



Impact of Industrial Effluents Discharges on Degradation of Natural Resources and Threat to Food Security

M. Anwar Hossain^{1,2*}, M. Khabir Uddin^{1*}, A. H. Molla³, M. S. I. Afrad⁴, M. M. Rahman⁵ and G. K. M. M. Rahman⁵

¹Dept. of Environmental Sciences, Jahangirnagar University, Savar, Dhaka, Bangladesh.

²Hazrat Shahjalal International Airport, Civil Aviation Authority of Bangladesh, Dhaka, Bangladesh

³Depts of Bioenvironmental Science, ⁴Agricultural Extension and Rural Development and ⁵Soil Science, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

*Corresponding author and Email: anwarbuet2007@yahoo.com, khabir88@yahoo.com

Received: 15 December 2010

Accepted: 17 March 2011

Abstract

The present study evaluates the impact of industrial effluent on degradation of natural resources and threatening of food security in Gazipur, one of the most thickly industrialized district in Bangladesh. The present survey study was conducted based on pre prepared questionnaire in two locations viz, Sreepur Upzilla and Gazipur Sadar Upzilla during July to October, 2009 with sample size of 50 person. Almost 100% of the respondents identified that untreated industrial effluents degraded surface water and soil along with negative impact on crop, insect pests and animals. The health and proper growth of human, domestic animals and aquatic animals are also affected by awful effects of untreated industrial effluents. The presence of tiny part (4%) of untreated industrial effluent decreases the quality of ground water. To address this alarming sign, immediate action should be taken for saving protecting the ecosystem from unplanned and untreated discharges of industrial effluents here and there.

Keywords: Industrial effluent, pollution, environmental degradation

1. Introduction

Industrial effluents coming from different industrial and commercial establishments posing serious threats to environment, particularly in urban and semi urban areas. It becomes the source of pollution for surface and subsurface water, soil and air. Its proper management and disposal is one of the most serious challenges all over the world and also in Bangladesh (Martin, 1991). Gazipur is one of the most thickly industrialized districts in Bangladesh. The production of industrial effluents in this district is also higher as compared to other areas.

Huge industrial establishment and their indiscriminate discharges pose a great threat to our environment. Industrial wastewater deteriorates not only the quality of soil, crop and

environment but are also directly harmful to the human, animal and aquatic lives. Unplanned discharges of industrial wastewater degrades the quality of food crops. The total land irrigated with raw or partially diluted wastewater has been estimated to be about 20 millions hectares in fifty countries, which is approximately 10% of total irrigated land (FAO, 2003).

The textile effluent is the most polluting among all industrial sectors considering both volume and composition of effluents in developed country, Japan (Vanndevivera *et al.*, 1998) and also in Bangladesh (Roy *et al.*, 2010). Disposal of textile industrial effluents in rivers decreased rice production and was a potential cause of environmental degradation (Setyorini *et al.*, 2002). It has been projected that after 20 years of

contamination, the average rice yield will be decreased by about 80% due to pollutions. The heavy metal content in the soil will be increased by about 18 - 98%, compared to the present unpolluted soil (Kurnia *et al.*, 2000).

Survey is an important and effective way of getting relevant field level information required for any research and development program. The aim of the present study was to generate information about the impact of wastewater on socio-economic, health and environmental aspects of urban and semi-urban areas of Gazipur district.

2. Methodology

In order to achieve the objectives of the study, an intensive field survey was conducted in two locations of Sreepur and Gazipur Sadar upazilas under the district of Gazipur (Table 1). An arrangement has been made in order to have responses of the residents living near these industrial areas about open discharges of industrial effluents. In this regard, fifty respondents living adjacent to each industry were interviewed, based on the pre-designed interview schedule during from July to October 2009.

Data gathered through direct interviewing were coded for processing and analysis. The

SPSS/PC+ computer program was used to perform the data analysis.

3. Results and Discussion

3.1. Quality of surface water

Surface water is a vital source of irrigation, household usages etc. However, the discharges of untreated industrial wastes have been deteriorating the quality of surface water. Table 2 shows that all of the respondents (100%) identified surface water as unusable for drinking in terms of quality, taste, color and odor. Surface water is completely unusable for cooking, bathing, irrigation and other domestic uses.

About 14 - 26% respondents report that the surface water could still being used for their bathing and also for domestic animals considering low decreasing of taste and color (Table 2). Such water was considered unsuitable due to bad odor. About 100% respondents opined that such water is not suitable for irrigation purpose due to indiscriminate discharge of untreated industrial wastes. Thus, quality of surface water in those areas was seriously deteriorated for various kinds of usages.

Table 1. Name, type and location of the industries in the study area

Sl	Name of the industries	Types of the industries	Specific locations
1	Colombia Washing Plant	Dying	Chapulua, Gazipur Sadar
2	Mark Wash and Dying	Dying	Khashpara, Monipur, Sreepur
3	Aswad Spinning	Spinning	Boiragirchala, Sreepur
4	Chittagong Textile	Textile	Boiragirchala, Sreepur
5	Fakhruddin Textile and Dying	Textile & Dying	Boiragirchala, Sreepur
6	Dat Composite Textile	Dying, Knitting, Garments	Satiabari, Rajabari, Sreepur
7	Denim Ltd.	Dying	Dogori, Mirzapur, Sreepur
8	Hasan Sweater & Dying	Sweater & Dying	Mulaid, Sreepur
9	Talha Textile	Textile	Mulaid, Sreepur

Table 2. Distribution of the respondents according to their responses on decrease in quality of surface water

Types of used	Types of quality	Respondents					
		LD		MD		HD	
		No	Percent	No	Percent	No	Percent
Drinking	Taste	-	-	-	-	50	100
	Color	-	-	-	-	50	100
	Odor	-	-	-	-	50	100
Cooking	Taste	-	-	5	10	45	90
	Color	-	-	7	14	43	86
	Odor	-	-	-	-	50	100
Bathing	Taste	12	24	7	14	31	62
	Color	7	14	3	6	40	80
	Odor	-	-	20	40	30	60
Using for domestic animal	Color	10	20	25	50	15	30
	Odor	13	26	27	54	10	20
Irrigation	Color	-	-	5	10	45	90
	Odor	-	-	25	50	25	50

*LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease

3.2. Quality of ground water

Ground water is the most important source of drinking water. At present almost all depends on ground water for drinking purpose. As per the responses of the respondents presented in Table 3, it is observed that drinking water still remains uncontaminated due to haphazard discharge of industrial waste water though a very few of them expressed their concern about gradual deterioration of quality of the ground water for the same reason.

3.3. Quality of soil

Soil is the important medium of plant growth. It controls crops' quantity and quality. Continuous throwing of industrial wastes on soil reduces its quality. As per the findings shown in Table 4, it is seen that low lands are the worst victim of the situation compared to medium and high lands. This is because discharged wastes are ultimately deposited in the low land and remain there for a long time unless these are washed away through flood water.

Table 3. Distribution of the respondents according to their responses on decrease in quality of ground water

Types of used	Types quality	Respondents							
		ND		LD		MD		HD	
		No	Percent	No	Percent	No	Percent	No	Percent
Drinking	Taste	45	90	5	10	-	-	-	-
	Color	48	98	-	-	2	4	-	-
	Odor	43	86	5	10	-	-	2	4
Cooking	Taste	50	100	-	-	-	-	-	-
	Color	46	92	4	8	-	-	-	-
	Odor	49	98	2	4	-	-	-	-
Bathing	Taste	38	76	10	20	-	-	2	4
	Color	46	94	4	8	-	-	-	-
	Odor	50	100	-	-	-	-	-	-

*ND= No Decrease, LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease

Table 4. Distribution of the respondents according to their responses on decrease in quality of soil

Types of land	Types of quality	Respondents					
		LD		MD		HD	
		No	Percent	No	Percent	No	Percent
High	Color	17	34	22	44	11	22
	Odor	32	64	18	36	-	-
Medium	Color	29	58	21	42	-	-
	Odor	30	60	18	36	2	4
Low	Color	-	-	12	24	38	76
	Odor	-	-	-	-	50	100

*ND= No Decrease, LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease

Table 5. Distribution of the respondents according to their responses on increase in insect infestation.

Types of crops	Respondents							
	NI*		LI		MI		HI	
	No	Percent	No	Percent	No	Percent	No	Percent
Cereals	-	-	4	8	45	90	1	2
Pulses	12	24	25	50	1	2	12	24
Oil seeds	3	6	22	44	25	50	-	-
Vegetables	-	-	3	6	9	18	38	76
Fruits	-	-	7	14	8	16	35	70

*NI= No Increase, LI= Low Increase, MI= Moderate Increase, HI= High Increase

It is revealed from Table 3 that a very small portion of the respondents identified low level decrease in quality of ground water due to dumping of untreated industrial wastes.

Regarding high land contamination, a substantial portion of the respondents (34% color and 64% odor) reported about low decrease in quality and more or less equal portion of them (44% for color and 36% for odor) pointed out medium decrease of the same. Similar result was obtained in case of medium land. Thus decrease in quality of all types of soil through dumping of unplanned industrial discharges has been reported by the respondents.

3.4. Insect pest infestation

Generally speaking, insects are the enemies of crops they may cause a substantial loss of a crop yield. The information provided by the respondents indicated that after establishment of

industries the insect pest infestation increased to a great extent (Table 5).

Information displayed in Table 5 indicates that all the respondents (100%) mentioned about the increase of pest infestation (from LI to HI) in cereals, vegetables and fruits in their localities after establishment of industries. As per the responses of some respondents (24% and (6%) there was no increase in insect infestation in pulse and oilseed crops.

3.5. Yield of crops

Due to establishment and their indiscriminate discharges crop yield was found to be decreased (Table 6) as reported by the respondent. Findings shown in Table 6 indicated that similar to the increase in insect infestation, all of the respondents (100%) reported about the negative impact of unplanned discharge of industrial wastage on yield of cereal crops and fruits.

Table 6. Distribution of the respondents according to their responses on decrease in yield of crops

Types of crops	Respondents							
	ND*		LD		MD		HD	
	No	Percent	No	Percent	No	Percent	No	Percent
Cereals	-	-	10	20	30	60	10	20
Pulses	10	20	20	40	20	40	-	-
Oil seeds	20	40	10	20	20	40	-	-
Vegetables	22	44	25	50	3	6	-	-
Fruits	-	-	10	20	34	68	6	12

*ND= No Decrease, LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease

Table 7. Distribution of the respondents according to their responses on decrease in quality of food crops

Types of crops	Nature of quality	Respondents							
		ND		LD		MD		HD	
		No	Percent	No	Percent	No	Percent	No	Percent
Cereals	Size and shape	18	36	13	26	18	36	1	2
	Taste	-	-	-	-	5	10	45	90
	Color	6	12	42	84	2	4	-	-
	Odor	-	-	-	-	3	6	47	94
Pulses	Size and shape	21	42	12	24	7	14	10	20
	Taste	-	-	22	44	14	28	16	32
	Color	48	96	2	4	-	-	-	-
	Odor	-	-	29	58	21	42	-	-
Oil seeds	Size and shape	2	4	12	24	28	56	8	16
	Taste	7	14	23	46	18	36	2	4
	Color	9	18	32	64	3	6	6	12
	Odor	15	30	22	44	7	14	6	12
Vegetables	Market value	8	16	24	48	8	16	10	20
	Size and shape	-	-	-	-	5	10	45	90
	Taste	-	-	-	-	-	-	50	100
	Color	-	-	-	-	22	44	28	56
Fruits	Odor	-	-	12	24	32	64	6	12
	Size and shape	8	16	25	50	12	24	5	10
	Taste	14	28	22	44	14	28	-	-
	Color	19	38	12	24	19	38	-	-
	Odor	22	44	16	32	5	10	7	14

*ND= No Decrease, LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease

Though, in case of oil seeds, vegetables and pulses some of the respondents (20%, 40% and 44%, respectively) opined that they did not find any decrease in their yield due to the discharge of the same. But within the broader context, all the crops mentioned incurred losses due to the establishment of industries discharging untreated wastes.

3.6. Quality of food crops

Qualities of food crops included size and shape, taste, color, odor etc. that are the determining factors of market value. Food qualities also increase the satisfactory consumption of the food items by the growers. Data presented in Table 7 reveal that a mentionable portion of the

respondents (36% and 12%) indicated no change in size, shape and color, respectively of cereals but in terms of taste and odor almost all of them (90% and 94%, respectively) found decrease in quality of food crops.

Almost all of the respondents (96%) hinted no change in color of pulses and it was 42 percent in terms of size and shape. However, decrease in odor and tastes were reported by all the respondents (100%). The findings were very alarming in case of vegetables, where almost all the respondents (100%) found severe decrease in quality. Similar results were observed in case of oilseeds and fruits. Therefore, it was clear that unplanned discharges of industrial wastes degraded the quality of food crops in the study areas.

3.7. Effects of industrial discharges on human, animal and aquatic lives

Untreated and unplanned industrial discharges deteriorate not only the quality of soil, crop and

environment but also directly affect the human, animal and aquatic lives. From the data displayed in Table 8 it is observed that most of the respondents (96%) in the industrial areas faced medium to high levels of dermal diseases and about equal portion of them (86%) have been suffering from respiratory diseases. The other diseases they suffered from Diarrhoea, Dysentery, Gall Bladder Cancer, Kidney problem, Sterility and Abortion of female.

In case of domestic animals, all of the respondents directed their opinions that foot & mouth disease, dermal disease and mastitis occur due to these untreated wastes dumping in the areas. Similarly, all the respondents also pointed out dermal diseases, low growth, and foul odor of aquatic animals after cooking. Thus, human being, domestic animals and aquatic animals are also suffering from bad effects of industrial wastes which are dumped untreated.

Table 8. Distribution of the respondents according to their responses on effects of industrial discharge on human, animal and aquatic animals' health.

Types of sufferers	Types of diseases	Respondents					
		Low		Medium		High	
		No	percent	No	percent	No	Percent
Human being	1. Dermal disease	2	4	12	24	36	72
	2. Respiratory disease	7	14	23	46	20	40
	3. Diarrhoea	13	26	25	50	12	24
	4. Dysentery	26	52	22	44	2	4
	5. Gall Bladder cancer	15	30	22	44	13	26
	6. Kidney problem	45	90	5	10	-	-
	7. Sterility	37	74	7	14	6	12
	8. Abortion of female	25	50	12	24	13	26
Domestic animals	1. Foot & Mouth disease	19	38	19	38	12	24
	2. Dermal disease	35	70	12	24	3	6
	3. Mastitis	23	46	5	10	22	44
Aquatic animals	1. Dermal disease	11	22	21	42	17	34
	2. Low growth	13	26	24	48	13	26
	3. Foul odor after cooking	18	36	12	24	20	40
	4. Taste	6	12	7	14	37	74

Besides the above findings, during the collection of data, the researchers directly and keenly observed the situations. Some of the respondents informed quick hasty decays of tins of their roofs. Some of them showed their discolored gold ornaments. Furthermore, during collection of soil and water samples, no aquatic animals were observed in the contaminated soil and water. A pictorial view of open discharge of industrial wastes and damaged crop fields due to stagnant are furnished in Figure 1 and 2 respectively.

3.9. Effects of industrial discharges on different types of animals

Most of the respondents (80%) in the industrial areas suppose that there are medium to high levels decrease of fishes, birds and earthworm while decreases of insect and frog are 70% and 60% respectively. Distribution of the respondents according to their responses on decrease in different types of animals is shown in Table 9.

Table 9. Distribution of the respondents according to their responses on decrease in different types of animals

Types of animals	Respondents							
	ND*		LD		MD		HD	
	No	Percent	No	Percent	No	Percent	No	Percent
Fishes	-	-	10	20	30	60	10	20
Frogs	-	-	20	40	20	40	10	20
Birds	-	-	10	20	20	40	20	40
Insects	-	-	15	30	13	26	22	44
Earthworms	-	-	10	20	34	68	6	12

*ND= No Decrease, LD= Low Decrease, MD= Moderate Decrease, HD= High Decrease



Fig. 1. Open discharge of industrial wastes in South Dhonua, Sreepur, Gazipur



Fig. 2. Damaged crop fields due to stagnant industrial effluents

4. Conclusions and Recommendations

From the findings and their local interpretation, it can be concluded that in the urban and semi urban areas of Bangladesh, the industrial establishments are increasing rapidly, which produce huge amount of effluents. Their indiscriminate discharges degrade surface and ground water, soil, crop, insect pest, animal and human lives. Quality of ground water, our major source of drinking water is also deteriorated. So, it is a high time to take special attention to take remedial measures for the industrial effluents. The existing laws should be strengthened and or applied for treating the untreated industrial effluents and improve our ecosystem in future.

References

- FAO 2003. Food and Agriculture Organization of the United Nation, World Water Development Report, Natural Resources and Environment Department, Water Development and Management Unit. Web address: <http://www.fao.org/nr/water/> dated 21 July 2010.
- Kurnia, U., Sutono, S., Markus Anda, Sulaeman, Kurniawansyah, A. M. and Tala'ohu S.H. 2000. Pengkajian baku mutu tanah pada lahan pertanian. Laporan Akhir Kerjasama Penelitian Bapedal-Puslitbangtanak, Indonesia. Web address: <http://www.agnet.org/library/eb/521/> dated 09 Feb. 2011.
- Martin, A. M., 1991. Biological degradation of wastes, Great Yarmouth, GB, Elsevier Science publishers Ltd.
- Roy, R., Fakhruddin, A. N. M., Khatun, R. and Islam, M. S., 2010. Reduction of COD and pH of textile industrial effluents by aquatic macrophytes and algae. *Journal of Bangladesh Academy of Sciences*, 34(1): 9-14,
- Setyorini, D., Prihatini, T. and Kurnia, U., 2002. Pollution of soil by agricultural and industrial waste. Food and Fertilizer Technology Center, Indonesia. Web address: <http://www.agnet.org/library/eb/521/> dated 09 Feb. 2011.
- Vanndevivera, P.C., Bianchi, R., Verstraete, W., 1998. Treatment and Reuse of Wastewater from the Textile Wet-Processing Industry: Review of Emerging Technologies. *Journal of Chemical Technology and Biotechnology*, 72: 289-302

