

EMULSION COOLANT- AN OVERVIEW

Introduction:

Emulsion coolant or water soluble coolant is the most commonly used Cooling and lubricating agent in machine tools. Ideally, water is the best coolant available; but because of its rusting tendency, it becomes unsuitable for usage. To overcome this problem and to ensure lubrication to reduce friction between the contact metal parts, oil is mixed with water to form an emulsion. Generally, oil and water are immiscible. An emulsifying agent is added to hold water and oil particles together and thus emulsion is formed. Emulsifying agents are normally inorganic whereas oil is organic. Emulsion coolant is of the following types and is based on the type of oil used for making the emulsion:

- Mineral oil based emulsion.
- Semi- Synthetic oil based emulsion and
- Synthetic oil based emulsion.

The life of the oil increases from mineral oil based to synthetic and so is the cost.

Characteristics of a Good Coolant:

The water soluble coolant is a mixture of oil and water and it should possess the following characteristics:

1. The coolant must cool and lubricate the point of contact of both the tool and work piece. At the point of contact, the temperature generated is around 300- 350 degrees centigrade and it is necessary to bring down this temperature to room temperature to ensure no change in work piece properties and shape. Further the friction generated due to the contacting metals may cause deformation in the job. To reduce this, the contact must be well lubricated. The coolant must perform both the above effectively.
2. The quality of coolant is highly dependent on the type of water used for the following reasons:
 2. a. The rate of heat transfer is reduced greatly reduced by the presence of salts in the coolant. The lower the quantity of salts, better the efficiency of heat transfer. It is always recommended to use low salt water like DM water to mix the emulsion as this will conduct the heat faster from the point of contact in the machine tool. Further the heat generated at the point of contact will evaporate the water in the coolant leaving behind the salts. On continuous usage there is a possibility that the level of salt in the coolant increases to a stage that it starts leaving behind deposits on the contact surface. This generally happens at a TDS of around 1300 ppm. For the best efficiency of the equipment the TDS should be kept as low as possible.
 2. b. The major cause of coolant disposal in the machine tool is the Smell and skin irritation caused by bacteria present in water. The source of bacteria in the water is the water used for mixing the emulsion. Bacteria reproduce every twenty minutes through DNA multiplication. The ideal temperature for this bacterial growth is around 25- 32 degrees centigrade which is maintained in the coolant sump. Bacteria reproduce at an alarming rate and consume the lube oil and the coolant oil available in the coolant. If this bacterial growth is left unchecked, a stage will come when the emulsion will break into water and oil phase. To avoid such problems it is suggested to go for the following precautionary measures:
 - The inlet feed water used for mixing with oil can be ensured with low bacterial contamination. It can be made possible by having UV treated water or RO product water.

Specific Solutions for all Processed Liquids

- The rate of bacterial contamination is enhanced by the presence of Tramp oil over the coolant surface. Bacteria exist as both Aerobic and Anaerobic form. Aerobic bacteria survive in the presence of air and anaerobic bacteria survive in the absence of air. The tramp oil in the coolant will form a film on the surface of the coolant preventing entry of oxygen. This condition will have an increase of anaerobic bacteria in the coolant which is more dangerous than the aerobic bacteria. To prevent this bacterial growth, it is suggested to ensure minimal tramp oil film on the coolant surface by frequent skimming of the oil from the surface. This will help in containing bacterial growth.

Some Housekeeping tips for containing Coolant contamination:

- Use low salt water for best coolant efficiency.
- Ensure minimal tramp oil contamination to contain growth of bacteria.
- Ensure minimal usage of coolant pump. This will break the emulsion with tramp oil into smaller particle and in the process will make tramp oil removal difficult. Further, if possible use Diaphragm pump for coolant as this will ensure minimal turbulence while pumping when compared to centrifugal pump thereby reducing tramp oil coolant breakage.