

**ANALYSES OF MATERIAL FLOW IN TWO AND THREE-PLATE  
MOLDS FOR MOLD DESIGN SELECTION**

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Syukur Alhamdulillah to Allah S.W.T for giving me the spirit to complete this project. Deepest thanks to my beloved wife Azzurawaty, my family and all of my friends.

“You will win if you want”

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## ABSTRAK

Kajian ini dijalankan dengan membuat perbandingan ke atas aliran bahan plastik ke dalam 2 dan 3-plat acuan untuk pemilihan rekabentuk acuan yang terbaik bagi proses suntikan plastik. Pengecas bateri bagi kamera video telah dipilih sebagai bahan kajian. Kajian dilakukan dengan mempertimbangkan semua jenis get (titik masukan aliran plastic ke dalam rongga acuan) yang bersesuaian bagi produk yang dipilih untuk direkabentuk di dalam 2 dan 3-plat acuan. Perisian Moldflow Mold Adviser kemudiannya digunakan untuk mengkaji permasalahan aliran bahan plastik terhadap sistem spru, pelari dan get bagi acuan 2 dan 3-plat. Di akhir kajian ini, di dapati perisian Moldflow Mold Adviser amat membantu di dalam menentukan kedudukan get, memberi panduan mengenai masa suntikan dan suhu nozel yang sesuai semasa proses suntikan plastik, meramalkan kadalaman permukaan berlekuk, kedudukan garis bahan plastik bercantum, kedudukan udara yang terperangkap dan corak aliran bahan berdasarkan kedudukan get, rekabentuk produk dan jenis bahan plastik yang digunakan. Selain itu, perisian ini juga akan memberikan gambaran sejauh mana ledingan dan kualiti penyejukan acuan berdasarkan produk dan rekabentuk saluran penyejuk. Berdasarkan keputusan-keputusan yang diperolehi daripada kajian didapati bahawa acuan 3-plat adalah paling sesuai bagi produk ini. Ini menunjukkan perisian Moldflow Mold Adviser amat berguna bagi membantu pereka bentuk produk dan jurutera pembuatan di dalam mereka bentuk produk, menentukan kedudukan get dan memilih jenis bahan plastik yang bersesuaian bagi produk yang direkabentuk.

## **ABSTRACT**

This study was conducted to compare the flow of plastic material in two and three-plate mold in order to select the best mold design for plastic injection molding process. Battery Charger for Video Camera has been selected as a product to be studied. The study done by considering the suitable gate to locate for the selected part in designing two and three-plate injection molds. Then, the Moldflow Mold Adviser is used to analyze the effect of the material flow to sprue, runner and gate for two and three-plate molds. In the end of this research, Moldflow Mold Adviser helps in order to advise the best position of gate location, equivalent injection time and melting temperature during plastic injection molding process, to show the sink mark, weld line, air trap estimated and skin orientation based on gate location, part design and material used. Besides that, it also advises the warping and cooling quality estimated based on part and cooling channel designed. From the analysis result, three-plate mold is more suitable for this product. So, the Moldflow Mold Adviser is useful to help the designer and manufacturing engineer in designing product, to decide the best gate position and to choose the suitable types of plastic material for the part designed.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction to the Problem

Plastics industry is one of the fastest growing major industries in the world. Every year, the amounts of the plastic products used are increasing. A good example can be seen is in the increase in percentage of plastics used in automobiles today's compared to 15 years ago.

The continuous rate of growth in the industry hinges on the development of improvement and invention of new thermoplastics with greater physical properties. This has opened the door to applications which is never thought possible before. These are emerging both as product innovations and as existing products converted from materials such as metal, glass, wood or paper to plastics for competitive and economic advantages.

The advantages of plastic injection molding are:

- High production rates
- High tolerances are repeatable
- Wide range of materials can be used

- Low labor costs
- Minimal scrap losses
- Little need to finish parts after molding

Meanwhile the disadvantages of plastic injection molding are:

- Expensive equipment investment
- Running costs may be high
- Parts must be designed with molding consideration

The injection mold will directly influence the stress level of the molded product and this has a significant effect on the plastic part properties and how they will ultimately perform when in use.

Injection molds are precise tools that are extremely rugged and can withstand hundred of thousands of continues cycle runs. When an injection molds is properly designed and precisely built, it allows the molds to economically produce plastic parts that will allow the plastic material to perform to its full capabilities. The maximum benefits are achieved with any plastic material and molded product on a well designed and builds molds.

Mold making is a science and not an art. If the mold making not a science then the molder would not be able to reproduce the same part, time and time again with negligible variations and close tolerance, especially when duplicate molds are builds with several cavities of the same part.

Mold designing is the beginning of the manufacturing (production) process and it marks the end of the product development process. The mold design cannot be started until the complete product design and the development have been accepted, followed by the model of actual product have been approved.

So, here the material flow into two and three-plate molds will be analyzed by using mold flow adviser. The capabilities of this software can help to built or design a good mold for injection molding.

## **1.2 Objective of Project**

The objective of this project is to do the analysis by comparing the material flow in two and three-plate molds for injection molding process.

## **1.3 Scope of the Project**

The scope of the study for this project consists:

- Two and three-plate molds
- Factors defected the flow of material to avoid plastic defect
- Moldflow Mold Adviser software for material flow analysis

## **1.4 Methodology of Study**

This research is divided into two parts. Part one is done in first semester and part two is done in the second semester. The activities of part one consists of literature review on plastic injection molding process, analyzing the molds design including the consideration on tooling structure, tooling types, types of gates, air vent, cooling channel and others. Then one product is selected to be used in the study. Based on that product, the molds two and three-plate molds will be designed by using Unigraphics software. Then it is further continued with the study of plastic defect and the machine parameter which affects the material flow into two and three-plate molds. Part two of this project starts with the analysis of the two-plate molds which has been designed in part one of project by using “Mold Flow Adviser”. Three-plate molds are also analyzed. Then the material flow into both of these types of molds will be compared.

## **1.5 Significance of Finding**

The research will produce the new molds design (two and three-plate molds) for the selected product. Hopefully at the end of this project, the research will be:

- Able to understand the mold structure for injection molding process
- Able to design two and three-plate molds for the part selected and any parts in the future
- Able to use Mold Flow Adviser software to do analysis of the material flow into two and three-plate mold designed for part selected and others parts in the future

Figure 1.1 shows the flow chart of the activities done for this project.

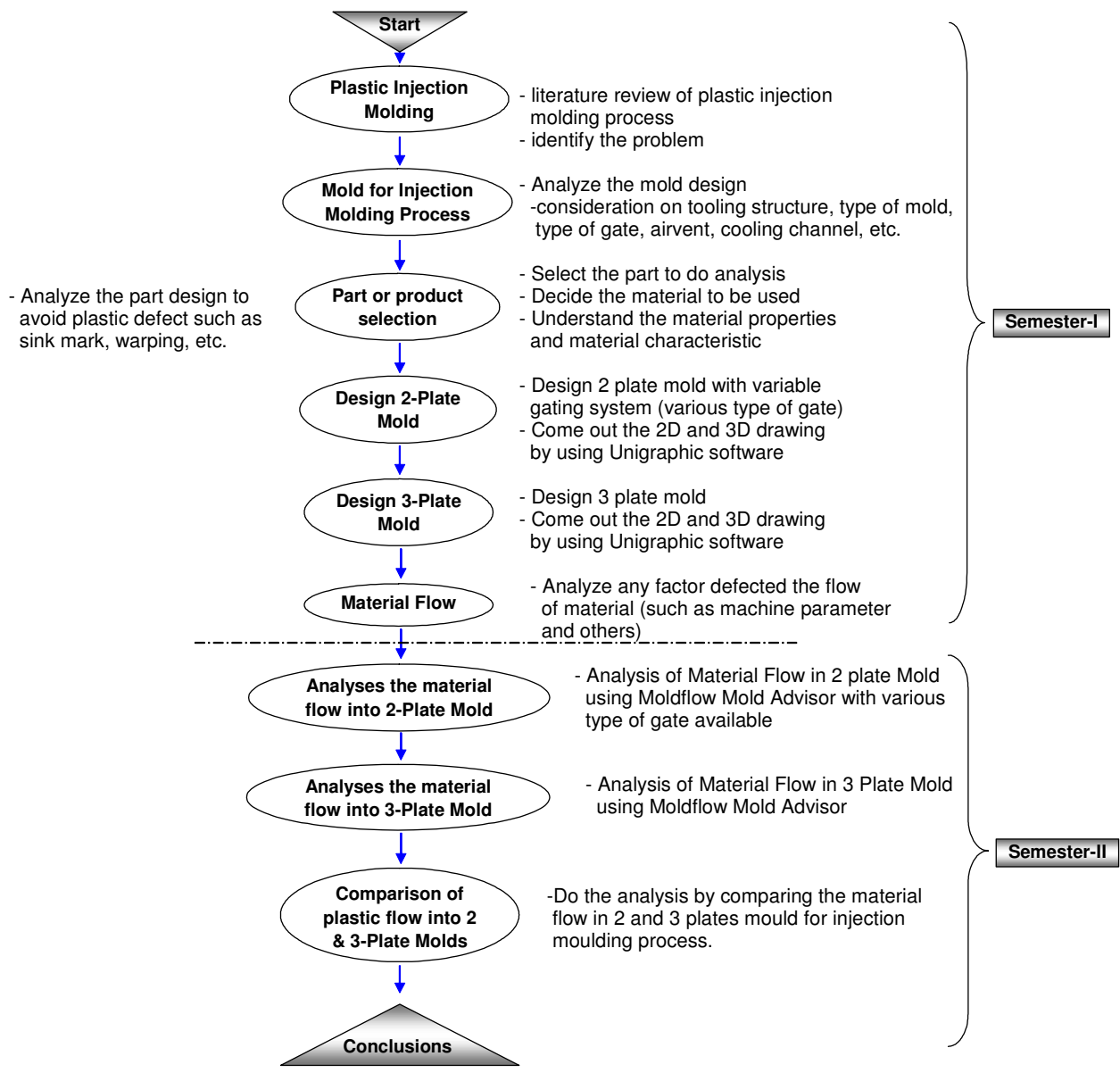


Figure 1.1: Project flow chart

## **1.6 Report Structure**

This report consists of ten chapters.

Chapter 1: Introduction, introduction of the research problem in the plastic injection molding process.

Chapter 2: Literature reviews and overview of the plastic injection and molds.

Chapter 3: Part selection, presented the part which are chosen to do the analysis.

Chapter 4: Mold design for two-plate mold, explain how the two-plate molds designed for the part selected.

Chapter 5: Mold design for three-plate mold, explain how the three-plate molds designed for the part selected.

Chapter 6: Comparison of mold designs, the comparison of two and three-plate mold for the part selected.

Chapter 7: Analysis of material flow in two-plate mold, the analysis of material flow in two-plate mold by using Moldflow Mold Adviser software.

Chapter 8: Analysis of material flow in three-plate mold, the analysis of material flow in three-plate mold by using Moldflow Mold Adviser software.

Chapter 9: Discussion on the analysis of material flow results.

Chapter 10: Conclusions, the conclusion and the future recommendation from this project.

## **1.7 Summary**

In this chapter, the overview of the study such as, introduction to the research area, objective of the study, scope of the study and methodology of the study and also significance of findings is presented. The next chapter will discuss the literature reviews on plastic injection and molds.

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