INTRODUCTION:

Cutting fluids are used in metal machining for a variety of reasons such as improving tool life, reducing work piece and thermal deformation, improving surface finish and flushing away chips from the cutting zone. Practically cutting fluids are classified into four categories such as Straight oils, soluble oils, Semi synthetic fluids and Synthetic fluids. Due to the importance of cutting fluids, significant issues have been raised in their application, recycling and disposal. Proper selection and application can reduce manufacturing cost and improve productivity on the other hand, manufacturing failure and wastes can be experienced by misuse of cutting fluids. And regarding to the environmental impacts and health hazards by cutting fluids, recycling and disposal of cutting fluid are also of great importance. Improper disposal actions can cause severe health and environmental problems.

These problems gave provision for the introduction of mineral, vegetable and animal oils. These oils play an important role in enhancing various aspects of machining properties, including corrosion protection, anti-bacterial protection, lubricity, chemical stability and even emulsibility. Vegetable oils can be classified in to various ways depending upon the source, application etc., oils can be edible or non-edible in nature. Compared to mineral oils vegetable oils in general possess high flash point, high viscosity index, high lubricity and low evaporative losses.

Various researchers have proved the worth of edible vegetable oils viz., coconut oil, palm oil, soya bean oil, canola oil to be used as eco-friendly fluid in recent past. But in present situations harnessing edible oils for lubricants formation restricts the use due to increased demands catering the growing population worldwide and local availability. Non-edible vegetable oils and other tree borne seeds can prove to be an effective alternative, although limited research has been done on varieties like Pongamia Pinnata (karanja), Jatropha curcas (Ratanjyot) etc., prominently for bio fuel applications and needs focused attention for fulfilling the environmentally friendly lubricant need their full potential. Castor, Mahua and Neem also process certain properties which makes them a promising candidate for such formulations. Non-edible vegetable oils are renewable and biodegradable in nature.

OBJECTIVE:

In recognition the importance of coolant in machining, this project is tried to achieve the following objectives:

1. To study the operating characteristics of non-edible oil as metal cutting fluid during drilling operation for mild steel.
2. To conduct experiment for various machining parameters like surface finish, chip-length, pitch length, chip thickness, and cutting force, by using non-edible oil as cutting fluid.
3. To compare the results obtained from non-edible oil, with petroleum based oil and dry running conditions during drilling operation.

**METHODOLOGY:**

Before starting the work, detailed literature survey are carried out on

1. Understanding the use of different types of cutting fluids for different Machining operations
2. Various Vegetable based oils used as a cutting fluid during various machining operations like turning, milling, grinding.
3. Effect of Vegetable based oils on the cutting parameters in Drilling operation. Through Experimentation, the different cutting parameters are investigated to know the performance of Honye, Neem oil and combination of these two oils respectively as cutting fluids on machining efficiency during drilling operation. The cutting parameters may include rotational speed, depth of cut and feed rate. The cutting force for all the data are noted by the use of drill tool dynamometer. Surface characterization like surface roughness are studied in details by determining its surface roughness by the use of surface roughness tester, the chip length, its thickness and its continuity during cutting operation of the work piece is determined. This results obtained helps in understanding the usefulness of Eco-friendly vegetable oil as cutting fluid replacing the petroleum based cutting fluids in the process.

4. Micro structural properties on the surface under the influence of different conditions of cutting fluids are discussed. It is understood that the variation in grain size on the machined surface is generally due to accumulation of heat in the work piece. More variation in grain size, more heat accumulated in work piece which reflects in understanding poor properties of cutting fluids. It holds good for hardness value also.

5. The microstructure and hardness on the surface and its role in determining good cutting fluids are studied in details.

6. Wear characteristics of work pieces obtained after machining with Eco-friendly vegetable oil and petroleum based cutting fluid are studied on pin on disc machine and compared. The wear properties generated here are then correlated with the actual machining process.

**RESULTS AND CONCLUSION:**

1. **PHYSICAL PROPERTIES OF CUTTING FLUIDS USED**
   a) **Flash point:** The highest flash point of 256°C was recorded for the blend of 50% Neem- 50% Karanja.
   b) **Fire point:** The blend of 50% Neem- 50% Karanja has got highest fire point of 290°C.
   c) **Dynamic Viscosity:** Optimum viscosity of 0.01648 N-s/m² was obtained for the blend of 50% Neem- 50% Karanja.
d) **Specific heat:** Comparing with Specific heats of other cutting fluids the blend of 50% Neem- 50% Karanja has got high specific heat of 1.6991 KJ/Kg K.

e) **Adhesiveness:** The Adhesiveness of the fluid should be optimum, i.e. it should not be high as the fluid helps the chips in sticking to machined surface through and if it low fluid flow through the machining zone and will affect the lubricating property. For 50% Neem- 50% Karanja, the value is 359 g/m². This value is optimum compared to others used.

2. **EXPERIMENTAL RESULTS DURING MACHINING WITH VARIOUS CUTTING FLUIDS:**

a) **Cutting force:** The cutting force should be less when a good cutting fluid is used. The cutting force of 169.23N was less for the blend of 50% Neem- 50% Karanja.

b) **Tool and specimen Temperature:** The temperature of tool and specimen was very less when the blend of 50% Neem- 50% Karanja was used. The temperature of tool was 36.2°C and the temperature of specimen was 39.1°C.

c) **Hardness:** Due to friction the heat flows through the specimen and this heat should be less if the cutting fluid is effective i.e. cutting fluid should absorb more heat. Properties of the specimen will vary compared to parent work piece and this change in properties depends on the heat given to the specimen during machining. For 50% Neem- 50% Karanja, the hardness of machined specimen(79.5 HRB) is very nearer to the value obtained with un-machined specimen(78 HRB)

d) **Study of chips formed:** The surface of the work piece depends on the type of chip formed during machining; If the chips formed are continuous and uniform then the cutting fluid used is very good resulting in good surface finish. The continuous chips and uniform were formed for the blend of 50% Neem- 50% Karanja.

e) **Color of the chips:** The chips formed for the blend of 50% Neem- 50% Karanja were in uncoloured silver indicating that heat carried by the chip is less. This can also be observed by the length of the chip which is long and continuous. This type of chip is formed only when the cutting fluid used is very good.

f) **Micro structural analysis:** From Micro structural analysis in case of 50% Neem and 50% Karanja the structure of the metal is same as of the metal before machining. This shows that maximum heat was carried away by the cutting fluid.

**CONCLUSION:**

1. From the above results it was found that the blend of 50% Neem and 50% Karanja is the best cutting fluid compared to other cutting fluids used in this work.

2. It is environmental friendly, bio-degradable, non-hazardous and economical

**FUTURE WORK:**

Petroleum based cutting fluids can be replaced by non-edible vegetable oils for its better performance and healthier environment. Still many other non-edible vegetable oils can be used as cutting fluid and explore their advantages and disadvantages.