



## Textile Industry Management Need to Play Vital Roles in Order to Protect the Water-bodies from Severe Pollutions

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### Abstract

*In the textile industries, water is a very essential element. For many operations in various stages of textile productions, in order to produce various sorts of textile products, starting from raw fiber to RMG (Ready Made Garments), especially for the textile dyeing and washing mills, water plays very important roles. As a result, we notice a lot of composite textile mills by the side of many water-bodies, especially rivers, lakes, canals, drains, etc. When rivers are polluted by the wastes of the textile industries, it harms / disturbs the eco-system in various destructible ways. The environment as well as seasonal climate is vastly dependent upon the balance of the eco-system. Moreover, textile products as well as clothing are also very important for human beings. So, the textile industry managers should take the responsibility to improve eco-friendly status of the wastages released from their industry. The aim of this paper is to highlight the ways by which textile industries pollute the water-bodies; the level of harm caused by these pollutions and the ways to minimize these pollutions by improving the eco-friendly status of the textile industry wastages released to the water-bodies or to the environment.*

**Keywords:** Eco-friendly, water-body, ETP, pollution, Eco-system, environmental hazards.

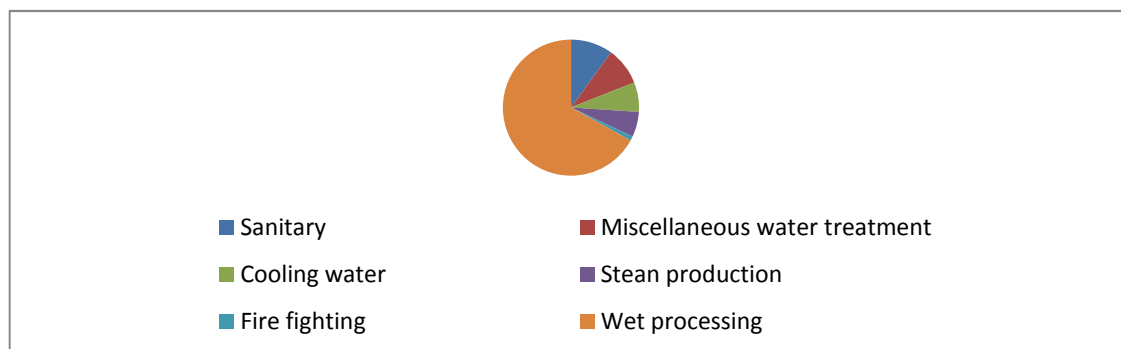
### Introduction

In the textile industries, there are wide varieties of wastages. Although over there, pollutions take place in a lot of ways, here we are giving high emphasis to the pollutions occurred by the wastages in the water-bodies. Water is such an important element in the world, over which the whole earth along with its soils, lands, living creatures, atmospheres, etc. are highly dependent upon. Astronauts are predicting of the presence of living organisms on those planets where there is the presence of water. So, they are trying heart and soul to discover water in different parts of the Solar system as well as in the Galaxy. It means, when there will be water-crisis on this earth, then the living-creatures will face the threat of extinction. Today, we all know, all the rich and modern countries across the globe, has withdrawn / removed textile industries, in order to protect their resourceful water-bodies such as oceans, seas, rivers, lakes, canals, drains, etc. from pollutions. But, it is very interesting to learn that, these rich countries are the major importers of the RMG<sup>1</sup>. Textile products and clothing are so important that, these are the basic demands of human beings as well as human civilization. Then, one may ask, "Who are playing the important roles of manufacturing the textile products?" It's although unfortunate, but true that, the Third World poor countries (e.g. Bangladesh) are the major sources from which the rich nations purchase the much needed clothing as well as other textile products. For these reasons, we generally find these third world countries being highly polluted. In Bangladesh, the water-bodies, such as rivers, by the sides of the textile industry belts, are highly polluted. This river-water is highly poisonous with toxic chemical wastages which are emitted from the dyeing and

washing plants of different textile mills and industries. The color of the water is dark and the odor coming out from there, are unbearable. The eco-system in the rivers are so endangered that, living organisms hardly survive there<sup>2</sup>. These try to escape from there or are found dead or pale. Even, this water is ruining the fertility of the adjacent cultivable soil of that area. These adverse effects are creating severe climatic/ atmospheric changes which are hampering the environmental balance of those regions causing floods, drought, mistiming of seasonal changes, etc., which are causing various diseases among living creatures as well as human beings. The main causes of malaria, diarrhea, dysentery, etc. water-bodied diseases are caused by water-body pollutions. Now, the question is, "shall the third world countries like Bangladesh stop producing textile goods which contribute (80-90) % of their foreign currencies to save the environment?" The answer shall be 'no', because there are definite ways by which these water-body pollutions caused by Textile Industries can be reduced up to (70-80) %, yielding eco-friendly water-body waste dumping to the rivers, canals, drains, lakes, etc. So, the textile industry managers shall be well aware of the effects of water-body pollutions caused by their mills / factories and thus, they shall search for legitimate solutions of minimizing hazards up to (70-80) % of the released water from their mills / factories<sup>3</sup>.

### Water Consumption in Textile Processing

The production of textile products is widely related to spinning, weaving / knitting, wet processing, and apparel manufacturing. The majority of the water consumption (60-70%) takes place in the wet processing of textiles.



**Figure-1**  
**Bangladeshi textile industry water usages percentages**

For preparing the fabric for dyeing, printing and finishing operations, intermediate washing / rinsing operations and machine cleaning water is required. Other major uses of water in the textile industry are steam generation as for boiler water feeding, water treatment plant, cooling of processing machines and cooling tower, humidification in spinning process and also for domestic purposes such as irrigation of lawn and garden, sanitation, cleaning, drinking and miscellaneous uses<sup>4</sup>.

### How Badly Textile Industry Pollute Water-bodies

Huge volume of water is required for textile production processes and highly polluted and toxic waste waters are discharged into sewers and drains without any treatment. The textile spinning, knitting, dyeing and apparel industries of Gazipur and Narayanganj generate large amount of effluents, sewage sludge and solid contaminated particles everyday which are being directly discharged into the surrounding channel, agricultural fields, irrigation channels, surface water and these finally enter in to nearby river. A number of inorganic and organic chemicals, detergents, soaps and finishing chemicals aid in the wet process to impart the required properties to textile products<sup>5</sup>. Residual chemicals often remain in the effluent from these processes. In addition, natural impurities such as waxes, proteins and pigment, and other impurities used in processing such as spinning oils, sizing chemicals and oil stains present in cotton textiles, are removed during desizing, scouring and bleaching operations. The textile dyeing and finishing industry has created a huge pollution problem as it is one of the most chemically intensive industries on earth. More than 4500 individual textile dyes are being manufactured by the Industry today. The industry is using more than 9500 chemicals in various processes of textile manufacture including dyeing, finishing, apparel washing and printing. A fraction of these may be listed as organic solvent, organic resin, formic acid, soaps, sulphur dyes, disperse dyes, vat dyes, sulphuric acid, caustic soda, softener, polyethylene emulsion, oxalic acid, reactive dyes, wetting agent, pva, ammonium sulphate, acetic acid, solvent 1425, leveling and dispersing agent, hydrogen peroxide, HCl, hydrosulphites and many more<sup>6</sup>. These chemicals are hazardous

and destructive human health directly or indirectly. By this survey, Some 85 toxic chemicals have been identified in water solely from textile dyeing, 38 of which cannot be removed. This indicates a great environmental problem for the clothing and textile manufacturers.

### What is the standard of Surface water?

Below table shows properties of Shitalakkhya river water sampled in the vicinity of the dyeing and garments washing activities. The tests were conducted by collecting river water at the adjacent point of several textile dyeing and garments washing plants from the Shitalakkhya River and compared with the river water standards. The results indicate that dye effluents increase pH, conductivity, TDS and turbidity, but decreases DO in river water. The water before entering the main path of the river and the river water at the entrance of the main path show similar properties<sup>4,7</sup>. The water sampled at the spillage site had higher pH, conductivity, TDS and turbidity and lower DO than the river water.

**How polluted water-body Harm the Environment:** Textile industries produce huge amount of effluent as hazardous toxic waste, full of color and organic chemicals from wet processing and finishing salts. Presence of acetic acid, soaps, chromium compounds and heavy metals like copper, arsenic, lead, cadmium, sulphur, naphthol, vat dyes, nitrates, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the effluent highly toxic. Other harmful chemicals associated in the water may be formaldehyde based dye fixing agents, hydro carbon based softeners and non bio degradable dyeing chemicals. The mill effluent is also often of a high temperature and pH, both of which are extremely destructive. If the waste water allowed flowing in drains and rivers it effects the quality of drinking water in hand pumps making it unfit for human consumption<sup>8</sup>. It also leads to leakage in drains increasing their overall maintenance cost. Such polluted water can be a breeding ground for bacteria and viruses and many other harmful lives. Impurities in water affect the textile processing in many ways.

**Table-1**  
**Comparison of the Shitalakkhya river water with river standard forms**

Parameters	River water (standard form)	Shitalakkhya River water (close to the Textile Mills)
pH	6.5-8.5	10.5
DO (Dissolved Oxygen)	6 mg/l	3.5 mg/l
TDS (Total Dissolved Solids)	< 13 mg/l	44 mg/l
Conductivity	32 $\mu$ S/cm	95 $\mu$ S/cm

**How polluted water-body Harm Living Creatures:** The colloidal matter present along with colors and oily scum increases the turbidity and gives the water a bad appearance and foul smell. It prevents the penetration of sunlight necessary for the process of photosynthesis<sup>5</sup>. Depletion of dissolved Oxygen in water is the most serious effect of textile waste as dissolved oxygen is very essential for marine life. When this effluent is allowed to flow in the fields it clogs the pores of the soil resulting in loss of soil productivity. The texture of soil gets hardened and penetration of roots is prevented.

Textile effluent is a cause of significant amount of environmental degradation and human illnesses. All the organic materials present in the wastewater from a textile industry are of great concern in water treatment because they react with many disinfectants especially chlorine. Chemicals evaporate into the air we breathe or are absorbed through our skin and show up as allergic reactions and may cause harm to children even before birth. Textile and dyeing industrial effluents may cause alteration of the physical, chemical, and biological properties of aquatic environment by continuous change in temperature, odor, noise, turbidity etc that is harmful to public health, livestock, wildlife, fish, and other biodiversity<sup>9</sup>. The presence of dyes in surface and subsurface water is making them not only aesthetically objectionable but also causes many water borne diseases, such as, mucous membrane, dermatitis, perforation of nasal septum and severe irritation of respiratory tract. Contamination to this aquatic system brings serious threat to the overall epidemic and socio-economic pattern inside.

## Recommendations

Many textiles industries in Bangladesh produce eco-friendly textile products nowadays following proper internationally famous buyers instructive suggestions. And the effluents released from their industries do not harm the environment. Our research found that this is only 10-15% of the total textiles industries in Bangladesh. If their formulae are properly applied by most of the textile industry management, a remarkable improvement of water body condition is possible most of which are briefly discussed below:

**Eco-Friendly Textile Processing: Reducing and Recycling Water:** It is important to remove the various pollutants from the waste waters before their final disposal. By reducing all forms of waste water industries can cut on costs and improve profits. It has been suggested that most companies can save 20% - 50% expenditure on water and effluent treatment charges by

reducing their water use. After identifying where the potential water savings can be made the next step is to introduce appropriate water saving measures like re-use of water. This consists of rinsing the product in a series of tanks using progressively cleaner water<sup>8</sup>. The rinse water is reused by moving it progressively from last rinse tank towards first. Wash water may also be suitable for re use elsewhere on the site such as for floor washing, rinsing containers etc.

**Awareness to Go Green:** We must change the ways fabric is made and finished. We need to produce luxurious, sensuous fabric in ways that are non-toxic, ethical and sustainable. Environmentally appealing technologies should be made available to the mainstream manufacturers. Efforts are needed to raise peoples' consciousness about the far-reaching implications of their textile choices. We can see the growing consumer consciousness to purchase eco-friendly clothing, drapes, or even carpets. A company cannot claim to sell a "green" shirt if the dyeing process used to color the garment wastes and pollutes water. Thus this new wave for eco friendly products is throwing a major challenge to several apparel manufacturers. Some companies have taken action and stopped using dyes on certain garments, but again, it everyone would not be happy with only off-white and beige colors to choose from. Consumers want color and variety in their clothing.

**Dyeing:** A solution seems to be in sight with the coming of "Air Dyeing Technology". Air Dyeing Technology is a dyeing process that uses air instead of water to dye garments, allowing companies to create garments with vivid designs and colors, without polluting the water and environment<sup>9</sup>. There are also other possibilities, such as, 95% less water can be used, 84% less Green House Gases could be emitted, 87% less energy required reduction of damage to goods, etc., compared to traditionally dyed garments. Again Air dyed fabrics can be washed at any temperature with or without bleach. Air dyeing also allows for new designs. Different sides of a single piece of fabric can be dyed in different colors or designs. This unique dyeing process is already in use to create vibrant, double-sided swimsuits, 100% recycled PET eco-chic t-shirts, window coverings, designer handbags and runway fashions of New York design house.

**Bleaching:** Chlorine bleach is known to be extremely toxic to the environment and to consumers, yet chlorine-based chemicals are still often used to bleach fabric. An alternative bleaching method which is oxygen-based (hydrogen per-oxide) can be used. Some mills have started using ozone, a very new

technology for bleaching. This technology relies on cool water rather than having to maintain the fabric in a hot water bath for many hours<sup>5</sup>.

**Functional Finishes:** Rather than using harsh chemicals to soften and finish the fabric a finish made of bees wax, Aloe Vera and Vitamin A are a good alternative. Efforts are on to find a Flame retardant finish that uses chemicals that do not have hazardous compounds.

**Sizing:** Instead of the use of polyvinyl alcohol (PVA) for sizing use of potato starch or carboxy-methyl cellulose (CMC) which is cellulose dissolved by an acid to become a liquid can be used. It is used in food and is chemically inert, non-toxic and is allowed under Global Organic Textile Standard 2.3.5.

**Fibers:** Cotton is the second-most damaging agricultural crop in the world; 25 percent of all pesticides used globally are put on cotton crops. Use of "bast" fibers such as hemp, linen, and abaca needs to be promoted. "Bast" fiber is spun into yarn from the stalk of the plant and not the flower. As Bugs do not attack the stalks, the plants can be grown without pesticides.

**Eco-Friendly Garments Washing:** The untreated effluents from the garments washing mills are highly poisonous due to the presence of various chemicals like acids, alkali, bleaching agents, sequestering agents, various salts, dyes, pigments, etc. This poisonous level can be remarkably reduced if eco-friendly washing is carried out by the application of cellulase enzymes to the washing recipe. In this way light-fabric garments as well as heavy-fabric garments, e.g. denim can be washed.

**Setting up the 'Effluent Treatment Plant (ETP):** Textile waste water can be handled by using evaporation and solid separation process. The technology is based on basic principle of reduction of quantity by concentrating the effluent and subsequently separation of salt and water<sup>8</sup>.

**The evaporation system:** The total process is under vacuum and the vapors generated in the system are re-used to economize steam consumption in multiple effect evaporation system with thermal vapour recompression system. Steam consumption is reduced here. Water recovered from the evaporator has low COD/BOD value and can be recycled in the plant.

**The separation process (Zero Liquid Discharge Section):** The resultant slurry (concentrate) is fed to the thickener and centrifuging section for converting the liquid concentrate to solid waste. The mother liquor from thickener and centrifuge is recycled back to evaporator. The water separated out from evaporator is good enough in quality to recycle in the plant for Dyeing.

**Water treatment to remove textile dyes:** Alternative treatment processes commonly used for waste water treatment in the textile industry are oxidation and adsorption (Özdemir et al., 2004).

Extensive use of activated carbon is expensive (Lima et al., 2008), making the method unsuitable for large scale application and in small scale where economic resources are limited<sup>10</sup>.

**Cost analysis of the water recycling process by ETP:** Wastewater treatment plant installation cost is in the range of US \$ 12.5–30 millions for small (below 300m<sup>3</sup>/d) scale textile dyeing industries. Again for medium (300–600m<sup>3</sup>/d) scale and large (above 600m<sup>3</sup>/d) scale textile dyeing industries, the cost is around US \$ 30-60 millions and US \$ 60-90 millions respectively<sup>11</sup>. The maintenance and operation cost is as below.

Total expenses needed for the water treatment and recovery is about US \$ 2.0/m<sup>3</sup> of the effluent. Due to non-availability of good quality water for dyeing processes in Narayanganj, many innovative technological approaches are required to set up which is economically viable in the studied area.

## Conclusion

Textile industry sector are the key driven forces to the overall national economy of Bangladesh. Lower class people lifestyles are greatly impacted by the textile industry in our country. By survey, we have found that, although 10-15% textile industries in Bangladesh adopted internationally acceptable water-treatment procedures, the remaining 60-70% or more industries lack or do not run such well-practiced technology, resulting in the harmful effluents release to the water bodies in order to save their factory cost. Their miserly ill-motivated activities have already contaminated most of the veins-like water bodies of Dhaka division and its surroundings. Despite of having many hazardous effects of textile industry, management should try best to solve these problems. So, joint efforts from manufacturers, buyers, government and many other agencies are required to find effective measures to minimize the adverse impact and alternatively promote the positive impact in Bangladesh. This Research has also found that the volume of water body pollution exceeds acceptable standards in our country due to above problems associated to textile industry. The concentration of these pollutants is increasing in an alarming rate with the increasing number of textile spinning, dyeing, knitting, washing and apparel industries. So the above suggestive measures can be effective to minimize the pollution to a significant extent. Finally, for the greater benefits and betterment of our country, all people involved in textile industry especially the management should be environmentally conscious to save our environment as well as to carry the reputation of our readymade garments.

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