UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF INJECTION MOLD FOR PLASTIC PRODUCT

This report is submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

By

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This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Pencetakan suntikan telah digunakan secara meluas untuk menghasilkan proses perindustrian global. Yang penting bagi produk plastic berkualiti terbaik. Oleh itu penambahbaikan yang berterusan dalam kualiti ketepatan produk adalah penting untuk mengekalkan kelebihan daya saing dalam industri pengacuan suntikan. Bahan, manusia, mesin, kaedah komponen ini sebagai satu process menghasilkan keberkesanan dan kualiti. Tesis ini memfokuskan kepada spesifikasi alir kerja arahan berdasarkan masa sebenar sepanjang fasa pengacuan suntikan. Kekangan aplikasi dan perbezaan evolusi mereka dengan ketidakcekapan prestasi disiasat dan seterusnya digunakan untuk memperoleh kaedah untuk membayar balik perbezaan parameter proses. Melalui prestasi berbanding dengan sistem nilai yang canggih, sistem pemantauan yang dimulakan oleh pemancar suhu dan tekanan digunakan untuk mengumpul data penjejakan dan meramalkan hubungan masing-masing pemboleh ubah dan struktur bahan plastic. Sistem pengendalian menyusun konsep konfigurasi sistem untuk mengimbangi variasi serta mempengaruhi pengamatan mesin. Program computer menggunakan perisian Solidwork Plastic dan analisis kuantitatif dari industry teknologi telah digunakan untuk memahami proses pencetakan semasa yang membina hubungan antara kegagalan dan pembolehubah. Parameter pencampuran suntikan yang optimum didapati daripada kajian ini. Aliran tindakan undang-undang untuk kajian ini akan mengikuti aliran proses dan carta Gantt. Untuk menghasilkan produk berkualiti, parameter pengacuan suntikan dan bahagian produk mestilah tepat. Untuk mencari dan menentukan keputusan yang dijangkakan simulasi dalam parameter pengacuan suntikan. Tidak ada ujian kekerasan terhadap bata mainan yang dijalankan dalam tesis ini.

ABSTRACT

Injection molding has been extensively used to produce significant global industrial processes of the best quality plastic products. Thus, ongoing enhancements in quality of product accuracy are essential to sustaining a competitive edge in the injection molding industry. Material, man, machine, method of these components as a process generates effectiveness and quality. This thesis focuses on commanding workflow specifications based on actual time throughout the injection molding phase. Application constraints and their evolutionary divergence with performance incompetence were investigated and subsequently used to derive methodologies to reimburse the divergence of process parameters. Through its performance compared to sophisticated value systems, the monitoring system initiated by the temperature and pressure transmitter is used to collect tracking data and predict interrelationships, respectively variables and structures of plastic material. System configuration concepts to compensate for variation as well as to influence machine observations. Computer program using Solidwork Plastic software and quantitative analysis from the technology industry was used to understand the current molding process that builds a connection between failure and variables. . The optimum parameter of injection moulding is to be found from this research. The legal action flow for this study will be following the process flow and the Gantt chart. To produce good quality product the parameter of injection moulding and the part of product must be accurate sizes. To find and determine the expected result of simulation in injection moulding parameter. There is no testing hardness of toy brick was conducted in this thesis.

DEDICATION

To my beloved family. I would like to express my gratitude for the moral support, guidance and motivation in completing my study.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertial
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle
r	-	Density

LIST OF ABBREVIATIONS

PCA	Principal Component Analysis
Al	Aluminium
LDPE	low density polyethylene
HDPE	high-density polyethylene
PP	Polypropylene
ABS	Acrylonitrile butadiene styrene
PET	Polyethylene terephthalate

CHAPTER 1

INTRODUCTION

1.0 Introduction

An understanding by examining and using current literature in order to build up study is one of the tasks necessary for conducting a thesis study. It is a tool for expanding our knowledge based on research, information, and focusing on research issues and bringing clarity. In the meantime, previous study knowledge can improve the methodology and make the results more contextual. It is important to create a theoretical framework, in order to comparison our findings with others and a body of knowledge, using a simple procedure to research the literature in our field of concern and to review these studies.

1.1 Background

Everything related to the mould in this daily life nowadays, such as switching on the fan or lamp, cover switch is made of injection moulding product, mobile charger plug, mobile charger extensions and cover are made from injection moulding. Next, when taking a bath, the toilet soap cover is also made from injection moulding. Almost all types of injection moulding products are needed in our daily lives. All types of these products have their own mould design. Especially all kinds of plastics and die casting. Mould is one of the processes used to make the product with accurate dimensions and tolerance.

Injection moulding has become the most efficient method of producing plastic Products on a large scale. Types of plastic injection products such as key chain, warehouse, bottles, toiletries, toys, casing for electrical and electronic products, automatic parts and more. In order to alleviate a billiard problem, injection moulding was invented. In the basic premise, the moulding of the injection is easy to define: evaporate the plate, inject it into a mould, turn the heat down, and instead start producing a plastic product from either the primary mould. Injection moulding is, in principle, an extremely complicated operation. There should be three major components for an injection moulding machine: the basic components are the clamp, the mould and the injection unit. Plastic cartridges in the barrel of the injection component throughout the hop-picker provender. A screw moves inside the barrel the cartridges. Bands of heating elements packed the warmed up plastic pellets throughout the barrel. As when the pellets were moved forward by the screw, by the time the counterargument is reached, gradually reheat and melt completely. When the plastic is overheated enough in front of the screw, it rams like a syringe plunger. The screw injects the moulded plastic into the empty part of the mould called the cavity. Illustration in a matter of moments. In less than a minute, the plastic strengthens, the mould decides to open and the part is ejected. Consequently, the mould must be closed and the period will always be repeated. All injection moulded particulates start with these plastic pellets, which were a few millimetres in circumference.

Smooth movement is required to avoid permanent damage to the mould. Even from the mould, recovering the part can be difficult. Once the plastic cools, it gets smaller and tightly trapped onto the core half for the mould. Moulds had already installed ejector connectors to try to force the component off the mould. The connectors ' finishes sit squeegee with the mould’s core quarter, but they will not be fully aligned. When the part begins to drop from either mould, an inspector should always start by removing the sprue that is the

plastic segment that attaches the mould's infusion unit. Sprues are manipulated or manually sliced off the part. Sprues should only be directly connected to objects in moulds that create one item at a time. Comparatively small items were made in multiple versions in a single mould. In many of these, the sprue connects not only to the part itself, but also to a production tunnel system called "runners," assisting runners out of the sprue and inserting each cavity into the mould via a small one. Typically, the parts for model planes are still connected directly to their runners. Moulds always have two parts at least. Where the mould parts are discovered is called the dividing line many types of plastic resin in the plastic family these days, but for the most used in warehouse injection in our house such as, high-density polyethylene (HDPE), low density polyethylene (LDPE), Acrylonitrile butadiene styrene (ABS) and polypropylene (PP). (Haque et al., 2018)

Polypropylene was a popular thermoplastic polymer used for many of these Multipurpose properties, mostly in industrial applications. Polypropylene components are moderately strong, translucent, durable, strong and immune to exhaustion and high temperatures. The main manufacturing techniques for polypropylene parts are surface roughness in injection moulding. A wide range of products is readily accessible through all these technologies: bowls, buckets, crates, toys, drums, medical components, bottles, battery cases, etc. Due to their affordability and lightness, plastic injection moulding sections become a key part of the world of large commercial production, especially when there are no mechanical qualifications (Farotti & Natalini, 2018). Recycle plastics recyclables have been given significant exposure globally because they can reduce pollution resources, generate power in production, and minimize overall environmental impact. (Haque et al., 2018) Three varieties of companies often interact directly with product development through most plastic component design. Industrial designers and ergonomics and capability professionals predominantly communicate directly in product development, designing

consistency that works directly with customers and produces actual shape. Mechanical engineers are developing the parts that make up the product. These component parts satisfy the functionalities specified by the customer. Process engineer manufacturing contributes and customizes the features required for variable manufacturing. Product development needs engineers to be comfortable with exceptional quality.

The production situation contributes to the variables of performance and manufacturing. Indeed, injection moulding is a significant aggregate creating method of thermoplastic polymers. Injection moulding operation generates more than 30 percent of all plastic parts. (Thellaputta, Chandra, & Rao, 2017) In response to patterns of technological improvements in machinery, packaging and parts in the clinical, ultrasonic and Information technology industries, microinjection moulding, have been developed and implemented as momentary technological advances in mass production for small, high-precision, high-value added business lines. Precision-injection moulding requires two industry average sections: a few milligrams of micro-component manufacturer or significant component parts with micro / Nano-scale surface features. There is indeed a relatively high concentration gradient throughout the thickness of the part due to other fundamentally small thermal conductivity of polymer products.

1.2 Objective

1. To design and development injection mold for plastic product
2. To simulate polymer flow and fill time use SolidworkPlastic
3. To investigate injection molding parameter

1.3 Scope of the Project

1. Production of good quality products
2. Injection mould machine parameter in fill time and outcomes products

1.4 Problem Statement

Critical parameters of precision in mould design and mould injection. Part is loaded in thicker sections or has increased shrinkage. Amount decreases as plastic cools and dissolves or part was not completely filled due to immediate melting gates or inadequate cooling time. The phase platform cover subculture advances a barrier or amalgamates flow fronts into multi-gated injection moulded parts outcomes in an ineffective adsorption bond. Inadequate clamping force, ground shut-off mould not sitting correctly. Pressurized air degrades resin throughout the mould. Non-uniform pressure due to excessive alignment or shrinking. Increased orientation, resin deterioration, over packaging, pollution or inappropriate design.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Part of the study and research that wants to be produced using injection mould in This chapter. In addition, to study types of raisins and materials in injection moulds. Studying and analysing cavity size, prototype, and rapid prototype.

2.1 Background

Field of research of specification of injection moulding-premium product data Analysis concept-design and development of two-plate moulding. Experimentation proposes at evaluating the best possible variable of injection moulding to produce good quality product seems to be a method of analysing research work and using it as a basis for data collection.

Implementing literature review is indeed an essential and innovative problem that needs to be solved. Conceptual model may be a recommendation for study complement or remuneration. Parameter of injection moulding produces good quality product Research idea design and development of two-plate moulding Research aims to determine the optimum parameter of injection moulding.

2.2 Material Properties

Aluminium alloys were widely found in large-scale engineering applications. Although at higher temperatures, the mechanical properties of Aluminium alloys may change significantly. Aluminium (Al) is a stimulating element with a nuclear number 13 in the boron bunch. The element is described as a delicate, unattractive, gleaming white, foldable metal that makes up about 8 percent of Earth's coverage. Aluminium is by far the most limitless metal in the wrapping and the metal is so synthesized responsive that local explanations are unusual and limited to exceptional situations of decline. Today, aluminium is the second most widely used metal on earth after iron.(Sabapathy, Sabarish, Nithish, Ramasamy, & Krishna, 2019)

Even though aluminium seems to have a high purity-to-weight ratio, those can be far enough strengthened by attaching troops and equipment along with ceramic molecules consequent throughout a metal matrix composite (MMC). The frictional aggression of participants in aluminium alloy is highly dependent on the mechanical properties. The yield stress, the supreme depression and consequent strains along with the Young's modulus appear to be particularly important product characteristics for systemic models using steel alloys. To evaluate the processing attitudes and behaviour of aluminium alloy constructions exposed to flames, it is really important to understand how tensile strengths can improve once the Aluminium alloy material is exposed to extreme temperatures at high temperatures. It has been well recognized that the mechanical characteristics of Aluminium alloys could be greatly affected by atmospheric pressure, and engineers must pay attention to fundamental behaviour patterns when taking into account temperature changes above 93 ° C at 200 ° F. (Saravanan, Inokawa, Tomoshige, & Raghukandan, 2019)