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ENVIRONMENTAL IMPACT ASSESSMENT OF TEXTILE INDUSTRIES OF CHITTAGONG CITY

Mst Farzana Rahman Zuthi, Most Mukta Banu, Sabuj Kumar, Tanjib Hossain and Abdullah Al-Masud

Department of Civil Engineering, Chittagong University of Engineering and Technology (CUET),
Chittagong-4349, Bangladesh
e-mail: *fzuthi@yahoo.com, mukta.cebuet@gmail.com, sabuj081@gmail.com, tanjib.hossain@yahoo.com, masudbuet93@gmail.com
*Corresponding author

Abstract- *The commercial and industrial activities of Chittagong have significant contributions in the national economy of Bangladesh. However, few industries located in this city have high potential to adversely affect the surrounding environment. In this backdrop, an Environmental Impact Assessment (EIA) of few textile industries of the city have been conducted in the study to identify environmental consequences of such projects. Physical survey and experimental investigation of water quality parameters were done to identify both beneficial and adverse effects due to the activities of selected textile industries. Significant economic development, improved quality of life and land value were identified as some of the beneficial effects whereas long term adverse effect on hydrology, atmosphere and ecology of the surrounding environment are expected as adverse consequences. Treatment and safe handling of industrial effluent, public awareness, strict monitoring to enforce environmental regulations etc. are recommended in the study to make such development projects sustainable.*

Keywords: Industry, Pollution, Environment, Impact, Assessment

1. INTRODUCTION

Chittagong being the export hub of Bangladesh has major contributions to the national economy of the country through its import-export activity, hydropower generation etc. Among different industries developed in the city, textile industry is one of the most important and rapidly developing industrial sectors of Bangladesh depending on its foreign exchange earnings [1,2]. However, like many other industries, the textile industries have potential to pollute the environment discharging their untreated effluents to natural water resources. In Chittagong city, most of the industrial effluents which may contain highly toxic substances are being disposed into the the Karnafully river directly or through almost twenty tributary canals flowing across the city to dispose city's wastewater and stormwater. Many studies have found that the effluents being discharged from various industries contained higher amount of physical and chemical contaminants [3,4,5]. Moreover a significant number of studies have found that the water quality of the Karnafully river has been highly polluted and become unsuitable for fisheries, irrigation etc .[5,6,7]. Many studies have been conducted to assess the industrial effluent as well as the water quality of the river of the city but the study on environmental impact assessment to identify the environmental consequences due to various industries are limited.

Environmental Impact Assessment (EIA) is one of the proven management tools for the assessment of environmental consequences (positive and negative) of any development plans, and for their incorporation in improved decision making. A special emphasis should be paid on the environmental protection through preparation of Environmental Management Plans (EMPs) for minimizing the impacts from developmental activities to achieve sustainable development goals (SDGs). In this regard an Environmental Impact Assessment (EIA) of few textile industries of the city have been conducted in the study to identify environmental consequences of such projects. Physical survey and experimental investigation of water quality parameters were done to identify both beneficial and adverse effects due to the activities of selected textile industries. Few suggestions have been made at the end of the study to receive optimum benefit from the industrial development.

2. STUDY AREA

The study area was Nasirabad industrial area of Chittagong city. There are seven textile industries in the area but the study was conducted on three important textile industries mentioned in Table 1. It is found that the selected industries dispose their effluents untreated in Shital Jharna Khal. The Karnafully River is the ultimate disposal point of the wastewater through Noakhal.

3. METHODOLOGY

The study was divided into two parts. In one part a socio-economic survey was conducted through a quesnnare survey. A semi-structured quesnnare was prepared and the local people was interviewed selecting randomly. Wastewater samples from different industries and water sample Sital Jharna Khal were collected and analyzed in the environmental engineering laboratory of Chittagong University of Engineering and Technology (CUET) in the second part of the study. All the tests are done as per as standard procedure and special precautions have been made during sampling. The sample identification along with the sample locations are shown in Table 1. Typical physical, chemical and biological parameters of water and wastewater have been analyzed in the study. Both the beneficial and adverse effects due to the activities of selected textile industries were identified after the completion of the survey and experimental investigation of water and wastewater quality parameters.

Table 1: Different wastewater sample collection point and their identification in the study

Name of the Studied Industries	Collection Point	Sample ID
Super Knitting and Dyeing Mills Limited (SKDM)	Dyeing	SK-1
	Washing	SK-1
KDS Textile Mills Ltd.	Dyeing	KD-1
	Washing	KD-2
Sirina Garments and Textiles Ltd.	Dyeing	S-1
	Washing	S-2
Shital Jharna Khal	Nearby Industrial Area	Khal

4. EXPERIMENTAL RESULTS AND DISCUSSION

The wastewater samples from different disposal points of the studied industries and water samples from nearest point of the Shital Jharna Khal were analyzed in the study. The pH values were found in the range of 6.9 – 11.6, and the highest value was found in the effluents from dyeing process of SKDM. All the effluents except the sample SK-1 are within the discharge standard as per the Bangladesh Environment Conservation Rules'1997 (BECR'97) [9]. The water of the Khal also had the pH value within the standard value and hence suitable for irrigation and recreation purposes. The wastewater samples contained suspended solids (SS) of a range of 310-760ppm (Figure 1) and the Khal had 1390 ppm of SS value. The industry is discharging the SS value beyond the discharge standard and the very high SS value of Khal might be not only due to the industrial effluents but also the solid waste dumping from the local community. Most of the industry had the total dissolved value (TDS) are within standard (2100 ppm) except the sample SK-1 and KD-1 (Figure 2). Although the chloride content and 5-day biochemical oxygen demand value of the wastewater and water seem to be reasonable (Figure 3), the very high temperature could be of critical concern (Figure 4). All the samples exceeded the standard, and thus may be harmful for the aquatic environment. The metabolic activities and biodegradability of organic matters increase with the increase in temperature. As a consequence, there is the possibility to reduce the dissolved oxygen level of the water, and thus the fish population could be at a high risk.

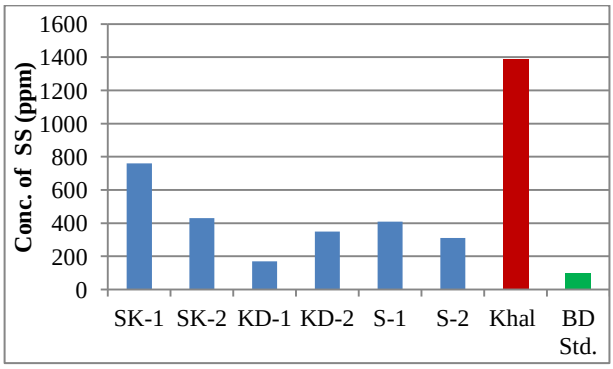

Figure 1: Concentration of suspended solids of wastewater and water samples

5. ADVERSE EFFECTS

World economic and technological activities are contributing to rapid and potentially stressful changes in the global environment. These changes may profoundly affect generations to come. Technological activities are essential for the country to meet the needs of present and future generation. Any activities may create pollution. The textile industries of the Nasirabad industrial area may affect adversely the different compartments of environment, and the details of which have been described summarized in the following sections.

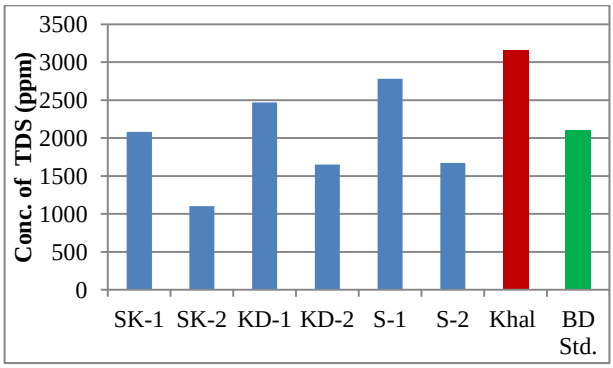

Figure 2: Concentration of dissolved solids of wastewater and water samples

5.1 Water Pollution

The city Chittagong is situated on the banks of river Karnafully, and the river is polluted by the various industrial effluents being discharged through various distributary canals. Shital Jhama Khal located in the study area is one of the canals of the city and the Khal carries the effluents to the river through Noakhal. Hence

industrial effluents of this area play an important role in contaminating the water of Kamafully. Moreover, there is the possibility to contaminate groundwater of this area by leaching the contaminants to the groundwater. There are few slum areas beside Shital Jhama Khal, and the inhabitants of these area use tube-well water, very close (less than 10 m) to the Khal for their drinking purpose and other daily uses. As a result, they may suffer from various water related diseases like diarrhea, cholera, typhoid etc.

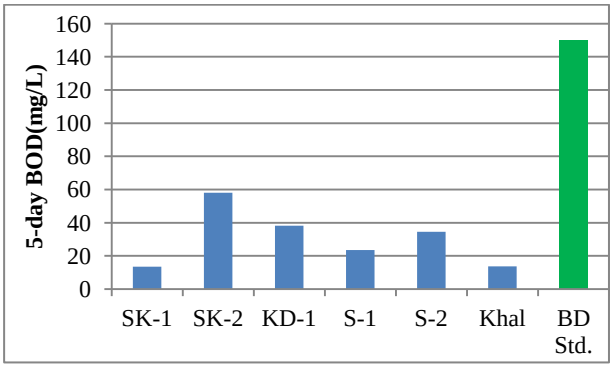

Figure 3: BOD_5 value of wastewater and water samples

Small chlorine contents or chlorine compounds formed on chlorination may also be toxic to fish. The fish life is affected due to depletion of DO. At higher temperature, the fish need more oxygen but at the same time due to increased rate of biological action at higher temperature, the rate of depletion of oxygen also increases and creates a crisis for the fish life. Turbidity, suspended solids are also higher than normal canal water. As a result normal hatching of eggs of fish is disturbed. Polluted water increases the salinity, which in turns increases osmotic pressure of fish & aquatic plants.

5.2 Air Pollution

Air quality depends on substance and their concentration at which they produce undesirable effects on human, animals and plants. These substances include CO_2, CO, SO_x, NO_x and suspended particulate matter (SPM). The combustion of hydrocarbon fuel in a motor vehicle products mainly carbon dioxide (CO_2), water and nitrogen (N_2). Due to construction works of industrial buildings produce large amount of dust which may result in air pollution. At the same time several infrastructural developments such as road construction, building construction etc. also produce huge amount of dust which ultimately leads to air pollution. It is found from the public consultation in the area that the following effects were identified (1) Eye irritation (2) Respiratory difficulties (3) Headache (4) Discoloration of painted buildings (5) Leaf discoloration or spotting and death.

5.3 Noise Pollution

Noise can be defined as unwanted sound in the wrong place at the wrong time. It can also be defined as any sound that is undesirable because it interferes with speech and hearing. A large number of industries in the studied area also create noise pollution. Due to abnormal noise the following health problems could be observed: (1) Hearing problem (2) Headache

5.4 Temperature Effect

According to Environment Conservation ACT 1995, temperature of inland surface water at discharge point should be maximum 40^0C at summer and maximum 45° C at winter season. But the investigated industries discharge their effluents at more than standard temperature, which are shown in Figure 4.

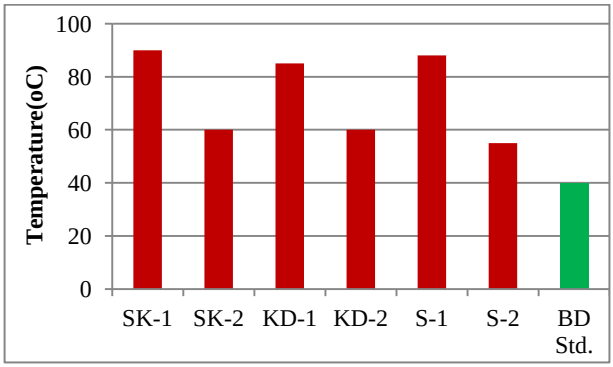

Figure 4: Temperature of wastewater and water samples

5.5 Water Logging

Due to illegal occupancy for industrialization, Shital Jharna Khal becomes narrower. Again textile industries through their solid wastes in it. As a result, water-logging and flood occurs at rainy season. The solid wastes become decomposed and cause odor nuisance due to improper management.

5.6 Health Effects

People who use the polluted water for cooking food, bathing may severelybe affected by water borne diseases. Due to use of polluted water of Shital Jhama inhabitants of the area also affected by skin diseases such as skin infection, scabies, eye infection etc. Peoples may suffer from bronchitis, asthma and other diseases as a result of air pollution.

6. BENEFICIAL EFFECTS

6.1 Economic Development

Before industrialization, most of the lands of the area were used for cultivation. As Bangladesh is an agricultural country, these products contributed a lot in the economic development of our country. On the other hand, due to industrialization, these lands are used for establishment of different industries which helps to reduce the unemployment problem of our country. As a result, economic activities of this area have shifted from agriculture to city based activities. Moreover, the industries produce export quality textile products which earn a lot of foreign exchange.

6.2 Socio-economic Status

Before industrialization the people in the area were farmers and day-labors, and they lived a life as a rural life. But with the establishment of the industries in the area the people shifted to other places as a result of township

development. There are low and middle income urban people are living in the area and hence the socio-economic status has been drastically changed from the previous status.

Table 2: Likely impacts due to the studied industries

Impacts	Nature of Impacts							
	ST*	LT*	R*	IR*	L*	W*	SI*	N*
A. Adverse Impacts on								
1. Environment:								
Water pollution	√	√						
Water logging	√							
Air and noise pollution		√			√			
Weather		√				√		
Ecology and fisheries		√						
Agriculture		√						
2. Human Health:		√						
3. Others: Stress on electricity		√						
B. Beneficial Impacts								
Employment & Economic development		√					√	
Quality of life, Land value & Socio-economic status		√					√	

*ST: Short Term; LT: Long Term; R: Reversible; IR: Irreversible; L: Local; W: Wide; SI: Significant; N: Negligible

6.3 Quality of Life

The basic needs of life like education, treatment etc. were absent in the area and thus the people led a poor quality of life value. However, industrialization has provided people at the place with all facilities of urban life. So, quality of life value has been improved a lot from that in the past.

6.4 Land Value

Previously most of the areas of this area were low-lying. These lands were used mainly for cultivation. But due to industrialization, the land value has been increased. Moreover, transportation facilities also increased due to industrialization. As a result, overall land value of the area is gradually increasing.

A summary of most like impacts are shown in Table 2.

7. CONCLUSION AND RECOMMENDATION

There are many textile industries in Nasirabad industrial area of Chittagong city. An environmental impact assessment study has been conducted on few of the industries in the study. Both the physical survey and experimental investigation of water quality parameters were done to identify both beneficial and adverse effects due to the activities of selected textile industries. Significant economic development, improved quality of life and land value were identified as some of the beneficial effects whereas long term adverse effect on hydrology, atmosphere and ecology of the surrounding environment are expected as adverse consequences. However, treatment and safe handling of industrial effluent, public awareness, strict monitoring to enforce environmental regulations etc. are of important concern to attain sustainability of such development projects.

8. REFERENCES

[1] J. Ahmed and M. Nizamuddin, "Physicochemical Assessment of Textile Effluents in Chittagong Region of Bangladesh and Their Possible Effects on Environment", *International Journal of Research in Chemistry and Environment*, vol. 2, no. 3, pp 220-230, 2012.

[2] BTMA: Bangladesh Textile Mills Association (BTMA) Annual report, vol. 14, pp. 35, 2007

[3] S. Akter, F. T. Jahara, M. Jibon, A. Halim and A. Hashem, "Quality Assessment of Industrial Effluent in chittagong Industrial Area, Bangladesh" in *Proc. of 3rd International Conference on Advances in Civil Engineering, CUET, Chittagong, Bangladesh*, 21-23 December 2016.

[4] M. K. Ali, A. Sarraz, P. K. Roy, A. M. Nahar, A. Jubaer, S. Das, R. Mallick, "Environmental Assessment of Industrial Wastewater in Chittagong City-Bangladesh", *International Journal of Science and Technology*, vol. 6 , no. 3, 2017.

[5] M. I. Sarwar, A. K. Majumder and M. N. Islam, "Water Quality Parameters: A Case Study of Karnafully River Chittagong, Bangladesh", *Bangladesh J. Sci. Ind. Res.*, vol. 45, no. 2, pp. 177-181, 2010.

[6] M.J. Ahmed, M.R. Haque, A. Ahsan, Siraj, M.H.R. Bhuiyan, S. C. Bhattacharjee and S. Islam, "Physicochemical Assessment of Surface and Groundwater Quality of the Greater Chittagong Region of Bangladesh", *Pak. J. Anal. Environ. Chem.* vol. 11, no. 2, pp. 1-11, 2010.

[7] I. Haider, A. Kadir, R. A. Mullick, and S. K. Palit, "Karnaphuli River Water Pollution and its Impact on Aquatic Species and Water Related Activities of Human Being" in *the Proc. of the 2nd International Conference on Advances in Civil Engineering, CUET, Chittagong*, Bangladesh, 2014.

[8] M. S. Hossain, M. S. Islam, M. A. T. Chowdhury,"Shore Based Pollution Sources of the Karnafully River and the Effects of Oil-Grease on the Riverine Environment", *J. Geo-Environ.*, vol. 5, pp. 55-66, 2006.

[9] BECR. The Bangladesh Environment Conservation Rules: pp 205-207, 1997.