MONITORING AIR QUALITY USING LOW COST TECHNIQUES AND ASSESSING THE IMPACT OF AIR POLLUTION ON VEGETATIVE CROPS

A PROJECT THESIS PRESENTED BY

VILANI DEASIKA KUMARI ABEYRATNE

to the Board of study in Environmental Science of the

POSTGRADUATE INSTITUTE OF SCIENCE

In partial fulfillment of the requirement
for the award of the degree of

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF PERADENIYA

SRI LANKA

2005

603424

MONITORING AIR QUALITY USING LOW COST TECHNIQUES AND ASSESSING THE IMPACT OF AIR POLLUTION ON VEGETATIVE CROPS

V. D. K. Abeyratne

Postgraduate Institute of Science

University of Peradeniya

Peradeniya

Sri Lanka

Human interference with the atmosphere has created or intensified problems, which are now causing air pollution concerns on a global scale. The cities of Kandy and Anuradhapura are expected to have a higher degree of air pollution owing to its geographic location and due to transboundary pollution respectively. Hence this study aimed to develop low cost, environmentally friendly air quality monitoring methods. Passive & active sampling methods were used to analyze three gaseous pollutants; NO_2, SO_2, and O_3 and PM_{10} in Kandy. Same gaseous pollutants except PM_{10} were measured in Anuradhapura using passive sampling method. This study also aims to provide a user friendly AQI, for use by laymen based on both the individual and composite criteria pollutants. Possible consequences of air pollutants for agricultural crops in Sri Lanka or its production have scarcely been explored. In order to fulfill this gap pollutant effects on plants were evaluated using low cost active and passive bio monitoring methods.

In the passive sampler method the pollutant is trapped on a paper filter impregnated with a special developing solution. In the active sampling method the pollutant is trapped into special absorbing media. The trapped pollutants were then analyzed using spectrophotometric and turbidimetric methods. Particulate matter was collected using glass fiber filters and determined gravimetrically. For the sampling period of 15th February 2002 – 31st December 2004, the data reveal that NO_2, SO_2, and O_3 analyzed exceed the recommended air quality standards in Sri Lanka on about 14%, 41% and 28% occasions respectively for Kandy while the corresponding exceedences in Anuradhapura were 0%, 21%, 27% respectively. PM_{10} analyzed during the sampling

period in Kandy exceeds the recommended US EPA standard on about 80% of the occasions. AQI for the composite criteria pollutants in Kandy and Anuradhapura represent "Good" categories on 57% and 100% occasions respectively. A significant effect on transboundary pollution was recorded from both cities during the sampling period.

In active bio monitoring method, sensitivity of 24 vegetable species to ambient air pollution and ozone was assessed using the open top chamber method. Growth differences of vegetative plants were observed in chambers supplied with filtered and non filtered air during the dry climatic period. The effects of ozone observed on plants above the critical level can be classified in to nine categories. In passive bio monitoring method, attempts were made to observe the stomatal response under different pollutant concentrations using the nail varnish method. A significant effect of SO_2 on stomatal pore opening was observed in the plant *Argyreia populifolia*.