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CONSTRUCTION OF A LOW COST SMOKEMETER

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Air pollution is a major environmental hazard, which arises due to industrial development and population increase. It is revealed that the growing air pollution problem is mainly caused by automobile exhaust gas.

Developed countries have taken some legislative measures to control this issue. The Sri Lankan government has also taken legislative steps by setting motor emission standards under "Motor Traffic Act" by a special gazette notice dated 03rd May 1994. For testing exhaust gas, an instrument has been imported from Sweden by the Central Environmental Authority (CEA). The maximum permissible emission level for diesel vehicles in terms of opacity measured by the above instrument is given in the gazette notice.

Even though the government had set standards, it was not successful because of the difficulty in using the instrument. The instrument imported by CEA is heavy and bulky. The cleaning process is very involved and it must be cleaned after every measurement. Measurements have to be taken when the temperature of the instrument reaches 70° C. The operation of that instrument is also very complicated. So it needs some trained people. Therefore only two instruments are now in working condition though about sixty units of them were imported in 1994. In addition, that instrument is fragile and sophisticated.

The objective of this project is to construct a low cost, easy-handling instrument for monitoring the automobile exhaust. The absorption of light by the soot particles is used as the analytical method. A light beam is allowed to transmit through a fixed length of the medium to be measured. The intensity of the light source is set constant by an electronic control. And a light dependent resistor is used as the detector. The absorption of light by the medium is proportional to the smoke concentration, C and the path length, λ. The proportionality constant, ε is the extinction coefficient. Therefore, by measuring absorption, concentration of smoke can be obtained. The relationship between absorption and the opacity of the medium, N is given by the formula, $\varepsilon C = -1/\lambda \ln(1-N/100)$. This smokemeter has been calibrated for different concentrations by using black coloured solutions. There are several advantages of our smokemeter over the available one. Since no smoke chamber is used, the cleaning process and waiting for reaching the operating temperature are not involved. It is rugged, portable and connected to the end of the cylinder which makes it possible to measure the smoke density of a moving vehicle with a load applied to it. This dynamic reading is a practical measure than the reading of the CEA instrument. In addition our smokemeter can be improved to measure the constituents of smoke by changing the wavelength of the light source and the sensitivity of the photoresistor.