



**KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN  
MALAYSIA**

## **Investigate of Parameter Setting in Plastic Injection Molding**

Thesis submitted in accordance with the requirements of the  
Kolej Universiti Teknikal Kebangsaan Malaysia for  
Bachelor of Manufacturing Engineering (Honours) (Manufacturing Process)

By

**Sullyfaizura Mohd Rawi**

Faculty of Manufacturing Engineering

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## DECLARATION

I hereby, declare this thesis entitled “Investigate of Parameter Setting in Plastic Injection Molding ” is the results of my own research except as cited in the reference.

Signature :  .....

Author's Name : SULLYFAIZURA BINTI MOHD RAWI

Date : 19<sup>th</sup> MAY 2006


**KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA**
**BORANG PENGESAHAN STATUS TESIS\***
**JUDUL: INVESTIGATE OF PARAMETER SETTING IN PLASTIC INJECTION MOLDING**
**SESI PENGAJIAN : 2/2005-2006**

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## ABSTRACT

The injection molding process was studied extensively in attempt to create plastic components at the highest quality possible. This project is to investigate of the parameter setting in Plastic Injection Molding. The Arburg Injection Molding was the instrument used for the molding process to produce the “Dog bone Specimen” as a product. Various parameters of the injection molding to s such as Injection pressure, Holding pressure, Temperature of Mold, Temperature of Material, Dosage Volume and Clamping Program as well as other processing parameters such as cooling time were tested. In order to find the optimum parameter settings with the least amount of experiments, the theories of the Design of Experiments (DOE) and 3k Design Factorial were applied. Beside that, measuring the mechanical properties of the polypropylene using the Universal Testing Machine(UTM) to test tensile strength of the material. Maximum value of the tensile strength will be fined based on the testing process.

## ABSTRAK

Pengacuaan suntikan merupakan proses yang paling meluas digunakan untuk menghasilkan pelbagai kompenan plastik pada tahap kualiti yang tinggi. Projek ini adalah menyiasat mengenai penetapan parameter dalam mesin pengacuaan suntikan. Mesin pengacuaan suntikan Arburg adalah insriment yang digunakan dalam projes ini untuk mneghasilkan “Dog bone specimen. sebagai produk. Pelbagai parameter di dalam proses pengacuaan suntikan seperti tekanan penyuntikan, tekanan pegangan, suhu pencairan bahan, suhu acuan, isipadu dos, and program pengapit dan parameter proses lain seperti masapenyjukan turut dilihat. Di samping itu, projek ini juga adalah untuk mendapatkan parameter yang optimum mengikut jumlah experiment yang dijalankan berdasarkan factorial 3k yang digunakan dalam experiment rekabentuk. Selain itu, pengujian bagi melihat keadaan mekanikal specimen yang dihasilkan menggunakan mesin Universal Testing Machine (UTM) untuk menguji kekuatan tegangan pada specimen. bacaan maximum bagi ujian kekuatan tegangan diambil berdasarkan pengujian yang telah dijalankan.

## **DEDICATION**

### ***For Beloved Mother***

*Wan Sepiah Binti Mohd Noor*

### ***For Beloved Sister***

*Sullyhatimarsila Binti Mohd Rawi*

### ***For Beloved brother***

*Mohd Shapuluddin Bin Mohd Rawi*

*Mohd Firdaus Bin Mohd Rawi*

*Mohd Shazruan Bin Mohd Rawi*

*Mohd Multazam Bin Mohd Rawi*

*Mohd Nur Aswad Bin Mohd Rawi*

*Mohamad Faris Jazli Bin Mohd Rawi*

### ***My Beloved Niece***

*Wan Ilya Maisara Binti Wan Mohamad Maizi*

*Wan Ainul Mardiah Binti Wan Mohamad Maizi*

### ***My Beloved Nephew***

*Wan Huzaiyah Bin Wan Mohamad Maizi*

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## LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

ASTM	-	American National Standard
ASTM D 638	-	Standard Test Method For Tensile Properties Of Plastic
ASTM D 3641-97	-	Standard Practice For Injection Molding Test Specimen Of Thermoplastic Molding And Extrusion Materials
ASTM D 4549	-	specification for polystyrene Molding and Extrusion Material (PS)
ASTM D 4101	-	specification for polypropylene plastic injection an Extrusion Material (PP)
$d_o$	-	Diameter
DOE	-	Design of Experiment
$L_o$	-	Length
PP	-	Polypropylene
UTM	-	Universal Testing Machine
MPa	-	Mega Pascal
mm	-	Millimeter
kN	-	Kilo Newton
kg	-	kilogram
Max	-	Maximum
Min	-	Minimum

# **CHAPTER 1**

# **INTRODUCTION**

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

Injection molding is a practical technique used in manufacturing for mass producing plastics parts quickly and inexpensively. As plastic parts have become more popular and critical in modern engineering applications, demand for quality has increased. The principle of injection molding is very simple. Injection molding is process in which a plastic material is heated until it becomes soft enough to force into a closed mold at which point the material cools to solidify and form a specific product. The action that takes place is much like the filling of jelly donut. A hypodermic style cylinder and nozzle inject the heated plastic into an opening creates in closer container(mold). The material is allowed to harden, a finished part is ejected and the cycle is repeats as often as necessary to produce the total number of pieces required.

This project conduct to investigate and optimize of setting parameter in plastic injection molding. For the injection molding process, the parameters include ram speed, injection pressure, barrel and nozzle temperature, mold temperature, mold clamp force, dwell time, cooling time, and material properties. However, for this study only five parameters (temperature of melt, injection pressure, holding pressure, dosage volume and clamping program) were varied while the rest were held constant. 3k factorial design, a formal method of the Design of Experiments (DOE) was applied to test these parameters in an efficient manner, using the least amount of experiments and therefore saving resources and time. The material will be use in this project polypropylene. We choose this material because this material have a

different properties and parameter for other material. So, finally we will find also the accurate result for polypropylene and we can conclude of the quality of product. We also will be do the tensile test of the product produced and analysis the result of the test using the UTM. Processing conditions have very strong influences on properties and performance of parts and products. Changes in processing conditions can lead to improvements or degradation of accuracy, shape, surface finish, fracture resistance and many other part properties and characteristics. One of the major activities of manufacturing engineering is the assessment of the effects of changing process parameter values on part characteristics. The primary use of process models is to predict these effects. Often process models are inadequate for this task, usually because the process is very complex or because accurate material behavior descriptions at processing conditions are unavailable. So the defect of from the result will produce should be analyze and try to improve the quality of the product. Outcome of the defect will be define to produce the better parameter.

## **1.2 PROBLEM STATEMENT**

Nowadays, quite a variety of different technique are employed in the forming polymeric material. Injection molding is the most common method for method for forming plastic polymer. Injection molding is the most widely used molding process for thermoplastics. Injection molding is economical only for large production quantities. Thus, the product of produced using injection molding have are troubleshooting. Most of the defect of the product have a come from not proper parameter setting in plastic injection molding. Beside that, in this project also have to optimize the parameter of the injection and determine the accurate value of the parameter. Before this, the parameter is manually setting and don't have the accurate value. The other side, the problem is to minimize of the defect of the injection molding. A through understanding of the molding process will be help determine the causes.

## **1.2 OBJECTIVE OF PROJECT**

Objective of this project is :

1. To optimize of the parameter in plastic injection molding.
2. To determine the maximum tensile strength value of polypropylene.

## **1.4 SCOPE OF THE PROJECT**

This project to investigate the parameter setting in plastic injection molding, so for the started to optimize the parameter, the sequence of the process is:

- i. Material selection for polypropylene. Pure polypropylene have been used in to investigate the parameter setting in injection molding
- ii. Produce the specimen using Plastic injection Molding. The parameter should be setting based on the parameter selection.
- iii. Tensile test for the produced specimen using Universal Testing Machine (UTM) to find maximum tensile strength of value for each specimen based on different parameter setting.
- iv. Analyze the result and find the optimum result for this investigation for parameter setting of Plastic Injection Molding.

**CHAPTER 2**

**LITERATURE**

**REVIEW**