

# Environmental Impact Assessment of Tanneries: A Case Study of Hazaribag in Bangladesh

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**Abstract**—From the very beginning of industrialization in Bangladesh, tanning industries have been playing a significant role in the country's economy. Due to its importance as a labor based export oriented industry the full flourish of this industrial sector is essential. But due to the absence of proper waste management, using inferior technologies, lack of facilities for treating industrial wastes; the tanning industries especially located in Hazaribag, Dhaka are aggravating environmental problems day by day. The discharging and dumping of wastes near the water bodies without treatment makes it almost look like an area which is lying under the blanket of pollution. It is an emerging problem not only for the environment but also as the social context of the country. This study focuses on the tanneries of Hazaribag located in Dhaka to assess the present situation arising from such activities and proposed several mitigation measures. This was done by analyzing the affects of various chemicals over human health and the surrounding environment. An Environment Impact Assessment (EIA) was undertaken for assessing several physical, ecological, human use and socio-economic parameters of the surrounding environment of the area.

**Index Terms**—Environmental pollution, impact assessment, health hazards, mitigation measures.

## I. INTRODUCTION

All sectors of our society like industry, agriculture, mining, energy, transportation, construction and consumers generate wastes. Industrial wastes are usually generated from different industrial processes, as a result the amount and toxicity of waste released from industrial activities varies with the industrial processes. Again, among all the industrial wastes tannery effluents are ranked as the highest pollutants [1]. Because of the relatively inexpensive cost of labor and materials, over half the world's tanning activity occurs in low and middle income countries. Between 1970 and 1995, the percentage of low to middle income countries contributing to the global production of light leather increased from 35% to 56% and from 26% to 56% for the production of heavy leather materials [2]. According to a study conducted by Blacksmith Institute roughly about 75% of chromium sites are located in South Asia and of these, nearly a third are associated with tannery operations, with mining and metallurgy sites also contributing significantly. The high concentration of chromium sites in South Asia is primarily due to the abundance of tanneries in the region. Many of the

tanneries have poor environmental controls [3].

Tanning industry is an old manufacturing sub-sector in Bangladesh with a long heritage of over six decades. The tanneries of Hazaribag started their journey from 1960. It was first introduced by Punjabi traders from what was then Pakistan. The industries expanded and after the independence of Bangladesh in 1971, the government took over the tanneries abandoned by the departing non-Bengali entrepreneurs and eventually made it a 'cash cow' to earn foreign currencies. The peak time of collection is during the Muslim festival of animal sacrifice, the Eid-ul-Adha. Leather manufactured from this place is being shipped to the US and Europe, and other parts of the world for further processing. With the current trend of more focus towards ethical manufacturing process, countries are much interested towards the way in which their products are manufactured. They focus on the fact that it is done in a way that does not infect the environment. Few large factories are providing some facilities while the smaller are in very bad and poisonous situation. Reused chemicals from the larger factories are being used by the small factories which are more dangerous and vulnerable for the workers as well as for the environment. About 40 heavy metals and acids are used for processing raw hides [4]. A few export-oriented factories use some safety equipments for their workers and others don't pay attention. Jaundice, nausea and headache are another common sickness among them. The European Commission is considering about banning the leather imported from Hazaribag due to its manufacturing process. So, it is very important to know the pollution level for the protection of environment and natural resources and require sustainable development in term of managerial routines.

## II. OBJECTIVES OF THE STUDY

So, the overall objectives of this study were:

- 1) To describe present scenario of the existing surrounding environment.
- 2) To identify the source of environmental degradation and other environmental concern.
- 3) To suggest an abatement plan to comply with Environmental Conservation Rules (ECR), 1997 of Bangladesh.

## III. LITERATURE REVIEW

The whole tannery industrial activity entails a series of tasks which pose threats to the ambient environment and health of working people. The tanning industry causes horrendous environmental pollution and high environmental

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impact of tannery effluents makes its treatment an essential fact, mainly due to its volume, nature and concentration of pollutants such as tanning agents (chromium and tannin), color, organic matter and others [5]. Many authors have worked regarding tanneries of Hazaribag before showing the impact of various pollutants on water, water test results, health hazards and some measures but no prior work was found conducting EIA during literature review. However, the adverse effects of tannery pollutants on environment and health are discussed here.

According to Imamul Huq (1998), various chemicals are used during the soaking, tanning and post tanning processing of hides and skins. The main chemicals used include sodium sulphite and basic chromium sulphate including non-ionic wetting agents, bactericides, soda ash, CaO, ammonium sulphide, ammonium chloride and enzymes. Others are sodium bisulphate, sodium chlorite, NaCl, H<sub>2</sub>SO<sub>4</sub>, formic acid, sodium formate, sodium bicarbonate, vegetable tannins, syntans, resins, polyurethane, dyes, fat emulsions, pigments, binders, waxes, lacquers and formaldehyde. Various types of processes and finishing solvents and auxiliaries are used, as well [6]. It has been reported that only about 20% of the large number of chemicals used in the tanning process is absorbed by leather, the rest is released as waste [3]. Hazaribag which is the largest tannery region in Bangladesh consists of more than 200 tanneries generate 7.7 million liters of liquid waste and 88 million tons of solid waste every day. The direct discharge of these wastes has contaminated the ground and surface water with dangerously high concentrations of chromium, as well as cadmium, arsenic, and lead [7]. The contamination of rivers also allows these pollutants to accumulate in common fish and shellfish species, which are used as local food sources.

The dumping of untreated liquid tannery wastes from tannery industries at Hazaribag, Dhaka is the major source of pollution of Buriganga. The chromium released from the Hazaribag tannery industries has been contaminating the water of the river Buriganga for the last 45 years. A statistics available from the Department of Environment reveal that 95 per cent of the tannery industries have been built in unplanned way at the congested places of Hazaribag during the last fifty years. According to a recent estimate, about 60,000 tons of raw hides and skins are processed in these tanneries every year, which release nearly 95,000 liters of untreated effluents into the open environment daily, resulting into the dead river Buriganga [8].

Chromium is a naturally occurring heavy metal that can exist in air, water, soil, and food, and common exposure pathways include ingestion, inhalation, and dermal contact. The primary health impacts from chromium are damage to the gastrointestinal, respiratory, and immunological systems, as well as reproductive and developmental problems. Chromium is a known human carcinogen. In addition, the chromium-laced solid wastes from tanneries are often converted into poultry feed as is the case in areas of Bangladesh—and can thus impact livestock and humans [9]. According to the WHO, over 8,000 workers in the tanneries of Hazaribag suffer from gastrointestinal, dermatological, and other diseases, and 90% of this population die before the age of 50 [10].

#### IV. STUDY METHODOLOGY

The study was conducted by a series of following tasks:

- 1) Visit to tanneries and surrounding areas.
- 2) On-site assessments and interviews with relevant personnel including workers, managers, and other stakeholders.
- 3) Preparation of EIA report from the interviews.
- 4) To suggest some mitigation measures to save the surrounding environment from further degradation.

##### A. Study Area

The study was conducted at Shahjalal Tannery and Latif Tannery which are situated in tanning industrial area of Hazaribag, Dhaka the capital of Bangladesh. The location is just adjacent to the Hazaribag Police Station and river Buriganga. The location of tanning industrial area (highlighted red) is shown in Fig. 1 according to the map of Dhaka City Corporation. Most of the surroundings are covered by other tanneries, houses, schools. There are many permanent and non-permanent settlements adjacent to the industries. Fig. 2 shows the solid wastes being dumped indiscriminately here and there in open places and Fig. 3 shows liquid waste containing chromium being discharged without any treatment into adjacent drain.



Fig. 1. Location of Hazaribag tanning industries.



Fig. 2. Solid wastes dumped in open spaces.



Fig. 3. Liquid waste with chromium discharged in drain without treatment.

## V. ENVIRONMENTAL IMPACT ASSESSMENT

Environmental Impact Assessment (EIA) is the assessment of the beneficial and adverse changes in environmental resources or values resulting from an industry or any development project. The EIA process of an industry essentially comprises of three sequential elements:

- 1) Identification of all potential positive and negative impacts on the natural and human environment resulting from an industry.
- 2) Evaluation or assessment which includes quantification of the identified impacts with respect to a common base and with respect to impacts from other industrial actions.
- 3) Preparation of a mitigation plan which upon implementation, will reduce or offset the potentially significant negative impacts to acceptable levels. This reduction may result from implementation of an industry production process alternatives or modifications or environmental protection measures. The plan simply reduces the number or magnitude of adverse impacts.

The EIA process may also include a monitoring plan to observe performance of the mitigation plan adopted for protection of the environment from degradation and to review the environmental changes during implementation and operation of the industry.

1) *The Method of Assessment:* Considering the situation prevailing in the country, a simple methodology was taken for EIA of tannery. The methodology is based on Environmental Evaluation System (EES). In EIA broader definition of environment is used and takes into account almost all environmental components considering Physical, Chemical, Biological, Ecological, Sociological, Cultural, Economical and Operational aspects. These various components influence the selection of parameters.

In Bangladesh, in the absence of a database it is only possible to estimate the potential environmental changes from the existing situation. In this method, the background environmental conditions were the reference level and the positive and negative changes in environmental conditions resulting from the tanneries was evaluated. The environmental impact was assessed by Environmental Impact Values (EIVs) which may be defined mathematically as equation (1):

$$EIV = \sum_{i=1}^n V_i W_i \quad (1)$$

Where  $V_i$  is the relative change in the value of environmental quality of parameter  $i$  with respect to existing situation.  $W_i$  is the relative importance or weight of parameter  $i$ , and  $n$  is the total number of environmental parameter related to the project. The computation of Environmental Impact Value (EIV) needs determination of  $V_i$ , the value representing the magnitude of alteration of the environmental parameters, and  $W_i$ , the value representing relative weight or importance of the respective parameters.

2) *Magnitude of Environmental Alterations:* The beneficial and adverse changes in environmental parameters resulting from a tannery, usually expressed in qualitative terms are plotted in a scale to quantify the environmental alterations in Table IV. Since the changes of environmental parameters are measured with respect to background conditions, no change has 0 values. The adverse changes have been given values -1, -2, -3, -4 and -5 to represent very low, low, moderate, high and severe negative impacts respectively. Similarly +1, +2, +3, +4 and +5 represent very low, low, moderate, high and very high positive impacts respectively. A value from the scale representing effect of the project on each parameter was taken to compute the EIV of the tannery.

3) *Relative Importance of Environmental Parameters:* The EES methodology is based on the assignment of an importance unit to each parameter by judgment of professional experts consists of chemists, biologists, civil engineers, environmental engineers, agricultural scientists, social scientists and urban planners. But in this study due to absence of proper guideline for selecting parameters and assigning importance value, judgment was used considering the surrounding environmental condition and some parameters were adopted from Battelle Environmental Evaluation System [11].

All environmental parameters influenced by the tannery are not of equal importance or weight. The importance of a parameter varies from country to country depending on the environmental concerns of the country. In Bangladesh, flood, employment, agriculture, fisheries, etc. carry more importance than many others. The parameters related to tannery industries were given different values based on prevailing environmental concerns in Bangladesh and are presented in Table I. The values representing importance or weight of the parameters can be used to compute the relative impacts of the parameters which are then summed up to obtain the total EIV. However, this method has following significant drawbacks [12]:

- 1) The input judgments are not quantified efficiently.
- 2) It does not consider the consistency of judgments.
- 3) Only neighboring parameters in the list are directly compared.

## VI. RESULTS AND DISCUSSION

The values indicating magnitude of environmental changes and corresponding importance or weight of environmental parameters influenced by the tanneries were placed in the appropriate columns in Tables I and then multiplied them to obtain positive and negative impact of the parameters. Finally all these impacts were summed up as illustrated in Table I to obtain the total EIV of -119.

TABLE I: ENVIRONMENTAL IMPACT ASSESSMENT (EIV) OF TANNERIES

Parameter	Relative Importance Value	Degree of Impact	Relative impact (positive)	Relative impact (negative)	EIV
<b>1. Physical</b>					-44
Surface Water Quality	3	-4		-12	
Ground Water Quality	2	+1	+2		
Air Quality	3	-5		-15	
Noise Quality	2	-5		-10	
Soil Quality	3	-3		-9	
<b>2. Ecological</b>					-32
Fisheries	2	-5		-10	
Aquatic Biology	2	-5		-10	
Vegetative Cover	2	-4		-8	
Wildlife	1	-4		-4	
<b>3. Human Use Values</b>					-15
Water Supply	2	+1	+2		
Power	2	+1	+2		
Agriculture	1	-5		-5	
Housing	3	-2		-6	
Recreation	1	-2		-2	
Sewage	2	-3		-6	
<b>4. Quality of Life Values</b>					-28
Employment	6	+5	+30		
Aesthetics	3	-5		-15	
Public Health	3	-5		-15	
Safety	3	-4		-12	
Solid Waste	4	-4		-16	
<b>Total EIV</b>					-119

Despite of some human interest related factors were positive the impacts on physico-ecological environment made the total EIV negative.

Based on the interviews it was found that the physical parameters gave the highest negative value of -44. It was due to contribution of tanneries to surface water pollution greatly and was clearly visible to everyone. The liquid wastes were discharged without any treatment. The bad smell in air and continuous sound in processing activities gave the air and sound quality negative degree of impact. During study it was also found that the solid wastes were dumped in open places and were burned openly. Thus the vegetative cover is harmed and also affecting the fisheries and aquatic biology. These reasons probably convinced the people during interview to give ecological parameters the negative degree of impact thus giving total value of -32.

Employment opportunities earned positive degree of impact because people living here are so poor that they are satisfied to earn rather than remaining unemployed although the working condition is totally adverse. Severe health problems prevail among them. During this study it was found that most of the workers do not use masks, safety goggles, special suits, gloves and special shoes rather they work in

bare feet. So parameters such as public health and safety gave negative degree of impact values. Aesthetics and solid waste parameters altogether with above mentioned parameters gave total quality of life values of -28.

Here the biggest problem is the absence of proper guideline. After the 1987 and 1988 floods, a multi-donor program called the Flood Action Plan (FAP) was undertaken in coordination with the World Bank. During the FAP studies, a substantial amount of information was generated that impacted variously on water resource development projects, particularly flood control, drainage and irrigation (FCDI) projects. As part of the FAP studies, the *Guideline for Environmental Impact Assessment (EIA)* was prepared in 1992 for use in ongoing and future FAP studies, similar FCDI and other water management projects. As a companion to the guideline, the *Manual for Environmental Impact Assessment* was prepared in 1995 to cover the technical aspects of EIA. These two documents are the first attempt to identify the environmental impacts of development activities in Bangladesh. They are still in use for medium and large-scale projects in the water sector. Another manual, titled *Guidelines on Environmental Issues Related to Physical Planning*, developed by the Local Government Engineering Department in 1994, is being used for small projects undertaken at the local level. But it is a matter of great regret that still there is no specific guideline for industrial sectors in Bangladesh to select parameters and assigning importance value with a view to conducting EIA. For this reason the authors had to use judgment. But some of these parameters from this study could be used for further EIA study for similar industrial sectors and it is high time to formulate an effective guideline to conduct EIA.

## VII. MITIGATION MEASURES TO AVOID HEALTH AND ENVIRONMENTAL HAZARDS

Despite of its adverse effects, its contribution to the GDP (Gross Domestic Product) in a poor country like Bangladesh is not negligible. Rather a sustainable approach should be taken to minimize the adverse effects of tanneries.

Following steps may be taken for sustainable practice:

- 1) Relocating the tanneries outside the Dhaka city.
- 2) Establishment of Central Effluent Treatment Plant (CETP) for treating the waste water.
- 3) Ensuring the safety of workers by providing gloves, masks, shoes, etc.
- 4) Assess the effects of tannery wastes on soil quality with respect to physical biological studies.
- 5) Using of chemicals within acceptable limits according to the regulation provided by the Department of Environment (DoE).
- 6) Managing the operating hours so that noise pollution does not affect habitant of the surrounding area.
- 7) Proper disposal of solid wastes containing harmful chemicals should be ensured, no wastes should be burnt in open place under any circumstances.
- 8) Wastes used as poultry food should be examined before it is given to the poultry farm, solid waste containing Chromium must not be used as poultry food.
- 9) Considering the socioeconomic aspect of Bangladesh

low cost coagulant such as alum, lime and ferric chloride can be chosen for the treatment of tannery effluents.

- 10) Effective Environmental Management Plan (EMP) should be introduced for maximum pollution abatement.

### VIII. CONCLUSION

In Bangladesh the tannery industries afflict the soil and river water environment and thus lessen ecological balance. This study has revealed that the tanning activities involve serious environmental hazards. Finally, it could be said that adequate preventive measures should be taken in tannery industrial activities with a view to ensuring safe, sound and healthy environment for the greater benefit of Bangladesh.

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