



Indoor Environment Health and Safety Status in Industrial Sectors of Bangladesh: a Case Study on Industries under Kumudini Welfare Trust

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Abstract

This study was conducted to know the indoor environment, health and safety status towards the workers of different industries situated in Narayanganj under Kumudini Welfare Trust (KWT) of Bangladesh. The data were collected during the month of March-April, 2016. Measured noise level in different industries under KWT ranged from 71-90.5 dB. During the study, among all of the four industries highest level of noise was measured in Kumudini Jute Bailing and Warehouse Ltd. (90.5 dB) followed by Kumudini Garments Ltd. (78 dB). Indoor temperature in different industries under KWT ranged from 26.5°C-32°C. Highest level of temperature was measured in Kumudini Garments Ltd. (32°C) followed by Kumudini Handicraft Ltd. (30.5°C), Kumudini Pharma Ltd. (29.5°C) and Kumudini Jute Bailing and Warehouse Ltd. (26.5°C). During the observations, highest relative humidity was measured in Kumudini Garments Ltd. (19.5%) followed by Kumudini Pharma Ltd. (5.2%), Kumudini Handicraft Ltd. (2%) and Kumudini Jute Bailing and Warehouse Ltd. (1.2%). In this study, observed level of CO₂ in the indoor environment of the study area ranged from 0.2 to 0.45 %. All of the measured CO₂ level is greater than standard concentration of 0.03%, except Kumudini Jute Bailing and Warehouse. Based on our present clarifications there was no oxygen deficiency in the indoor environment of the industries under KWT.

Key words: Environmental safety, Indoor environment, Kumudini welfare trust, Noise level, Working environment

Introduction

Environmental pollution is as old as the civilization itself. It has become a major concern in the last few decades. It is the by-product of the development of civilization and in fact a price for the progress. It is more prone in case of Bangladesh. Air pollution of Bangladesh is mainly caused by the vehicle emission, industrial discharge and burning of fossil fuel. The water resource of Bangladesh becomes a major health hazard due to arsenic contamination, inadequate solid waste and industrial effluent management. Necessary steps are to be taken to protect the environment for our own existence (Alam, 2002).

Pollution has become the first enemy of the mankind. Industrial revolution of 19th century led to environmental disaster. The whole world is now more afraid of pollution rather than nuclear blast (Rahman, 2003). Technological advancement has brought revolutionary changes in life style and national economy with overwhelming power over nature. The protection of environment has become a major issue around the globe for the well being of the people and economic development. The present environmental condition of Bangladesh is not at all equilibrium. Severe air, water and noise pollution are threatening human health, ecosystems and economic growth of

Bangladesh. Air pollution caused due to increasing population, burning fossil fuels, industrialization and associated motorization.

The 1980s mark the beginning of the rapid integration of Bangladesh as a small and open home based garment industry into global garment chain as a result of liberalization of the economy. At present the readymade garment industry (RMG) is a highly globalized industry. In most countries, particularly in developed countries, including UK and other European countries and the USA, Canada and Japan, not only textile but also apparel industry was developed in response to domestic demand.

Work force engaged in the industries in all types of Garments like knitwear, woven and sweaters, Pharmaceuticals and Jute industries are generally suffer from mal-nutrition, anemia, gastric, dysentery, diarrhea, respiratory problem, gynecological problems for women, tuberculosis and urine infection, heart diseases, hypertension etc. Moreover, gender equity status and existing disparity; indeed, practically depriving female workers from the public health care system. Moreover, married female workers suffer from various problems. They do not get maternity leave with pay for more than 30 days, in some cases maximum 60

days. These pregnant female workers suffer from malnutrition, anemia, along with other complications. But they do not have access to proper health care for this kind of ailments. At the same time, they face serious problem to feed her and support the family.

Within a short period, Bangladeshi entrepreneurs got familiar with the world apparel markets and marketing. They acquired the expertise of mobilizing resources to export-oriented RMG industries. Foreign buyers found Bangladesh an increasingly attractive sourcing place. To take advantage of this cheap source, foreign buyers extended, in many cases, suppliers' credit under special arrangements. In some cases, local banks provided part of the equity capital. The problem of working capital was greatly solved with the introduction of back-to-back letter of credit, which also facilitated import of quality fabric, the basic raw material of the industry. The government assigned high priority to the development of RMG industry.

Till the end of 1982, there were only 47 garment manufacturing units. The breakthrough occurred in 1984-85, when the number of garment factories increased to 587. The number of RMG factories shot up to around 2,900 in 1999. Bangladesh is now one of the 12 largest apparel exporters of the world, the sixth largest supplier in the US market and the fifth largest supplier of T-shirts in the EU market. The industry has grown during the 1990s roughly at the rate of 22%. In the past, until 1980, jute and jute goods topped the list of merchandises exported from Bangladesh and contributed more than 50% of the total export earnings. By late 1980s, RMG exports replaced jute and jute goods and became the number one in terms of exports.

Objectives of the study

The objectives of the study is to provide an overview of the existing health and environmental situation in the industries under Kumudini Welfare Trust (KWT) and to recommend measures to be practiced for improving the overall health and environmental

scenarios in industrial sectors of Bangladesh. The specific objectives of the study are as follows:

- I. To measure the present level of indoor environmental parameters (moisture, temperature, light, noise) in different industries under KWT
- II. To measure the level of indoor air quality parameters like CO₂, CH₄, O₂ of the study zone
- III. To depict the impacts of these environmental parameters on workers' health from different industries under KWT

Methods of the study

Description of the study area

The study area was conducted in Narayanganj city of Dhaka Division, Bangladesh. It is very nearest to Dhaka, the capital city of Bangladesh. Figure 1 shows the study area. The river port of Narayanganj is one of the oldest in Bangladesh. It is also a center of business and industry, especially for jute trade and its processing plants, and for the textile sector of the country. It has nicknamed the Dundee of Bangladesh due to the presence of many jute mills. Narayanganj is located at south-east of capital city of Dhaka, Bangladesh. Named after Bicon Lal Pandey, a Hindu religious leader who was also known as Benur Thakur or Lakshmi Narayan Thakur Pandey acquired ownership of the region from the British East India Company in 1766 after the Battle of Plassey. He declared the marketplaces on the banks of the Shitalakshya river as endowed property to pay for expenses for the worship of the God Narayan. Subsequently, the region was named Narayanganj. It is bounded on the north by Gazipur and Narsingdi districts, on the east by Narsingdi and Comilla districts, on the south by Munshigonj district and on the west by the Dhaka district. The total area of the district is 759.6 km². Narayanganj became a district on 15 February 1984. Formerly, it was a sub-district of the Dhaka district.

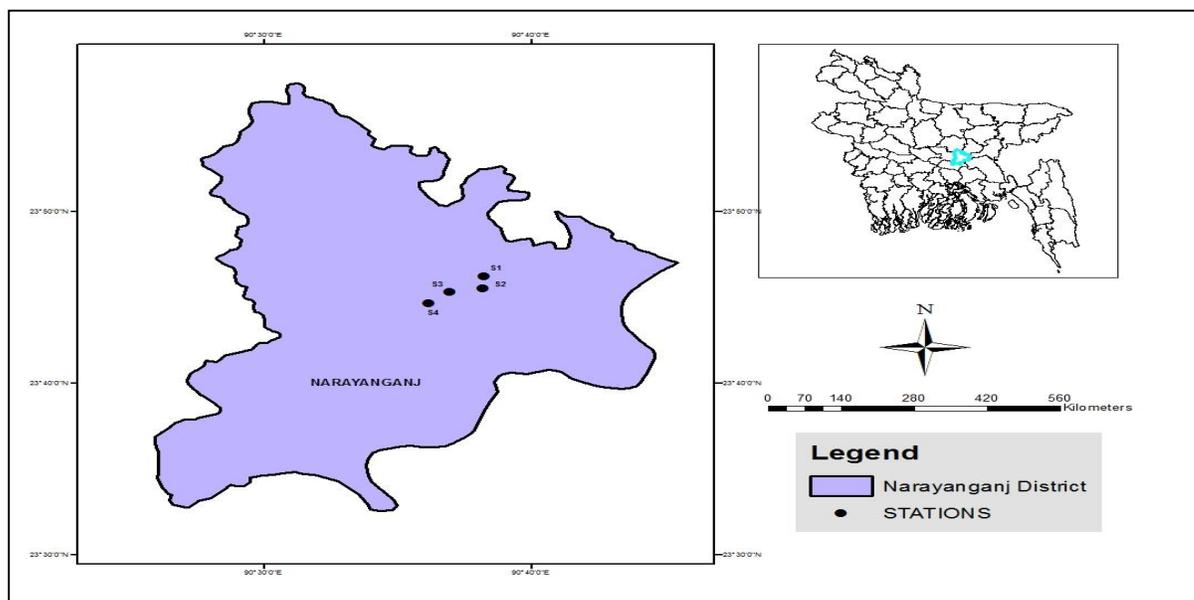


Fig. 1. The map of Narayanganj district showing the sampling location

Data collection

The study was conducted during the month of March-April, 2016 to observe overall Environmental Health Condition (EHC) of workers at the industries under KWT in Narayanganj. In order to examine noise level (dB), temperature (°C), relative humidity (%) and light intensity (Lux) a multi-function environmental meter were used at the working places of those industries. GPS meter was used to locate Longitude (E) and Latitude (N) for those industries. Finally, a gas analyzer (LFG 20) was introduced to measure the level of indoor air pollutants like CO₂, CH₄ and O₂ in the working places of those industries. A questionnaire survey was conducted among 100 respondents from 4 industries to know the health and working environment of work places of the industries under KWT.

Results and discussion

Observed noise level at the working places under KWT

Noise is an unwanted or damaging sound that may damage our hearing capacity and cause other health

effects such as stress, hypertension, increased blood pressure, heart disease, headache and increased heart rate (Chowdhury, 2002; Hoque *et al.*, 2011). It can also interfere with communication at work, which could lead to accidents. Standard level of noise has been recommended for industrial areas of Bangladesh 75 dB and 70 dB day and night time, respectively (Table 2). As shown in Table 1, noise level in different industries under KWT ranged from 71-90.5 dB. During the study, among all of the four industries highest level of noise was measured in Kumudini Jute Bailing and Warehouse Ltd. (90.5 dB) followed by Kumudini Garments Ltd. (78 dB), Kumudini Handicraft Ltd. (75 dB) and Kumudini Pharma Ltd. (71 dB). Figure 1 shows the noise level in different industries under KWT in compare to the standard levels, which are set by DoE, Bangladesh. From figure 1, noise level in Kumudini Garments Ltd. and Kumudini Jute Bailing and Warehouse Ltd. are more than the standard exposure level whereas Kumudini Pharma and Kumudini Handicraft Ltd. has lower noise level than that of the DoE standard.

Table 1. Various environmental parameters in industries under KWT

S.L.No.	Name of the Industry	Indoor environmental parameters				Indoor air quality parameters		
		Noise level (dB) at Working Place	Temperature (°C)	Relative Humidity (%)	Light Intensity (Lux)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)
01	Kumudini Garments Ltd.	78	32	19.5	35	0.22	0.015	19.8
02	KumudiniPharma Ltd.	71	29.6	5.2	45.1	0.45	0.018	19.9
03	Kumudini Handicraft Ltd.	75	30.5	2	33.5	0.10	0.2	19.7
04	Kumudini Jute Bailing and Warehouse Ltd.	90.5	26.5	1.2	32.4	-0.2	0.3	19.7

Table 2. Noise level standards of Bangladesh

S.L	Category of areas	Sound levels (dB)	
		Day time	Night time
01	Silent Zone	45	35
02	Residential area	50	40
03	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
04	Commercial area	70	60
05	Industrial area	75	70

(Source: Department of Environment (DoE), Bangladesh, 2002)

Thermal condition at the working places under KWT

Worker shall not be required to work regularly in the immediate surroundings of a substance or process radiating a large amount of heat or surrounding air that is harmful to health. Fixed or movable screens, deflectors, suitable protective equipment or other suitable devices shall be provided and used to protect workers against any exposure to large scale intake heat, including the heat of the sun. In any workplace where there is situated a refrigeration chamber, tank, room or other space in which the temperature may be endanger for the health of a worker, who is working in excess heating environment and the employer shall ensure that the chamber, tank, room or other space is so constructed to approved standards at all times (Ahmed and Raihan, 2014).

As shown in Table 1, ambient temperature in different industries under KWT ranged from 26.5°C-32°C.

During the study, highest level of temperature was measured in Kumudini Garments Ltd. (32°C) followed by Kumudini Handicraft Ltd. (30.5°C), Kumudini Pharma Ltd. (29.5°C) and Kumudini Jute Bailing and Warehouse Ltd. (26.5°C). Figure 2 shows the distributions of ambient temperature level in different industries under KWT in compare to the standard levels. From Figure 2, temperature is slightly high for Kumudini Garments Ltd. and for Kumudini Handicrafts Ltd. it may happens due to excessive number of workers on the floor as well as low ventilation quality. As a result, workers of those floors face health problem such as vomiting, chronic or acute headache, dizziness, respiration problem etc. From our observation, Kumudini Pharma Ltd. and Kumudini Jute Bailing has less heating problem due to installation of AC and well furnished ventilation system, respectively.

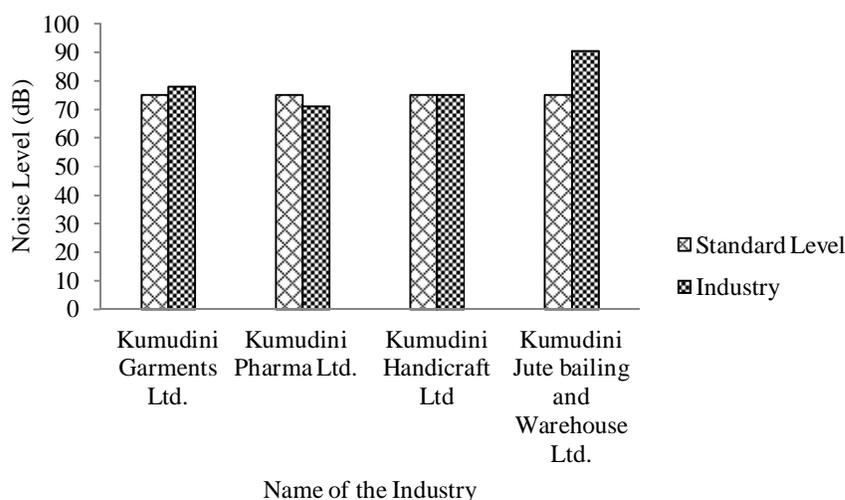


Fig. 2. Noise level at the industries under KWT

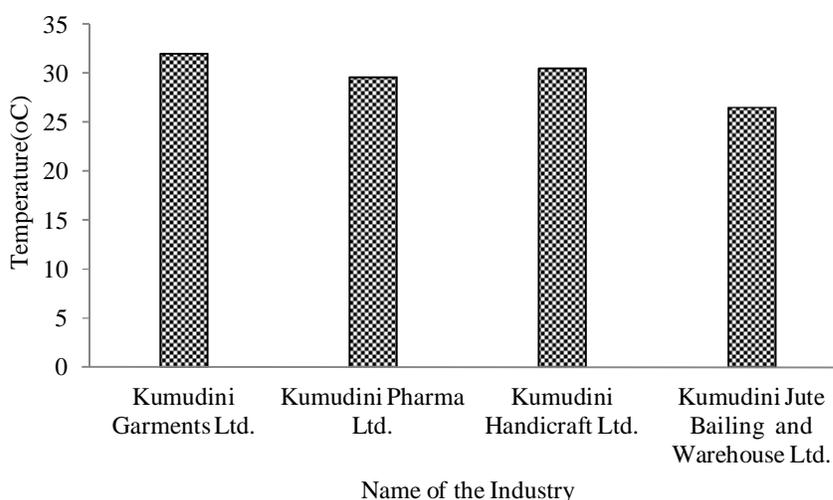


Fig. 3. Temperature (°C) of working place in the industries under KWT

Level of relative humidity at the working places under KWT

For a pleasant working environment, it is important to make sure relative humidity does not fall below 40%. When relative humidity is less than 40%, the risk of disease is increased (HSE, 2014). Generally, it can be stated that symptoms that are caused by dry air vary, but three main factors can be distinguished: static electricity, moisture stability and health effect. Viruses can survive least at a relative humidity of between 47 and 70%. Pleasant ranged of relative humidity for working place is between 40 and 60%. For peoples

those are suffering from allergies and asthma, relative humidity must be between 45 and 55%. High relative humidity can cause constriction. Level of relative humidity in different industries under KWT ranged from 1.2-19.5%. During the observations, highest relative humidity was measured in Kumudini Garments Ltd. (19.5%) followed by Kumudini Pharma Ltd. (5.2%), Kumudini Handicraft Ltd. (2%) and Kumudini Jute Bailing and Warehouse Ltd. (1.2%) (Table 1 and Figure 4). From the Figure 4, it is cleared that measured level of relative humidity in all industries under KWT is less than the standard level.

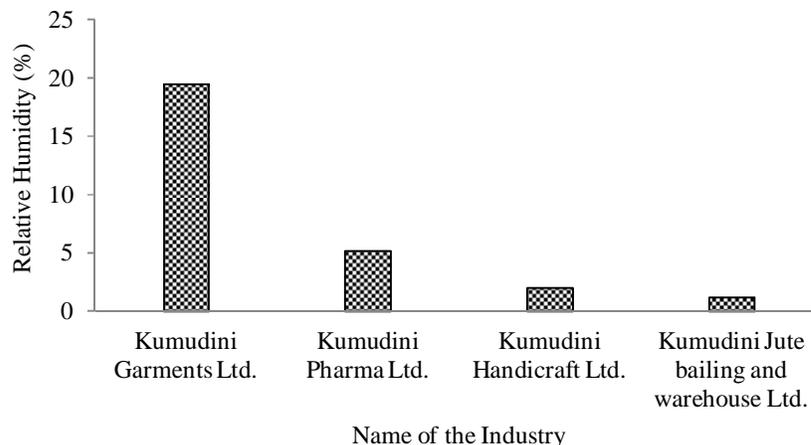


Fig. 4. Relative Humidity (%) of working place of the industries under KWT

Lighting condition at the working places under KWT

Adequate and appropriate lighting shall be provided at a workplace to an approved standard, and at any other place where a person may be required to go in the normal course of work, including means of access to and egress from a workplace and emergency exits (HSE, 2014). Illumination can be measured through Lux meter. Adequate and appropriate lighting shall be provided for the tasks performed by each person at work in accordance with an approved standard. According to OSHA, factory workers needed average illumination 50 lux and minimum 20 lux, whereas office needed an average illumination of 100 lux and minimum of 50 lux. As shown in Table 1, light intensity in the working place under KWT varied from 32.4-45.1 (lux). Highest light intensity was measured in Kumudini Pharma Ltd. (45.1 lux), followed by Kumudini Garments Ltd. (35 lux), Kumudini Handicraft Ltd. (33.5 lux) and Kumudini Jute Bailing and Warehouse Ltd. (33.2 lux). From the measured data, it is obvious that all the Industries under KWT having enough lighting intensity as all of them are well furnished with lighting system. Moreover, windows and doors are open there during working hours especially for Kumudini Jute Bailings and Warehouse Ltd., Kumudini Garments Ltd as well as for Kumudini Handicraft Ltd.

Level of CO₂ in the indoor environment of the Industries

CO₂ is one of the most important gases in the atmosphere. It is also considered to be a major GHG and contributing to 60% of GHGs. Higher level of indoor CO₂ exposure can produce a variety of health effects including headaches, dizziness, restlessness, a tingling or pins or needles feeling, difficulty breathing, sweating, tiredness, increased heart rate, elevated

blood pressure, coma, asphyxia, and convulsions. During the observations level of CO₂ in the indoor environment of the study area ranged from -0.2 to 0.45 %. The highest CO₂ level(0.45%) was found in Kumudini Pharma and the lowest level(-0.2%) was found in Kumudini Jute Bailing and Warehouse Ltd. (Table 1) All of the measured CO₂ level is greater than standard concentration 0.03%, except Kumudni Jute Bailing and Ware House.From Table 1, except Kumudini Jute bailing and warehouse ltd. all of the industrial units under KWT were having higher CO₂ level due to huge number of workers in a confined area. Whereas Kumudini Jute bailing and warehouse has less CO₂ due to jute has high carbon di-oxide assimilation power.

Level of CH₄ in the indoor environment of the industries under KWT

Methane (CH₄) is another important GHG. Methane is a colorless, odorless, and extremely flammable gas that can be explosive when mixed with air. It is also called methyl hydride. Methane in its gas form is an asphyxiant, which in high concentrations may displace the oxygen supply you need for breathing, especially in confined spaces. Decreased oxygen can cause suffocation and loss of consciousness. It can also cause headache, dizziness, weakness, nausea, vomiting, and loss of coordination. Skin contact with liquid methane can cause frostbite. From Table 1, indoor level of CH₄ in different industries under KWT ranged from .015 to 0.3%. The highest level of CH₄ 0.03 % was found in Kumudini Jute Bailings and ware house Ltd. and the lowest value 0.015% was found in Kumudini Garments Ltd. (Table 1). All of the measured CH₄ values are greater than standard value 0.0002%, which may contributes higher to increase atmospheric greenhouse gas emission in particular. Formation of

higher level of methane in all the working places of Kumudini industrial complex is associated with respiration activities from the workers.

Level of indoor oxygen (O₂) in the working places of the industries under KWT

The normal composition of breathable air is approximately 21% oxygen and 79% nitrogen. Accidental release of non-breathable gases can replace oxygen, causing a breathing hazard. Nitrogen, helium and carbon dioxide are the three most-common compressed gases that can replace oxygen. Gas may accumulate in corners or enclosed spaces if an accidental release occurs. If oxygen falls below 19.5% or increases above 23.5%, a dangerous, hazardous situation for employees exists, according to the Occupational Safety and Health Administration (OSHA). Oxygen can drop below safe levels in a confined space. Gas used in a number of different industries may leak, replacing oxygen with non-breathable chemicals. Avoid hazards and protect your business and workplace by performing a gas hazard assessment and using oxygen monitors. As shown in Table 1, the level of oxygen in Kumudini Pharma Ltd., Kumudini Garments Ltd., Kumudini Handicraft Ltd., Kumudini Jute Bailing and Warehouse Ltd. are 19.8, 19.9, 19.7 and 19.7%, respectively (Table 1). So base on our present observations there is no oxygen deficiency in door environment of the industries under KWT as oxygen percent is greater than minimum standard level of 19.5% and less than maximum level of 23.5%.

Perception of workers towards indoor working environment of KWT

Knowledge of environmental sustainability towards the workers

The activities that are allowed to gain economical prosperity of a nation have adverse effects on the environment. As wealthier countries built factories, highways, and started producing and using consumer goods on a large scale, the earth's air and water became polluted, natural resources depleted, and sensitive habitats are destroyed. By the last decade, industrial pollution has been triggered climate change noticeably which leads to a repercussion of serious events. Such that scientist forebode by the year of 2050 more than fifty million species will become extinct from the world. But it can be realized that, based on the present and past environmental condition, if we will not be able to follow environmental sustainable industrialization and protect the nature a devastating threat has been waiting for us that will be appeared soon.

The workers of the factories under KWT face various problems due to lack of knowledge about environmental sustainability. Even they don't know the term as the management does not think to aware them regarding working environment. As a result, workers don't have minimum knowledge about environmental sustainability as the authority want more profit with less cost. From the Figure 5, 80% of the respondents from four industries under KWT are not familiar with the term environmental sustainability. 20 % of the respondents, who know about environmental sustainability, are mainly from Kumudini Pharma Ltd. and Kumudini Garments Ltd and few of the workers from Kumudini Handicraft Ltd.

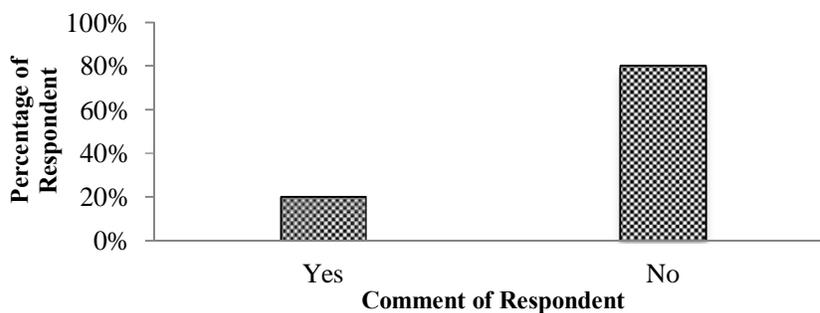


Fig. 5. Comments of respondent about the knowledge of environmental sustainability

Health problem faces by the workers

The workers face various health related problem due to lack of safe drinking water and inadequate numbers of toilets. As the working environment is crowded, so

they are suffering from various due to of lack of proper ventilation, excess heat in working places, excessive noise, dust, unhealthy working environment etc. Kumudini Handicrafts and Garments are facing more

problem as large number of workers are working in the floor same time. As shown in Figure 6, 65% of the respondents are facing various health problems such as

dizziness, hypertension, skin disease, chronic respiratory problems etc.

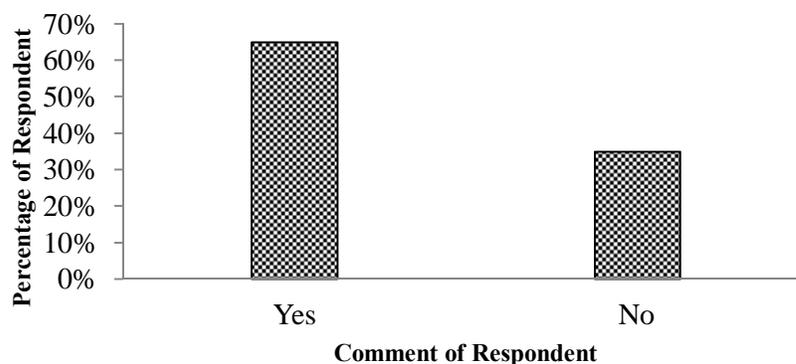


Fig. 6. Comments of respondent about to face their health problems

Conclusions

This study was conducted in the study area to find out the indoor environmental status of different industries under KWT. Noise Level in Kumudini Garments Ltd. (78dB), Kumudini Jute Bailing and Warehouse Ltd. (90.5dB) are more than the standard exposure level (75dB) whereas Kumudini Pharma and Kumudini Handicraft Ltd. are within the standard set by the DoE, Bangladesh. Higher noise level at Kumudini Jute Bailing and Warehouse Ltd. may be due to operational activities to bail raw jute.

Level of temperature is slightly high for Kumudini Garments Ltd. and for Kumudini Handicrafts Ltd. due to excessive number of workers on the floor as well as low ventilation quality. As a result, workers of those

floors face serious health problems such as vomiting, chronic or acute headache, dizziness, respiratory tract infection.

High level of CO₂ (0.1-0.5%) was measured in the all of the industries under KWT during the study, except Kumudini Jute bailing and wear house Ltd., which may happens due to huge number of workers in a confined area. In the same time lowest level of CO₂ (-0.2%) was detected in Kumudini Jute bailing and warehouse Ltd., as jute may having high carbon dioxide assimilation system. During the study, we found 65% of the respondents face health problem including dizziness, hypertension, skin disease, chronic respiratory problems etc.

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