

DESIGN OF CHEMICAL MIXER MACHINE

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Design of Chemical Mixer Machine

Report submitted in accordance with the requirements of the Universiti Teknikal
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(Manufacturing Management)

By

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This thesis submitted to the senate of UTeM and has been accepted as fulfillment of the requirement for the Degree of Bachelor of Manufacturing Engineering (Manufacturing Design). The member of the supervisory committee is as follow:

.....

Mr. Zulkeflee Bin Abdullah

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ABSTRACT

This report is provided to explain the result of Chemical Mixer Machine design. The focused company for data collection is Continental Sime Tyre which is located at Alor Star, Kedah. This study covers the importance, benefits, specifications and any related issues that occurred in designing the machine. The data was obtained from several methodologies included the interview, observation, and site visit. In addition the discussion with the customer has been done and specifically discusses the specifications that will be including in the machine. The data was observed and analyzed by using Quality Function Deployment to select the characteristics, types of materials, and manufacturing processes for the product. The result was showed in the House of Quality diagram and the ergonomic consideration has been discussed from it. In addition, the safety factor has been given priority while designing the machine. The Chemical Mixer Machine is an effective processing machine and the application of the machine can be implemented for other mixing purposes.

ABSTRAK

Laporan ini disediakan bagi menerangkan hasil keputusan rekabentuk Mesin Pembancuh Kimia. Syarikat yang difokuskan untuk mengumpul data adalah Continental Sime Tyre yang terletak di which is Alor Star, Kedah. Kajian ini meliputi aspek-aspek kepentingan, faedah, spesifikasi dan isu-isu yang terlibat sepanjang merekabentuk mesin ini. Data dikumpul melalui pelbagai kaedah seperti temuramah, pemerhatian dan lawatan tapak. Selain itu, perbincangan bersama pelanggan juga turut diadakan khusus membincangkan ciri-ciri yang diperlukan bagi mesin tersebut. Maklumat yang diperolehi dianalisis menggunakan kaedah Fungsi Kualiti Strategik atau *Quality Function Deployment* bagi memilih karakteristik, jenis bahan dan proses pembuatan yang sesuai untuk mesin tersebut. Keputusan analisis ditunjukkan di dalam rajah Rumah kualiti atau *House of Quality* dan dari situ penilaian ergonomik telah dilakukan. Ciri-ciri keselamatan pada mesin telah diberi keutamaan di dalam merekabentuk mesin ini. Mesin Pembancuh Kimia adalah sebuah mesin pemprosesan yang efektif dan kepenggunaannya boleh diperluaskan kepada lain-lain tujuan pembancuhan.

DEDICATION

To my beloved family especially my mother and father,
Mrs. Hasimah Bte Abas and Mr. Ismail Bin Abdullah,
I would like to thank my parents for their continuous support to me
in completing this task, and the journey does not end here.

To my supervisor, Mr. Zulkeflee Bin Abdullah
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CHAPTER 1

INTRODUCTION

1.1. Introduction

Manufacturing (from Latin *manu factura*, "making by hand") is the use of tools and labor to make things for use or sale. The term may refer to a vast range of human activity, from handicraft to high tech, but is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale. Manufacturing takes place under all types of economic system. In a capitalist economy, manufacturing is usually directed toward the mass production of products for sale to consumers at a profit. In a collectivist economy, manufacturing is more frequently directed by a state agency to supply perceived needs. In modern economies, manufacturing occurs under some degree of government regulation (Anon, 2007a). Manufacturing is generally a complex activity involving a wide variety of resources and activities and one of the important activities is product design.

Product design is critical activity because it has been estimated 70% to 80% of the cost of product development and manufacture is determined by the decisions made in the initial stages. The design process begins with the development of an original product concept. An innovative approach to design is highly desirable at this stage, and even essential, for the product to be successful in the marketplace. Innovative approaches can also lead to major saving in material and productions costs (Kalpakjian and Schmid, 2006).

In engineering design, the set of decision making processes and activities used to determine the form of an object given the functions desired by the customer (Dieter, 2000). The design of a product requires a thorough understanding of the functions and performances expected of that product (Kalpakjian and Schmid, 2006). The function of a product and what is customer expected to perform from it must be clearly defined by the designer.

Nowadays, machines are one of the backbones in the industrial field around the world. Many products produced from chemical mixture and machines become one of the main elements in the manufacturing field in fulfilling human needs. In order to compete with other competitors, the company has to ensure that the machines used must be relevant and efficient beside fully meet design requirements, products specifications, and standards of the production of the company.

The design of the chemical mixer machine as requested specifications from the customer which is Continental Sime Tyres Sdn Bhd in Alor Star, Kedah will give ease to the company in mixing the chemical substances and relegate the conventional system (human power) which will definitely strive for higher levels of productivity. To develop the machine, the study of its functions and performances expected by the customer must be clearly defined and understood.

Besides, the ergonomic aspects will also be studied in this project and the approaches will be used for further design and development. Ergonomics (or human factors) is the application of scientific information concerning humans to the design of objects, systems and environment for human use (definition adopted by the International Ergonomics Association in 2007). Ergonomics is commonly thought of as how companies design tasks and work areas to maximize the efficiency and quality of their employees' work. However, ergonomics comes into everything which involves people. Work systems, sports and leisure, health and safety should all embody ergonomics principles if well designed (International Ergonomics Association in 2007). It is the applied science of equipment design intended to maximize

productivity by reducing operator fatigue and discomfort. The field is also called biotechnology, human engineering, and human factors engineering.

This chapter will provide an overview of the research and development project entitled “Design and Development of Chemical Mixer Machine for Industrial Purposes”. A project is conducted in Metal & Metal (M) Sdn. Bhd. which situated in Pusat Perindustrian Sg. Chua, Kajang, Selangor Darul Ehsan. It includes the problem statement, objective, scope of study, company background, importance of study and the study outline.

1.2 Company background

Continental Sime Tyre Sdn Bhd (CST), is a joint venture between Continental AG of Germany and Sime Darby Berhad. Continental AG is the fourth largest tyre manufacturer worldwide and one of the world’s leading suppliers to the automotive industry for tyre and brake technology, vehicle dynamic control, as well as electronic and sensor systems.

The tyre manufacturing activity is carried out by its two manufacturing facilities; Continental Sime Tyre PJ Sdn Bhd (CST PJ) with its factory located in Petaling Jaya, and Continental Sime Tyre AS Sdn Bhd (CST AS) located in Alor Setar, Kedah, Malaysia. Its marketing and sales is carried out through Continental Sime Tyre Marketing Sdn. Bhd.

Under the new expansion programme, CST PJ will be specialising in producing Truck and Bus Radial (TBR) tyres and CST AS will be producing various ranges of Passenger Car Radial (PCR) tyres. Upon completion of the ongoing expansion plan, CST PJ will be able to produce 450,000 units of TBR tyres and CST AS 5 million PCR tyres annually.

The smooth running of the organisation’s operations is being carried by a workforce of more than 3,000 employees. The company has the largest tyre dealer network

totaling over 1,000 tyre outlets providing a wide range of car care and tyre services to motorists throughout the country. The tyre brands include Continental, Dunlop, Barum, Sime Tyres and Simex.

The company's research and development (R&D) activities are being carried out by Continental Sime Tyre Technology Centre Sdn Bhd, which transmits Continental's latest tyre technology to CST factories in Alor Setar and Petaling Jaya, Malaysia. Continental Sime Tyre Technology Centre's laboratories are accredited with ISO/IEC 17025 Certification. The tyre-testing laboratory is a registered facility with the UK Vehicle Certification Agency for testing tyres to European ECE regulations. (Anon, 2007b)

1.3 Problem statement

Problem Statement:

1. There is tyre manufacturer use conventional system (human power) in mixing large scale of chemical compound.
2. The varieties of substances need to be mixed well in the tank automatically according to the specific time set.
3. An existed machine not suitable for large production capacity.
4. Safety precaution is not implemented in existed machine.
5. Existed device produce wastages in mixing and transferring substances.

1.4 Project objective

Objectives of the Project:

- 1) To study the need of a chemical mixer machine in industrial sector
- 2) To study the suitable design
- 3) To generate product concept
- 4) To evaluate product concept
- 5) To develop details drawing of the product by using Solidwork

1.5 Scope of project

The project will covered the application of the machine in industrial field especially related to its efficiency in the customer company. The functions of the machine and its desirable levels of performance can be studied during design project. Besides, this design project can find the solutions that are better, faster, less expensive, lighter, safer and also synthesize new ideas in this project. The project also will come out with a few alternative designs and solutions in order to overcome any problem in the designing phases. The project will also determine and establish evaluations criteria with which can be compared with merits of alternative designs by using Quality Function Deployments (QFD) approaches. Finally, customer satisfactions are the main aspect and criteria need to be achieved in this machine design and development project.

1.6 Project benefits

The benefits from the project are:

1. Replace conventional system in mixing large scale of chemical compound.
2. The variety of substances will easily load and mix well in the drum
3. The chemical mixture can easily transfer out through the pipe under the tank which can prevent any accidents and wastages.
4. Improving company profits through the rising of productivity, reducing wastages and man power and avoiding an accident

1.7 Project outlines

This report is divided into seven chapters. Chapter 1 is mainly about the introduction which consists of problem statements, objectives, scope of project, project benefits and the study outlines.

Chapter 2 is the literature review. Based on the reference gathered, this chapter will discuss the aspects of technical, economic, safety and ergonomic aspects from the project materials collected. Besides, this chapter will also explain about data requirement and the basic concept in designing machine, the required functions and finally obtain details manufacturing specifications sufficient for fabricating or assembling the desired project.

Chapter 3 is the methodology part. This chapter is discussed the research methodology that were used to gather the data required to support the development and analysis of the study. This chapter includes the data gathering method, detail discussion and the steps of development Chemical Mixer Machine. The choice of materials and its ability also will be studied and the ergonomic aspects from the materials collected also will be discussed in this chapter.

In Chapter 4, the design concept will be obtained. The analysis will be done to select the best design and next will be proposed to the customer.

Chapter 5 covered the design configuration where it will show the calculation and analysis process of the machine components. Besides, it will describe the joining technique in fabricating the machine and the safety factor that will be built on the machine.

Chapter 6 will explain the detail design of the Chemical Mixer Machine. Each part will be describing more details and the assembly drawing will be obtained. The Quality Function Deployment (QFD) and ergonomic considerations will be obtained and the product specifications will be finalized.

Chapter 7 will conclude the whole study in designing the machine. The benefits from the product and impact to the user will be elaborated in this chapter.

Figure 1.0 shows the steps involved in design and manufacturing product.

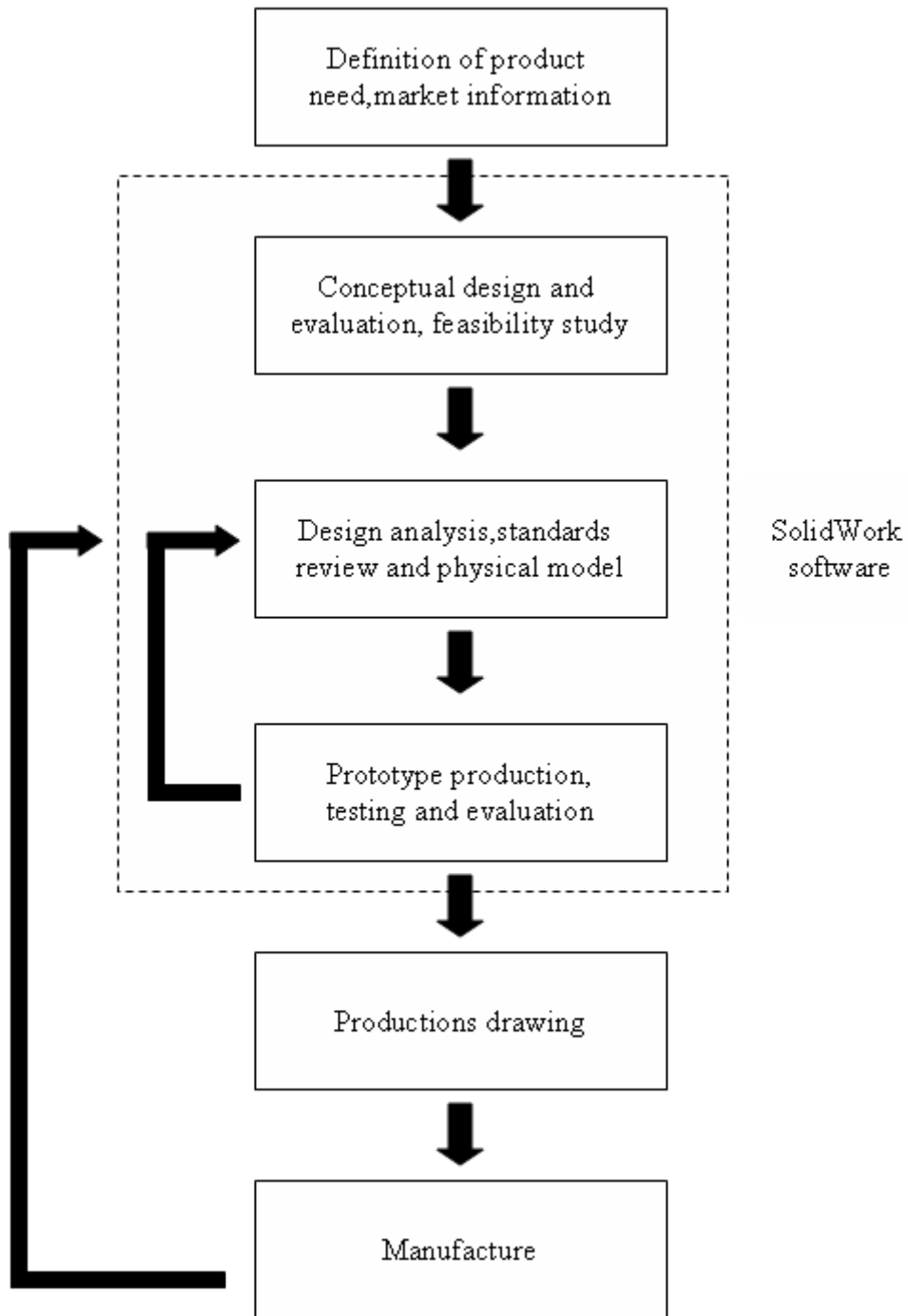


Figure 1.0: The steps involved in design and manufacturing product