MONITORING OF INDOOR AIR QUALITY FOR IMPROVEMENT OF SAFETY AND HEALTH FACTOR TOWARDS SUSTAINABLE WORK ENVIRONMENT IN INDUSTRY

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ABSTRACT

The research represents the preliminary data of the monitoring of IAQ for improvement of Safety and Health Factor towards sustainable work environment in industry. The system were develop and using the computer application and the IAQ instrumentation such as IAQ meter and the TOXIC meter to getting the direct reading data. The data were transfer and evaluate by using the Visual Basic Software. The readings have the standard and if more than 80% of total TLV, the system will give an alarm. The sequence will move from section to section and data collected will shows the patent of IAQ and the Toxic level based on the requirements of Factory and Machinery Act 1967 and Occupational Safety and Health Act (OSHA 1994).

Keywords: IAQ, Safety and health

INTRODUCTION

Continuous sampling is one of the common approaches for assessing indoor pollutant level. It is believed that the longer the measurement time, the higher the accuracy and confidence level of the measurement can be achieved. However, measurement efforts and uncertainties associated with the sampling method have not been addressed. Alternative sampling scheme taking shorter measurements in the sampling period were proposed in some circumstances (Wong and Mui, 2005).

Occupational health problems related to poor indoor air quality were identified as early as in the 1960s. Many organizations have conducted studies to identify these problems, such as the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the American Congress of Governmental Industrial Hygienists (ACGIH), and the World Health Organization (WHO. Indoor Air Quality (IAQ) was specified in the form of a guideline and an IAQ certification scheme for offices and public places has been launched since 2003 (HKEPD, 1999)

The IAQ certification scheme details the steps to certify the indoor air quality of a workplace and the sampling requirements for indoor pollutant levels. In particular, it specifies an 8-h time weighted average period in sampling the indoor pollutant concentrations for a balance between measurement effort and accuracy. In a workplace with a daytime operating ventilation system, building-related contaminants would normally peak in the morning and occupant-related ones would normally peak in the afternoon. A continuous sampling in an entire occupied period would be a good approach in determining the average pollutant concentration in a typical day.
In response to the concerns about exposures to indoor pollutants, policymakers need the best information and resources available to develop a full range of policy responses. Although all were developed for an indoor pollutant, these responses are non-uniform in their approach, choice of acceptable levels and impact on affected populations. If the uncertainties of the sampling method can be identified, the policymakers can make a better decision on resources and manpower management in pollutant level monitoring and the inappropriate level of reliance on the results can be avoided.

The focus of IAQ is on measuring the concentration of indoor polluted air, locating the source of pollution and the risk faced by the occupants. This also requires looking into problems can be caused by ventilation system deficiencies, overcrowding, tobacco smoke and others which causes discomfort and creates an unhealthy surrounding for workers or occupants. Standard guidelines from the Department of Occupational Safety and Health (DOSH) as well as ASHRAE will help improve the selected working environments.

RELATED WORK

In this research, integrated IAQ in working environment carries a very broad scope. The working environment ranges from almost everything, such as office lots, factories, laboratories, workshops, and so on. Thus in this study a few environments may be taken into consideration. The environments are industrial sectors and mechanical workshops. These environments are selected due to the fact there are a lot of pollutant factors and the various numbers of activities taking place simultaneously.

Spatial contaminant distribution in large semi-open building areas such as warehouse and other industrial hall, is critical to estimating exposure, health risks and building energy performance. It is considered a challenge to measure experimentally how effectively the ventilation system removes or dilutes air pollutants in a large open space, taking into consideration the usual non uniformity of the air flow created by local heat and contamination sources, geometrical obstructions and the distribution system (Demokritou, et. al, 2002).

Exposure to air contaminants in the building environment constitutes a potential health hazard especially in large industrial halls and commercial buildings with indoor air pollutant sources such as combustion by products and other chemical emissions from equipment. Dilution ventilation along with other pollution source control measures is the most widely applied strategy to lower the contaminant level below the threshold limit. But even if an acceptable average room concentration can be achieved at given ventilation rate it does not mean that localized areas with unacceptably high concentrations do not exist in such a large space.

According to Demokritou, et. al, (2002), ventilation effectiveness, $n_v$, can be defined as follows:

$$n_v = \frac{\int_0^\infty C_{ref} dt}{\int C_{ave} dt} \quad (1)$$

Where $C_{ave}$ is the average concentration in the space and $C_{ref}$ is the concentration at a reference point (i.e. exhaust grille). A more simplistic definition was proposed as

$$n_v = \frac{C_r}{C_{ave}} \quad (2)$$

Where $C_r$ is the concentration in the return opening.

Modern populations spend typically 80-90% of their time indoors, whether at home, work or elsewhere. Thus, indoor air quality is recognized as a significant environmental and health problem in most countries.
Environmental research has pointed out that pollutants in indoor air occur more frequently and at higher concentrations than in outdoor air. It is then clear that indoor air is the major source for environmental exposure to air pollutants (Brooks, and Dadvis, 1992), (Knoppel and Wolkoff, 1992), (Maroni, Seifet, and Lindvall, 1995), (Seifet, 1996) and (Adam and Leman, 2005).

**OBJECTIVES**

- To determine the existing of indoor air quality of manufacturing factory area.
- To compare with the rules and regulation such as Occupational Safety and Health Act (OSHA) and Regulations, and IAQ Code of Practice by DOSH.

**METHOD**

The methodologies are based on formulation of six factors which contain:

i. Laws of Malaysian (Act)
ii. Standards
iii. Productivity
iv. Work Environment
v. Instrumentation and record
vi. Simulation

![Figure 1: Formulation of Research Environment](image-url)
RESULTS AND ANALYSIS

From the analysis, the result was showed the values of IAQ parameter which is tabulated in Figure 3 to Figure 5. The measurement by work schedule were compared to the selected of data measurement. The temperature values are above that recommended by ASHRAE and DOSH. At the same time the worker protection must be controlled by other method to ensure the safety and health factor in workplace.
Figure 3: Result of measurement (Temperature and Relative Humidity)

Figure 4: Result of measurement (Carbon monoxide)
CONCLUSIONS

As overall results, this study had successfully achieve the objective which are to determine existing IAQ of manufacturing factory area and to compare the results with rules and regulation (Occupational Safety and Health Act and Regulations, ASHRAE Standard 62.1-2004 and IAQ Code of Practice by DOSH.

This research is still in progress under the University Research Grant. So the current result which is published is considered as preliminary result .The number of the industry involved will be increased and also the other type of data collection (gases) will set up.

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REFERENCES


