram	30
4.1.	Quality Function Diagram	46
4.2.	Isometric View	52
4.3.	Exploded View	53
4.4.	Bill Of Materials	55
4.5.	Process Flow Chart In Fabricating	57
4.6.	Development Of The Wall Panel Machine	61

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LIST OF ABBREVIATIONS

HDPE	-	High Density Polyethylene
PP	-	Polypropylene
LDPE	-	Low Density Polyethylene
PS	-	Polystyrene
PVC	-	Plasticised Polyvinyl Chloride
PET	-	Polyethylene Terephthalate
QFD	-	Quality Function Diagram
3D	-	3 Dimension
CAD	-	Computer-aided design

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LIST OF SYMBOL

Mpa	-	Mega Pascal
Gpa	-	Giga Pascal
˚C	-	Degree Celsius
%	-	Percentage
Kg	-	kilogram
F	-	Fahrenheit

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CHAPTER 1

INTRODUCTION

Recycle plastic can easily to get and we must take opportunity to develop a product from that. This project that to develop recycle plastic of wall panel machines due to problem from the pervious process of wall panel. This project discuss the process that matching for produce wall panel from recycle plastic by using new process which is continuous process. Previous process mostly use hot pressing machine to develop wall panel

1.1 Background of study

In this era, there have much improvement that we need to consider to increase the quality life. There have some situation that we have to focus to development of mankind from the different average. From this statement, nowadays there are so many products that we reuse, recycle and reduce (3R). People must know about the important to care about the wastage material that can give benefits from 3R. The material wastage that we focus is product from plastic.

Recycle plastic the most things that we can find easily. It is so many products from plastic such as bottle, rack, bowl, spoon and etc. Regarding this situation, we can collect the wastage plastic to form the usable product for other. The benefits recycle wastage plastic because of the characteristic of the plastic respectively. The characteristic of the plastic are durable, lightweight and inexpensive material. In addition, plastic also can easily be moulded into various shapes. From the fact, every hour American use 2.5 million plastic bottle and most of the bottle are throw away. This goal of recycling the plastic can reduce

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high rate plastic pollution. There have category of plastic which are Polystyrene (PS), Polypropylene (PP), Low- Density Polyethylene (LDPE), Plasticised Polyvinyl Chloride (PVC), High-Density Polyethylene (HDPE) and Polyethylene Terephthalate (PET).

The process that uses to manufacture this wall panel is hot pressing process. In other way the process like sandwich wall panel. The 3D panel is a formless wall framework utilized in the development of inside and outside, bearing and non-bearing wall, rooftops, floors, stairs and significantly more. The boards comprise of an inflexible core of extended polystyrene protection sandwiched between two layers of 2x2-inch eleven gauge steel work which are interconnected by nine-gauge steel brackets puncturing through the polystyrene core at balance points, and spot-welded the steel work layers. The support wires hold the wire work about ¾-inch far from the polystyrene core. At the point when the boards are set up, both sides are covered with a 1½" to 2" layer of Shotcrete that covers the wire work.

Figure 1.1 : Product of Wall Panel (Five Star Bungalow,2015)

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1.2 Problem statement

Nowadays, there are many products that create to become a plastic product including toys, bowl, bottle, cap of bottle and etc. User usually use the product for the certain period time, after the product have limit to use then it will throw away. As we know, there are many recycle materials are still standing in landfills. The person that in charge to collect this recycle material is under controlled to handle that because of many people just throw in landfills.

According to Buasri et al. (2018), in industry and municipal the waste is increase around the world. It represent that, people have responsible to take action by safe this situation. It is not just to produce new product from recycle plastic but at the same time to minimize pollution in the world. According to the fact of plastic, it is estimated that 100 million tonnes of plastics are produced each year.

Realising this situation, recycling is a way to prevent this problem that must take action to improve this. It is also can improve pollution of environment. When use the waste material it can reduce the cost to produce new product.

Current technique to recycle plastic by collection bundle of recycle plastic, sorting the waste with follow the type of plastic, crash into pallet and cleaning process by using detergent. There have some process that suitable for plastic to manufacture new product such as hot press, extrude process, rolling, and injection moulding.

Thus, there is need to develop a new recycle plastic machine and process that are effectives which are less operating cost, easy to operate, high productivity and quality.

The product that we focus is wall panel that produce from recycle plastic. As we know, the process that uses to produce wall panel is hot pressing. The process current use is hot pressing has some problem during manufacture the problem. The process is take long time because it produces one by one set of wall panel.

The process not effective regarding the standard of procedure takes long time.In this project that needs to propose is about the process to manufacture the wall panel. The things that consider design a new machine of recycle plastic by following the needs. The requirement must consider about the quality, cost, time and type of plastic.

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Figure 1.2 shows the waste of plastic in landfills. There are many waste that throw away in landfills.

Figure 1.2: Landfills of plastic (Magazine of The Society for Science and The Public,2018)

1.3 Objective

The objectives of this study are:

i. To improve the current manufacturing technique on plastic recycling process
ii. To design and develop a new effective recycle plastic machine based on QFD design approach.
iii. To evaluate on the effectiveness of the propose recycle plastic machine in term of cost, time and product quality.

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1.4 Scope

This project studies for final project to design and fabricate of recycle plastic wall panel machine. It focuses on the industrial that use or produce product from recycle plastic. The material that focuses on plastic but it is only for waste material. The materials that suitable are recycling plastic. Product to produce by using the recycle plastic is wall panel. In addition, wall panel from recycle plastic can reach target because of the material easy to find. The effective to focus among of product quality, cost and time. This project chooses method of QFD and Pugh method. The focus is to identify the data to design the machine. Type of plastic that use in this project focus on HDPE and PET.

1.5 Organization of the report

There are three chapters for PSM 1 covered of introduction, literature review and methodology. The chapter 1 contains background of study, problem statement that we found from the situation on industry, objective, scope and important of study. Chapter 2 focuses on literature review that we found from journal to support our research dividing into some element on this project. Otherwise in Chapter 3 discuss about methodology that use to produce the product. In PSM 2, it covers of result and conclusion. Chapter 4 focuses on result that we find from the experiment, from the result we will analyse and discuss. For the last chapter is conclusion, that conclude overall of the project.

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CHAPTER 2
LITERATURE REVIEW

In literature review, there are some search that conducts to compile the information about the plastic itself, process that suitable for plastic and others. From the search, the comparison between the processes can conduct and choose the good process regarding to the time, cost, and quality.

2.1. Introduction of recycle plastic

2.1.1. Plastic

Plastic is a material that can be form in several of shape because of the characteristic. According the Practical Action (Recycling plastics n.d.) , giant organic is a molecule that have in organic polymeric material. In addition, plastic is a form of polymeric structure. In polymer structure that have monomer which is a units that repeating in series. The monomer represent the characteristic of that plastic.

The plastic bottle can give warm protection that can diminish the utilization of power for cooling (Safinia and Alkalbani 2016). It is represent the characteristic of plastic respectively. The plastic have the power to cooling that product during in hot season ,it is easily to use even though in hot weather. Furthermore, the recycle plastic is easy to mould in various shape according the requirement.

2.1.2. Effect of recycle plastic

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