DESIGN OF A SIMPLIFIED INSTRUMENTATION TO MEASURE AIR POLLUTION PRODUCED FROM FARM MACHINERY

BY
WESSAM SHAWKY ABD EL MOHSEN MOHAMED

B. Sc. Agricultura (Agricultural Engineering), Faculty of Agriculture,Cairo University (1999).

A Thesis Submitted in Partial Fulfillment
of
The Requirements for the Master Degree
In
Environmental Science

Department of Agricultural Science
Institute of Environmental Studies And Research
Ain – Shames University,
Cairo, Egypt.

2010

APPROVAL SHEET

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Abstract

Wessam Shawky Abd El-Mohsen. Design of a simplified instrumentation to measure air pollution produced from farm machinery. Unpublished the Master of Environmental Science, Department of Agricultural Science, Ain Shams University, Institute of Environmental Studies and Research (2010).

Air pollution is one of the most important problems around the world. Agricultural activities which related to mechanical operations of crops are a major source of high levels of pollution in rural atmosphere. Fine particles are harmful to human health. Fine particles emission from threshing machine needs to be quantified for many purposes.

The aim of this study is to design a simplified instrumentation to measure air pollution produced from farm machinery. The instrument prototype was designed as a simplified instrument and it was fabricated at the workshop of Agriculture Engineering Research institute (AEnRI).

The instrument consists of two main parts, first: main device which consists of straw collection mechanism (main frame- filtration unite- suction fan unit) and sensation system (spring steel- sensor- PCD device). Second: stand device (telescopic stand- stand base).

Many experiments were run in the laboratory and field to calibrate the new design instrument. The results from laboratory calibration found the relationship between the weight on spring steel sensor (gm) and Read of spring steel sensor by using PCD device (micro-strain), $\mathrm{gm} = \frac{1}{60}$ $\mathrm{Micro\text{-}strain}$.

The experiments in field were run during wheat harvesting season of 2008 in Monofia Governorate, to calibrate and test the instrument. The instrument was fixed at variable heights from the ground surface 0.75, 2, 2.5 and 3m, at different distances far from the machine 60, 100, 140 m to cover an area of 80 m width X140m length. Computer Program was used to analyze data to found the relation between the pollution particles absorbed by the filter (Wf), the weight of pollution particles fall on sensor (Ws), the distance between farm machine and the instrument (d) and the height of the instrument (h) then found total pollution (Wt).

The obtained general regression equation (the instrument software) was $W_f = 1.9 - 0.05\,h + 0.002\,d + 3.462\,W_s$, $R^2 = 0.96$

This regression equation is limited to the condition of the experiments.

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1- INTRODUCTION

Air pollution is considered the most dangerous pollution to the environment. There are many sources of air pollution such as smoke from industry; vehicles and direct combustion of organic waste materials. Dust and suspended particles are other sources of air pollution. Agriculture operations produce several types of air dust and suspended particles that pollute the environment of the rural areas. Fine dust stays suspended in the air for long time which affects human health, animals, and plants. For humans, it can cause many diseases such as asthma, heart attacks and lung cancer. It can trigger symptoms that include nose, eyes, and throat irritation. Agricultural operations are one of source of air pollution in the rural area, such as harvesting and threshing.

Currently, there are about three millions feds cultivated by wheat which used more than 50,886 of the thresher machines **(Ministry of agriculture, 2008)**. The quantities of dust to surround environment during wheat crops threshing may reach 2905 $gm.m^2/h$ when using threshers, and 98 $gm.m^2/h$ when using harvesters **(Sahar, 2002)**. The quantities of fine dust inhaled by labor during wheat threshing by different machines and combine respectively, the quantities were recorded from 15 : 62 gm/m^3 **(El Gindy et al., 2001)**. The world limit for allowed pollution is about 9.2 gm/m^3 **(NMAOH, 1999)**.

A simple instrument easy to move (portable) device that can be used at variable elevations from the ground surface can be devoted.