CHARACTERISTICS OF OIL MIST CONTROL BY CORONA DISCHARGE

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INTRODUCTION
There are a number of sources emitting fine oil mist and fume. One of them comes from metal working fluids which act as coolant, lubricator and flushing material of metal chips during the metal working process. The particle size of oil mist and fume produced by such process is so fine, such as 0.03-1.0 µm in diameter, that oil mist and fume pose a serious hazard, for example, causing respiratory problems. Consequently, it is required to create safety and maintenance concerns as particles settle on expensive machinery, work surface and finished products. Among the control technologies of such oil mist and fume, electrostatic precipitator (ESP) is known to the most effective way of the control of them. This paper presents the characteristics of collecting oil mist and fume by utilizing ESP system which consists of pre-ionizer and collection plates. The role of the pre-ionizer gives the charge into the oil mist before oil mist enters the collection plates, resulting in the enhancement of collection efficiency of oil mist.

METHODS
The pilot scale experimental system was made for the control of oil mist and fume, where the available capacity of the system was about 15 m³/min of the flow rate. It is composed of an oil mist and fume generation section, pre-ionization section, collection section and measuring section. The pre-ionizer consists of metal wires having small diameters and operates with a positively direct current high voltage in the range of 0 - 15 kV. Such high voltage on the wire creates an electric field to charge the oil mists. The initially produced electrons in the pre-ionizer flow across the oil stream and in turn collide with or adhere to the particles, imparting a charge on them. The collection section is a series of parallel metal plates which are spaced apart with alternate plates charged and grounded. Charged oil mists are driven by an electric force from the charged plates toward the ground plate where they are collected. The metal working fluids oil investigated in this study was insoluble cutting oil in water.

RESULTS
In this study, the performance of the system has been investigated as a function of voltage, inlet gas velocity, initial oil concentration, inlet gas temperature. The effect of voltage applied to pre-ionizer on the removal efficiency has been represented in Figure 1, where the applied voltage was positive DC, inlet velocity was 1.3 m/sec, the inlet concentration was 500 mg/Nm³ and the inlet temperature was 50°C, respectively. Under the condition of 13 kV, it has been observed that the removal efficiency of oil mist was achieved up to about 87%. The collection efficiency of oil mist was found to be largely enhanced as a result of applying voltage to the pre-ionizer. In this study, we have also examined the effect of inlet velocity on the removal efficiency represented in Figure 2.

![Figure 1. Effect of Applied Voltage on Removal Efficiency](image1.png)

![Figure 2. Effect of velocity on Removal Efficiency](image2.png)