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TREATMENT OF WATER SOLUBLE CUTTING FLUIDS USING MEMBRANE FILTRATION

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ABSTRACT

Metal cutting generates heat due to friction and energy lost deforming the material. The surrounding air has low thermal conductivity (conducts heat poorly) meaning it is a poor coolant. Ambient air cooling is sometimes adequate for light cuts and low duty cycles typical of maintenance, repair and operations. Production work requires heavy cutting over long time periods and typically produces more heat than air cooling can remove. Rather than pausing production while the tool cools, using liquid coolant removes significantly more heat more rapidly, and can also speed cutting and reduce friction and tool wear. Hence water soluble cutting fluid is used in this process to reduce friction, heat and to cool tool- work interface. The main problem with water-soluble coolants is that they become contaminated with use and have to be replaced with new ones, thus yielding waste coolant. However, cutting fluids and metal chips result in environmental pollution and are harmful to the human body. So in order control environmental and harmful effect of cutting fluids on the humans, a membrane filtration system integrated with antibacterial layers is preset to the machine to treat the cutting fluids for removal of metal chips, swarf, lubricants and biological contaminants as it passes through the membranes. The cutting fluid is tested to determine parameters such as pH, concentration of fluid, temperature, corrosion and bacterial contamination of water soluble cutting fluid with and without the filtration system to check the effectiveness with respect to cooling and lubricating properties, its degradation effects on tool and work piece thereby reducing the environmental pollution and harmful effects on workers during use and disposal.

Keywords : Water Treatment, Environment, Pollution

I. INTRODUCTION

[1] During machining process, friction between workpiece - cutting tool and cutting tool- chip interfaces cause high temperature on cutting tool. The effect of this generated heat decreases tool life, increases surface roughness and decreases the dimensional sensitiveness of workmaterial. During metal cutting heat generated as a result of work done .Heat is carried away from the tool and work by means of cutting fluids, which at the same time [2] reduced the friction between the tool and chip and between tool and work and facilitates the chip formation. Cutting fluids usually in the form of a liquid are to the formation zone to improve the cutting condition. The application of cutting fluids is another alternative to obtain higher material removal rates.

Cutting fluids have been used widespread in all machining processes. However, because of their damaging influences on the environment, their applications have been limited in machining processes. Cost effectiveness of all machining processes has been eagerly investigated. This is mainly affected selection of suitable machining parameters like cutting speed, feed rate and depth of cut according to cutting tool and workpiece material. The selection of optimum machining parameters will result in longer tool life, better surface finish and higher material removal rate.

II. OBJECTIVES

The main problem with water-soluble coolants is that they become contaminated with use and have to be replaced with new ones.

- Cutting fluids and metal chips result in environmental pollution and are harmful to the human body
- To improve environmental and harmful effect of cutting fluids on the humans, a membrane filtration system integrated with antibacterial layers is preset to the machine
- It is used to treat the cutting fluids for removal of metal chips, swarf, lubricants and biological contaminants as it passes through the membranes.
- The cutting fluid is tested to determine parameters such as pH, concentration of fluid, temperature, corrosion and bacterial contamination of water soluble cutting fluid with and without the filtration system to check the effectiveness with respect to cooling and lubricating properties
- Its degradation effects on tool and work piece thereby reducing the environmental pollution and harmful effects on workers during use and disposal.

II. LITERATURE REVIEW

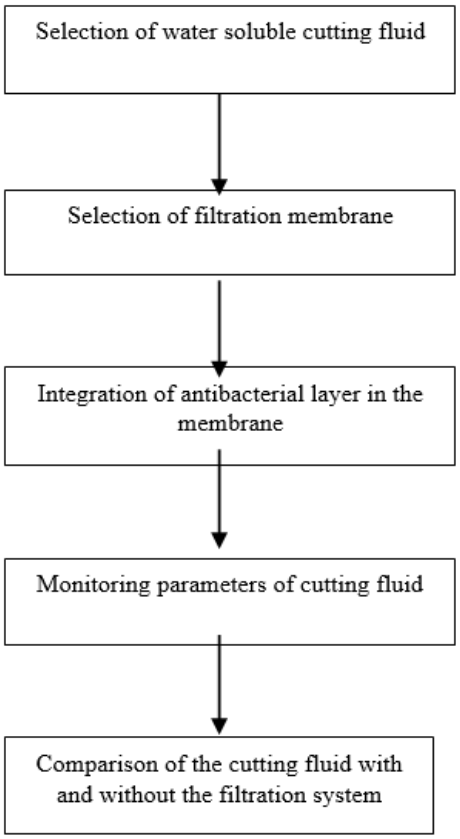
Choon-Man Lee, Young-Ho Choi, Jae-Hyeon Ha, and Wan- Sik Woo[1] In this research it mainly aims Recycling of Cutting Fluids and Metal Chips. Mainly to protect environment eco – friendly technologies were developed. Cutting fluid helps to decrease heat between tool and workpiece interface. It increases tool life and productivity by cooling. Elzbieta Rogos, Andrzej Urbanski[2] In this research it mainly aim in a device and a method for recycling emulsion cutting fluids waste emulsion fluids that has been used in subtractive steel machining were subjected to test after coagulation, barrier filtration, adsorption, and aeration methods. Janja Križan, Arnela Muri, Irena Petrinic, and Marjana Simonic[3] they stated that how to treat membrane treatment of spent cutting-oil before disposal. They needed to be treated before disposal because of losing of their functional properties. The main disadvantage of membrane is that there is particle accumulation in pores of membrane that they don't allow cutting fluid to pass through. Kenji Yamaguchi, Yasuo Kondo, Satoshi Sakamoto,Mitsugu Yamaguchi and Ryoichi Nakazawa[4] they have investigated on recycling of amine-free water-soluble coolant. In this process basically three steps were carried. First they have done execution by separating oil from coolant by using surfactant treatment and second they have done separation of tramp oil process. Contaminant oil is isolated and removed by gravity separation. Third step is filtration. The recycling of amine is done in 3 axis machine then they have observed pH, corrosion, cooling performance because of this advantageous result to use it in water soluble coolant. Karolina dziosa[5] he investigated on analysis of the possibility of used coolant regeneration. In this used coolant contains solid particles, chemical products and

elements of cooling system. It could be recovered by using hybrid membrane techniques. They have determined pH,corrosion, bacterial contaminant. Frederick

J. Passman[6] he has discussed regarding types of microorganisms contaminate present in metalworking fluids. Metalworking fluid spoilage can be defined as any change in the fluid that adversely affects its utility. Four factor that dominate in controlling microbial life are energy source, nutrients and acceptable thermal and pH conditions. Metal working fluid keeps on changing due to physical, chemical and microbiological activity.

IV. METHODOLGY

Work flow model right from selection of water soluble cutting fluid to Comparison of cutting fluid with and without the system is shown in flowchart as given below as follows.



V. RESULTS

The cutting fluid is tested to determine parameters such as pH, concentration of fluid, temperature, corrosion and bacterial contamination of water soluble cutting fluid with and without the filtration system to check the effectiveness with respect to cooling and lubricating properties

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