CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Manufacturing usually occurs in large scale that involves mass of production. Beside the manufacturers in the competitive marketplace because of the manufacturing environment, low costs, goals of high rates of production, and high quality. The minimization of cutting fluid also leads to economic benefits by way of saving lubricant costs and workpiece/tool/machine cleaning cycle time (Dhar et al., 2006). In order to improve the traditional manufacturing, many technologies are developed and it causes many machines have been created as well as the tools themselves. There are many types of machine and tools that are used to process the material in manufacturing process. Some of them may involve high cost to operate the process such as cost of machine, cost of maintainence, energy consumption, labor and so on. Therefore, in mass production, it is important to consider the economic aspect in order to make the industry profitable and growth. Many traditional techniques and hybrid methodologies have been developed to make the manufacturing process more effective such as directly assess the machining performance (Jawahir et al., 2003).

Machining process require specific cutting tools to be used in order to obtain optimum machining performance. We can use high quality of material to create better tool for example by using TiN-coated carbide cutting tool as it can stand at high temperature, high cutting-speed and it was prove that can improve the tool life. The coated tools are used more than 40 % in industry and perform more than 80 % to all machining (Cselle and Barimani, 1995). However, the performance of that cutting tool is depending on many variable of cutting conditions.
This project focused on the technique to apply MQL performed in machining AA6061-T6 using coated carbide tool and CNC end milling machine. The mechanical properties for AA6061-T6 depend greatly on the temper, heat treatment, of the material. The aluminum offers advantages over other materials because of its relatively low density, high recyclability, design flexibility in mass production and economic benefit (Chu and Xu, 2004). Besides that, the aluminum is getting more popular due to increasing concern in fuel economy and stringent government emission regulations, lightweight materials Aluminum are also being extensively adopted by design engineers for structural components. Surface finish is essential factor in evaluating the quality of products and average surface roughness ($R_a$) most is common index used to determine the surface finish. The response surface method (RSM) as a statistical method that been used to optimize the surface responses. The RSM quantifies the relationship between response surfaces and input parameters. Fuh and Hwang (1997) constructed a model that can predict the milling force in end milling operations by using RSM method. They measured the speed of spindle rotation, feed per tooth and axial and radial depth of cut as the three major factors that affect in milling operation. The comparison between the experimental data and the values predicted by this prediction model showed the model’s accuracy to be as high as 95%. In this experiment focuses on best usage of machining AA6061-T6 and coated carbide in respect to the cutting force, tool life and surface roughness using the RSM approaches in the CNC milling machine.

1.2 PROBLEM STATEMENT

Performances of milling machine almost depend highly on how fast the machine can cut the work piece. Ulutan and Ozel (2011) mentioned that the accuracy of workpiece dimension, tool wear, surface finish, and tool life on the MRR and cutting tool have increased for enhancing the product performance in relation to the impact of the environment. High productivity needs high rate of metal removal, so it can reduce manufacturing cost and operation time. The large amount of the cutting fluid used in machining is damaging and environmentally harmful become it may contain damaging chemical elements which is dangerous to the skin and lung of the operators plus it can cause air pollution (Sreejith, 2008). The minimal quantity lubrication will be used in our experimental will be compare with another cutting fluid. MQL in an end-milling
process is very much effective regarding (Lopez de Lacalle et al., 2004) and they mentioned that MQL can reach the tool face more easily in milling operations compared with other cutting operations. AA6061-T6 is more suitable choice due to its cost-efficient element (MacMaster et al., 2000) and economical aspect has always been important when it comes to mass production while there is more material such as aluminum alloy AA 6069 (Chu and Xu, 2004). Ghani et al. (2004a) investigated that the coating typically reduced the coefficient of friction between the cutting tools and reduce the tool wear. Eventually, sudden failure of cutting tools lead to loss of productivity, rejection of parts and consequential economic losses. The coated carbide tool is to be considered in this study to evaluate the performance of a machining process depends on tool wear or tool life.

1.3 OBJECTIVE OF THE PROJECT

The objectives of this project are as follows:

i. To experimentally investigate the machining characteristics of aluminum alloy in end mill processes for flooded and MQL techniques.

ii. To investigate surface quality finish of coated carbide cutting tool by using MQL method.

iii. To study the tool wear and the material removal rate regarding the MQL technique.

1.4 PROJECT SCOPE

i. Using CNC milling machine to operate the end milling on AA6061T6 by coated carbide using MQL.

ii. Determine optimum performance of coated carbide cutting tools in milling operation by vary machining parameter which is cutting speed, feed and depth of cut.

iii. Design of experiments and Optimization model develop are prepared using MiniTab software.

iv. Mathematical model used response surface method.