DETERMINATION OF HEAVY METALS IN DIFFERENT INDUSTRIAL SITES OF SAVAR UPAZILA OF DHAKA

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DHAKA-1207

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A THESIS
BY

M.GOLAM RABBI TANVEER
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ABSTRACT

Bangladesh is a low lying area covered country with a huge number of populations. Most of the population depends upon the agricultural land and cultivation of soil. But with rapid industrialization, land especially nearside of Dhaka are going too covered with industries. As expected task, industries are polluting the surrounding environment with their discharge. The study was carried out to find out the impact of the Industrial discharge on surrounding environment and agricultural productivity. During the study a total number of 40 soil samples were collected from different target location (Tannery, pharmaceuticals, textile, dyeing, food and beverage Industry prone area) of Ashulia, Savar, Amin Bazar, Dhamsona union of Savar upazila. Later, Different parameter like pH, P, Fe, Mn, Cd, Cr, As, Pb, DO were analyzed from the collected sample. The mean value of pH, P, Fe, Mn, Pb, As in the soil sample of target area in Ashulia was 6.88, 28.27mg/kg, 122.42 mg/kg, 55.56 mg/kg, 27.88 mg/kg, 5.03 mg/kg. In savar it was 7.01, 25.98 mg/kg, 85.67 mg/kg, 44.96 mg/kg, 30.3 mg/kg, 5.39 mg/kg. In Amin Bazar it was 5.94, 24.75 mg/kg, 88.4 mg/kg, 52.62 mg/kg, 38.06 mg/kg and 5.80 mg/kg. In Dhamsona it was 6.90, 25.24 mg/kg, 94.04 mg/kg, 46.21 mg/kg, 30.67 mg/kg, 5.23 mg/kg. Soil of Amin Bazar was more acidic (5.94 pH) and soil of savar (pH 7.01) and Dhamsona (pH 6.98) union, It was almost in neutral in condition. Mean P was higher in Ashulia soil (28.24 mg/kg). Pb (38.06 mg/kg) and As (5.81 mg/kg) was higher in Amin Bazar soil. Industrial waste must not be discharged to any of the open field, River, Canal or any other water bodies before recycling. Therefore, Industrial waste is a great concern to ecosystem and environment. It destroys the ecosystem function, environment balance and health hazards. Further study should be carried out to carry out multiple variables related to waste and metal discharge to investigate the crisis so that clear and deeper information of impact may found.

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LIST OF ABBREVIATIONS

AEZ	:	Agro-ecological zone
ADB	:	Asian development bank
BAU	:	Bangladesh Agricultural University
BBS	:	Bangladesh Bureau of Statistics
DoF	:	Department of forestry
et al.	:	and others
FAO	:	Food and Agriculture Organization
VS	:	Veterinary Surgeon
AEO	:	Agriculture Extension Officer
UAO	:	Upazila Agriculture Officer
MoH	:	Ministry of Health
SRDI	:	Soil Resource Development Institute
LGED	:	Local Government and Engineering Department
Wikipedia	:	A site of information

INTRODUCTION

In particular of Bangladesh and world, pollution through heavy metals are one of the most severe tricky in soil, water and plants. Therefore it is much more likely to cause the contamination of soil. It has become a serious issue for the next generation to face the challenges of the metals effect that is causing by the rapid urbanization and the large scale industrialization. Heavy metals contamination is one of the great issues as these have the toxicity and ability to accumulate in the biota. Industrial or municipal waste water irrigation is a common example in almost three fourth of the cities in Asia, Africa, and Latin America (Gupta *et al*., 2008). Investigations on the accumulation of heavy metals from vegetables grown around the industrial sites have revealed high levels of Ni, Pb and Cd in vegetables.

"Heavy metals'' may be termed as the metals that have the character of toxicity and poisonous effect in a low concentration, relatively high in density (Lenntech, 2004). Heavy metals are the compounds that have specific gravity greater than 5 parts. The "heavy metals" is generally a collective term, which applies to the group of metals and metalloids with atomic absorption density greater than 4 g cm-3 or 5 times or more, greater than water (Huton and Symon, 2005 ; Hawkes, 1997). Generally heavy metals are termed as the trace elements, microelements, micronutrients, trace inorganic elements and minor elements. So far, it has been identified that there are 38 elements known as the heavy metals, meanwhile most industries discharge with more than thirteen elements (Rizwana,2016) like as - copper (Co), iron (Fe), mercury (Hg), molybdenum (Mo), cadmium (Cd), chromium (Cr), cobalt (Co), nickel (Ni), lead (Pb), arsenic (As), tin (Sn) and zinc (Zn). In addition to say that mostly some of the heavy metals are insignificant both human and health. But some of these heavy metals are essential in trace amounts, namely Cobalt (Co), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo) and Zinc (Zn) to plants and Nickel (Ni), Chromium (Cr) and Tin (Sn) to animals

but Cadmium (Cd), Arsenic (As), Mercury (Hg) and lead (Pb) either not proven essential both for plants or animals. Heavy metals are such a topic to emergence due to their capability to bind on both organic and inorganic colloids. Few of the sources of heavy metals contamination in both soil; and water are referred as the pesticides, fossil fuels, fertilizers, manure, municipal wastes, industrial discharge, sewage-sludge, mining wastes, animal wastes, contaminated water etc. (Arora *et al.,* 2008). These discharged element have a final fate of the soil sink. Kabata and Pendias showed that Soil is the final sink or goal for all the trace elements, and the elements. It was expected that the residence time of Cd in the soil might be in the range of 75 - 380 years and more strongly sorbet elements like As, Cu, Ni, Pb and Zn ranged from 1500 - 3000 years (Butt, 2005). In recent times in the nearside of Dhaka metro it has been showed that the cultivation of the vegetables are more rapidly increasing in number matched to the cereal cultivation. A significant use of the waste water in cultivation in these area are more common as there is a great lack of pure water in the rabi season and almost all year round .Therefore there can be great opportunity of passing heavy meats in human food chain.

In the recent times, wastes are considered as the most described topics. Industrial waste is one of them that is describing as issue of most imperative. In all environments industrial wastes are considered as the main source of effluence those of which urges a on spot treatment before positioning in a sewage systems (Imorgor *et al.,* 2005). The environment of soil and water are in much pressure discharge of effluents of rapidly expanded industries. A progressive increase in industry wastes are seen as there is a rapid increase in industrialization, in Bangladesh. Such products are causing soil, air and water contamination and polluting the environment thus.

A agro-based country like Bangladesh with a mass pollution of more than 1077 (BBS'16) are in great threat to it. Pharmaceuticals, textile, sugar, fertilizer and

leathers are the main industries in Bangladesh. Unfortunately the processing of production and raw materials are polluting the environment of these industries. As Bangladesh is a developing country of third world and is in a vulnerable position. About 30,000 industrial units of which about 24,000 were small and cottage industry is present in Bangladesh (Nuruzzaman *et al.*, 2008).

Production has increased by 46 percent since 1981. Also a group of Tannery, industrial chemicals, pharmaceuticals and garments products is increasing by 200 to 4000 percent over last ten to fifteen years (DoE, 2008). About 1200 industries those are polluting in huge with no treatment facilities of wastes (DoE, 2008).

These effluents that are coming out of these industries are discharging either to soil or river (Khan, 2006). As global environment are polluting fast, also causes are inter-connected. It has become a important issue. Few cases like, lack in logistic support, rapid industrialization, poor waste treatment, monitoring inequality and unplanned urbanization modified the situation greatly. Environment has become hostile in recent time; health and welfare due to these pollutants of industries are in a threat (The Daily Star, 2016). The environment of water and soil contamination with various pollutants has been increased considerably in most of the part of the world. Discharged effluent of the industries and urban sewage finds its own way to water bodies and soil surface via surface run-off and rivers. Pollutants are receiving by the water bodies like lagoons, ponds and lakes, out becoming vulnerable. A profound contribution of heavy metals to the soil is carried out by the wastewater. This all things are causing a rapid health hazards as plants are absorbing the effluents rapid. Human as well as Livestock are the main receiver o the crops that are absorbing the metals form these effluents. Now it’s a matter of great concern of soil and water contamination with heavy metals over the world. So, Metals like, Mn, Zn, Fe, Cu and Mo are essential for plants but like

by Ni, Cr and Sr. for animals but few like Cd, Hg, Pb and As appears to be toxic to plant and animals (Hayes and Green land, 2008).

Water and soil are considered as the two major resources of Bangladesh. A rapid and unplanned urbanization are causing a higher degree of water and soil contamination in the areas especially where industries are grown in fungal – birth.

In the resource evaluation, quantity and quality are demanded. Thus, soil and water quality assessment turn a crying issue in context of its use for the production of crop. A high amount of heavy metals like, Cu, Cr, As, Cd, Fe, Hg, Mn, Ni, Pb, and Zn are found in the industrial effluents and waste disposal. (Arora *et al*., 2008 and Larson *et al.*, 1975). This gradual accumulation of metals causes a higher toxicities and leads to hazards in plants, animals, and human health (Rizwana, 2016).

Most of the industrial effluents are using for irrigation in crop in Bangladesh. Providing some helpful nutrients, it also contains some other plant harmful particles. These in particular reducing the normal activity. Rapid up taking of heavy metals in plants causing the efficiency loss in absorption in plant nutrient (Rahman, 2011). Soil has a property of heavy metal sinking that helps in accumulation at a higher rate or large volume ascends some other delinquent in the long run. Contamination of Agricultural soil may also occur through industrial solid waste, municipally pollutants, fertilizers, sewage sledges etc. The total amount of heavy metals in living tissue is usually low and it need to maintain in a range up to optimum biological performance. Only mean or the simple way for better yield and crop quality is the avoidance of using this water and use of manure that can increase total absorption capacity of plant nutrients (Rizwana, 2016). Bangladesh is a largely populated country with a Limited space. Meanwhile its most of the people are depended on agriculture that is about 60-80% directly and indirectly. Bangladesh had to support this huge population with

this limited supply of resources. Therefore, a limited reduce in the production may cause a huge change in the national index. Health support from country is not adequate too. Therefore Bangladesh has to go further careful. A limited increase in health hazards are helping a large scale change in the National index. Higher crop output level is desired and that can be achieved by intensive use of present land. Water bodies and Agricultural field are highly damaging with the unplanned and expanded industries. Majority of these pollutants discharged by the industries are reported in the low areas resulting from industrial operations and causing crop productivity, food quality and soil quality ceasing. So it is time to evaluate these industrial wastes for their toxicity level investigation and fertilizer value.

Ashulia, Savar, Aminbazar and Dhamsona of Savar Upazila are important industrial area of Savar upazila. Textile, pharmaceuticals, tannery, dyeing, food and beverage industries are available in these areas of Saver that is surrounded by the river Turag and Buriganga's part, Also River Dhawleshari runs across the area and a huge number of agricultural land are inside this areas that are cultivated highly with the polluted water as irrigation also. In the last few years, productivity faced serious problem and reduced by the influence of wastage that caused lower rice yield, reduced production of livestock and fish culture.

Thus, the present study aims to achieve the under mentioned objectives:

1. To investigate the actual level of contamination of soil in some specific area of Saver upazila.
2. To measure the concentration of major/important heavy metals in soil in some industrial area of Saver upazila.
3. To identify the effect of industrial waste in soils of contaminated study area.

REVIEW OF LITERATURE

This piece will signify a total review of research information in esteems to evaluate the industrial left-over disposal impact. A few research works relevant to this study have been cited below.

2.1 Chemical Properties of soil

SRDI (2013) stated that pH values of Saver ranged from 4.5 to 7.5. pH of Saver municipal area ranges from 4.10 to 8.9.

Adrianoo (2006) stated that the availability of Cu, Fe and Mn are reduced as the time is added to the soil causing pH increase. Generally, soil fixation capacity of some trace elements increases with a increase in pH.

Brogher and Hermees (2005) described that increase of acidity increases the mobility of Cd, Pb, Cu, Cr, Hg, Zn and Ni are increased with pH of soil in increase but in Alkaline condition the immobile state is in effective.

2.2 Nutrient status of available phosphorus

Bhuiyan (2012) observed phosphorus availability of few soils of Bangladesh ranges from 2.2 to 140mg.g-1 with the mean value of 21.24 $mg.g^{-1}$ soil the content of available phosphorus found to be different in different areas, different soil profiles in different layers.

Cheng (2003) reported that about 43% soils of Bangladesh contained phosphorus under level of critical and 30-40% in near optimum level.

Chojancki and Slusarczyk (2000) stated that soil of Tangail, Mirzapur contains a level of phosphorus below the critical level. About 45% of Mirzapur's soil contain a low phosphors and 35% of soil below critical level.

SRDI (2010) reported that available P content in Savar ranges from 0.00 to 0.16 mg. g^{-1} soil.

SRDI (2011) represent a result of a Phosphorous content in Rupganj Dohar Upazila, Dhaka soil ranged 0.00 – 0.16 mg g^{-1}.

2.3 Heavy metal status in soil

Different heavy metals such as Ni, Cr, Fe, Co, Zn, Pd, Cd that is known as trace element were studied in some soil samples. Some of the related work that is also analyzed in this study.

Mishra (2008) stated that soil that has been polluted with these metals causes the death of plant in a premature stage.

Muniruzzaman *et al.* (2014) stated that about 18 percent soil that is polluted are in great risk that cannot be used by plant at any state in Narayanganj.

Atiqur (2011) observed that the availability of heavy metals are much in the tannery compared to the basic dyeing industries.

Maldonado (2008) suggested that the metallic in soil that is in little uptake by the plant.

G. Herms (1980) stated, by the accumulation soil pollution by heavy metals Causes the pollution in a great context. A metal that shows a specific graving greater than about 1.5 g/ cm^3 is called as heavy metals.

2.4 Lead Availability

Cao *et al.* (2003) reported that contamination of Pb in the Shooting Ranges for plants and soils is a concern for environment. A total Pb concentration in Bermuda grass (806 mg/kg) and surface water (289 ug/L) were observed in the same range.

Cheng (2003) reported that it was found that about 705-850 mg/ kg of Pb may present in the above ground part of plant and in below ground part it may about 850-950 mg/kg.

H. Huton *et al*. (2005) studied that the transport of Pb as one of fine particulate and through mixed into the surface or in deeper layer in case of land of cultivation.

Olaisoye *et al*. (2013) stated that usually metals are in range of 18 to 132 $mg.kg^{-1}$ for lead. European Union estimated the level of tolerance for lead in plant is usually about 200 $mg.kg^{-1}$. In most of the polluted soil contains a higher degree than its recommended level and this are entering into the food chain through feeding materials mostly abuses health problems.

Hernandez (2005) stated that usually lead is transported to the foliar parts of the plants. In most of the soils, usually heave meats are found within the first 20 cm of the soil layer.

2.5 Heavy Metals contamination in soil:

Satter *et al.* (1998) stated the association of some elements as Co, Zn, Cu, Ni, Fe, Al in soil samples. The author also stated the loading of Co, Zn, Cu and Ni with Clay, Al and Fe, indicate that Fe and Al Hydroxides and clay content play significant roles in the sorption and distribution of these metals in soil. This state

of metals enters into food chain and poses a human hazards and Animal health in the area.

Havorak *et al.* (2006) explored the Pb/Zn smelter for heavy metal contamination and observed that area of arnoldestion soil (Karnnten, Austria) were heavily metal polluted by the lead and Zinc smelting while plant took Pb in low amount. Plant toxicity by Zn was in normal range and for animal feedings, Cadmium exited the threshold level.

Villini *et al*. (1992) stated that environmental quality was adversely affected with the heavy metals in soil. Subsequent acidity by Cd exchange to pH, removed in-between 65-95% to total Cd, Zn, Cu and Pb from the contaminated soils.

Huy *et al*. (2003) reported that from untreated water of sewage used in Irrigation was one of the major causes of increasing crops and soil metals and shorter periods of sewage water in irrigation go high of individual metals in soils by 2-80% and increased metals in crops by 14-209%.

Dolly and Ford (2001) stated that the greatest common sources of urban environment area from atmospheric testimony of lead ensuing from the blister of lead petrol, Removal of Pb successions and dye of makeover work. The flashing and washer's used corrugated iron roots, Metallic wheel, past practices of waste are the least common sources.

2.6 Consequence of industrial effluents

As the increase in population along with urination and country's industrialization, industrial effluents and wastes are also increasing.

DoE (2011) stated that there is a deleterious implication for water and soil quality due to increasing in dye industrialization and urbanization in Bangladesh. A public health implication area present as pollution are causing by the agrochemicals, inorganic and organic substances that enter into food chain.

Daily star (2016) reported that much of industrialization in Savar are based on the river and canals with the continuously adherence to waste, color of water and soil of those rivers and canals have been changed. DoE (1998) reported industrial until in Savar, Ashulia and Amin bazar are the sources of pollution.

Adriano (2006) reported usually heavy metals have two main ways to enter into the agro ecosystem via- non-aerial and aerial, Aerials includes aerosols, suspended matters, Air borne Dusts and Non-aerial comprise pesticides, fertilizers, industrial waste and effluents and other soil amendments.

Valinni *et al.* (1992) stated that Environment pollution is caused by the sludge of various tannery treating procedure.

Kifan *et al.* (2003) reported that the tannery not only causing the availability/ of Cr but also the metals like- Cd, As, Cu, Pb and Zn, in a great extent. The investigation found that in the top soil the factory that uses wastes, are high exposed to the metals.

Nuruzzaman *et al*. (2012) observed that concentration of N (2.7%) below 120 cm in tannery waste.

Thomas *et al.* (1992) stated that- Chromium is much immobile in soil the form that is highly added with the tannery is trivalent chromium. Sludge compost and vermi-compost that is affected by tannery on qualitative and quantitative composition of soil organic substance. In many countries, many of them uses the factory effluents and wastes as manure in soil, but it in turns add the metals to the soil.

Elahi (2008) stated that Municipal waste water usually high in concentration of several metals like as, Ni, Pb Cr and Cd. Their unlikely use in Agricultural and land for irrigation may lead to result in accumulation in the surface soil (Gupta *et al.*, 2008).

Jarvis and Jones (2001) stated about the trace elements of soil that was increasing as industrial waste water, sewage sludge were applying.

Bahasha (2001) stated that, to overcome the salinity problem ideal solution may be rhizobia strains that is isolated from environments and tannery effluents- Polluted soil with enrichment of soil with symbiotic nitrogen fixing.

Zaman *et al.* (2011) stated that few of metal ion enters the food chain and are capable of causing cancer. These effluents requires like- Zn and Cu in significant amount but Cd and Pb is in trace amount.

2.7 Effect of Industrial waste water in Soil

It has been showed that metals like Pb and As present within the waste water are highly toxic to the plant growth. Cl^- and SO_4^{2-} that have known for his adverse effect are usually in the limit at paper and pulp waste water.

In some of the courtiers of world tannery industries effluents and waste water are also concern environment hazard. As tannery industries has a field of manufacturing that is concerned to soil pollution and fresh water.

Elahi (2008) reported that industrial waste and effluent have a higher range of persistent capacity to any waste ecosystem. Specially Pb, Cr Ni and Cd have more than two decades and have their Continuous power of accumulation in soil.

Vallini (1992) reported in the meanwhile a number of suggestion for tannery byproduct purification is provided but waste water for environment is still a concern.

The study of textile pollutants effect on collected soil of agricultural land that is adjacent to textile effluents outlet in Jodhpur shows high build – up of Na (289.5 mg/ 100g), Moderate P (35.8 kg ha^{-1}) and high K (308.2 kgh^{-1}). Also showed that effluents collected directly was more toxic to the one collected from various points of mixing in irrigation water bodies (Cheng *et al.*, 2003).

CHAPTER III

MATERIALS AND METHODS

A study was conducted during January 2016 - June 2017 to determine the impact of Industrial waste in Savar, Ashulia, and Aminbazar and Dhamsona. The acceptable facts of materials and methods for the study are offered in this section.

3.1 Location Description

Savar is an upazila of dhaka district in the division of dhaka, Bangladesh. It is located at a distance of about 24 kilometers (15 miles) to the northwest of Dhaka city. Savar is located at 23.8583°N 90.2667°E longitude and latitude. Savar has 13 Unions/Wards, 350 Mauzas/Mahallas, and 321 villages. The municipal area (Savar Town) consists of 9 wards and 55 mahallas. The area of the town is 24.1 km². It has a population of 124,885; male 53.03%, female 46.97%; population density per km² of 5182. It has 66,956 units of household and a total area of 280.13 square kilometres (108.16 sq mi). The whole area is bounded by Kaliakair and GazipurSadarupazilas on the north, Keraniganjupazila on the south, Mirpur, Mohammadpur, Pallabi and Uttarathanas of Dhaka City on the east, and Dhamrai and Singairupazilas on the west. The land of the upazila is composed of alluvium soil of the Pleistocene period. The height of the land gradually increases from the east to the west. The southern part of the upazila is composed of the alluvium soil of the Bangshi and Dhalashwari rivers. Main rivers are Bangshi, Turag, Buriganga and Karnatali. The Bangshi River has become polluted due to industrial waste disposal. The total cultivable land measures 16,745.71 hectares (41,379.6 acres), in addition to fallow land of 10,551.18 hectares (26,072.5 acres), (Ministry of Local Government, 2017).

3.2 Demographic characters

As of the 2011 Bangladesh census, Savar upazila had a population of 1,387,426. Males constituted 54.20% of the population, and females are 45.80%. This Upazila's eighteen-up population was 207,401. Savar had an average literacy rate of 58.16% (7+ years), and the national average of 54.4% literate. Male literacy was 64% and female was 51%. The religious breakdown was muslim 88.59%, hindu 10.41%, christian 0.93%, buddhist 0.03% and others 0.04%, and ethnic minority group nationals numbered 319 including Buno, Garo, Chakma (Sangma), and Burman. The main occupations are Agriculture 24.34%, agricultural labourer 12.84%, wage labourer 4.44%, cattle breeding, forestry and fishing 1.90%, industry 1.37%, commerce 17.35%, service 20.68%, construction 1.66%, transport 3.96% and others 11.46% .

3.3 Climatic conditions

Savar is generally marked with monsoon climate with moderate temperature, considerable humidity and moderate rainfall. The rainy season starts from mid-May and continues up to the month of mid-September. The annual rainfall is 1580mm. The highest mean temperature of about 19-22°C during the month of November- December and minimum mean temperature about 17°C. The maximum mean temperature is about 15-16°C during January and minimum mean temperature about 13.6°C. Maximum relative humidity recorded of about 58% (November to December) and minimum of about 49%. Maximum relative humidity was about 52% (January) and minimum about 49%.

3.4 Economy of Savar Area

Agriculture and manufacturing are the two major economic sectors at Savar. The main crops grown here are paddy, jute, peanut, onion, garlic, chili and other vegetables. The extinct or nearly extinct crops in the region are aus paddy, AshaKumari paddy, sesame, linseed, kali mator, randhunisaj, mithasaj, kaun and mas kalai. The main fruits cultivated here are Jackfruit, mango, olive, papaya, guava, kamranga, berry and banana. There are 181 combined fisheries, dairies and poultries dairy, 5 hatcheries, 209 poultries, and 139 fisheries. Manufacturing facilities include Ceramic industry, beverage industry, press and publication, garments industry, foot ware, jute mills, textile mills, printing and dying factory, transformer industry, automobile industry, biscuit and bread factory, pharmaceutical industry, soap factory, brick field, cold storage, welding, plant nursery, etc. Bangladesh Export Processing Zone is located in this upazila. The Main industries includes 86 small and medium tannery factories,129 small and large garments factories,103 dyeing factories,13 food and beverage factories,8 weaving, 100 goldsmith and 29 others workshops. The main exports are Jackfruit, papaya, flower, sapling, dairy products, meat, transformer, fabrics, dye, medicine, readymade garments, electronics and electric goods, shoe, brick, sweetmeat etc. There are 62 km of pucca (first-class), 56 km of semi pucca, 562 km of mud road; and 50 km of highway. Transports used here include the traditional (and extinct or nearly extinct) Palanquin, bullock cart and horse carriage as well as modern day vehicles (Wikipedia, 2018).

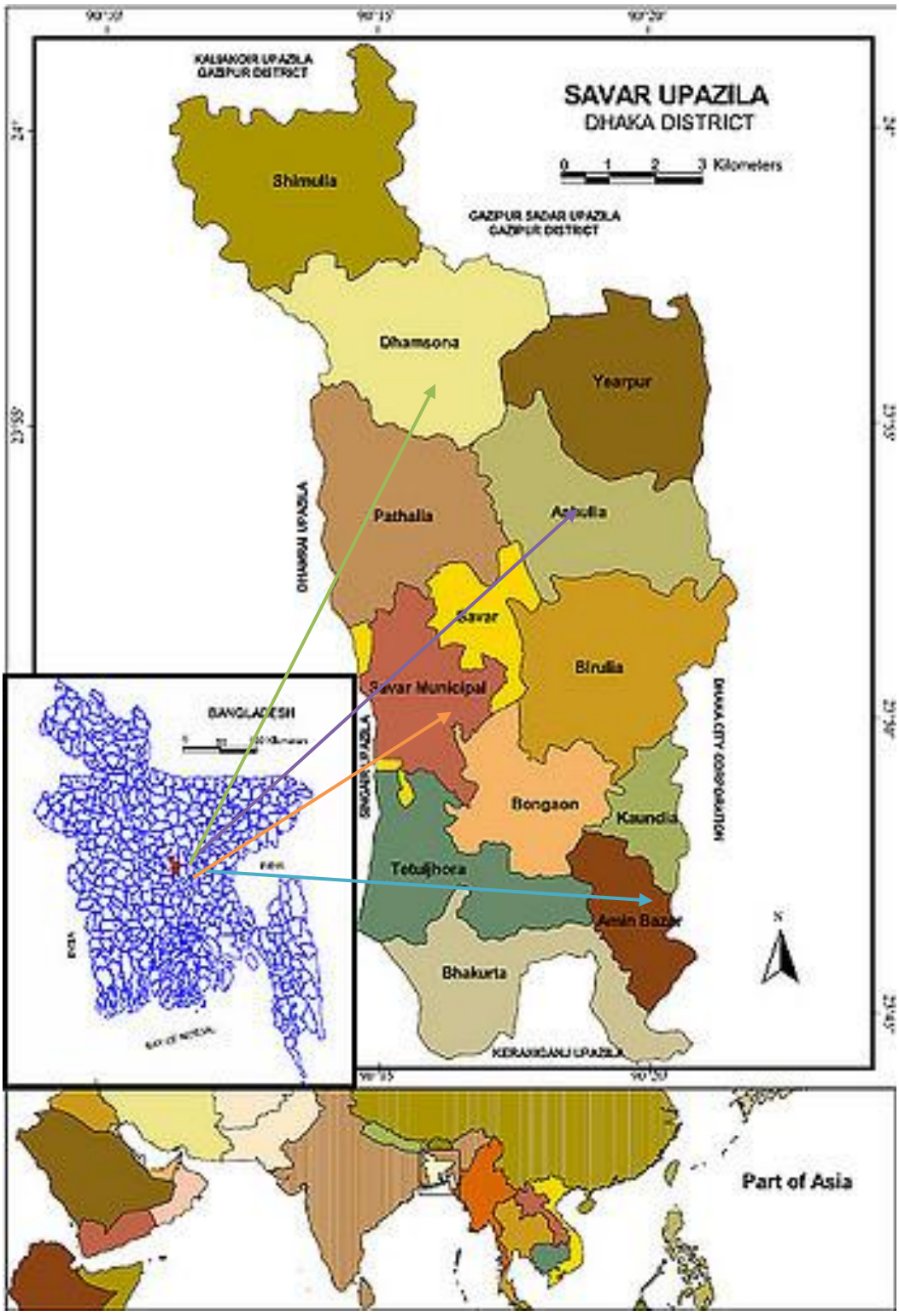

Figure 1: Map showing locale of the study area at Savar Upazila

3.5 Soil

Generally a loamy-clay loam, red colored soil is the dominant types of soil in this region. A complex mixture of calcareous sandy with the soil of clayey and siltyalluvium are profound in this region. A low organic matter and slightly acidic condition observed (SRDI, 2017).

3.6 Sample collection sites

A Total of twenty 40 soil samples, 10 from each of the four union were collected from four union of savar upazila (Amin bazar, Ashulia, Dhamsona and Savarsadar) that areas are highly covered with the industries like tannery, pharmaceuticals, food and beverage, dyeing etc. and twenty from each of the industrial areas; SavarSadar (23.891°N-90.423°E), Ashulia (24.483°N-89.124°E), Aminbazar (24.993°N-90.114°E) and Dhamsona (23.938°N-90.112°E) union of savar upazila of Dhaka district. From the mentioned union of savar upazila soils were collected near from side of the industries, closely cultivation plot near industries bus stands, drains and road side.

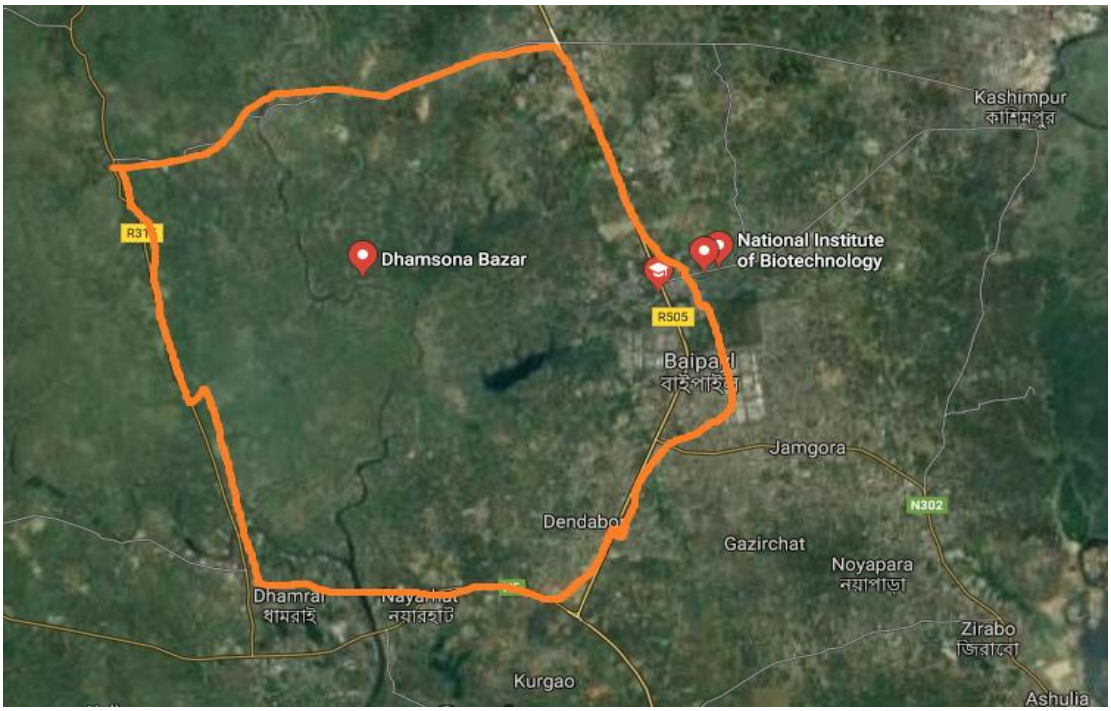

Figure 2 : Sampling Area (Dhamsona Union)

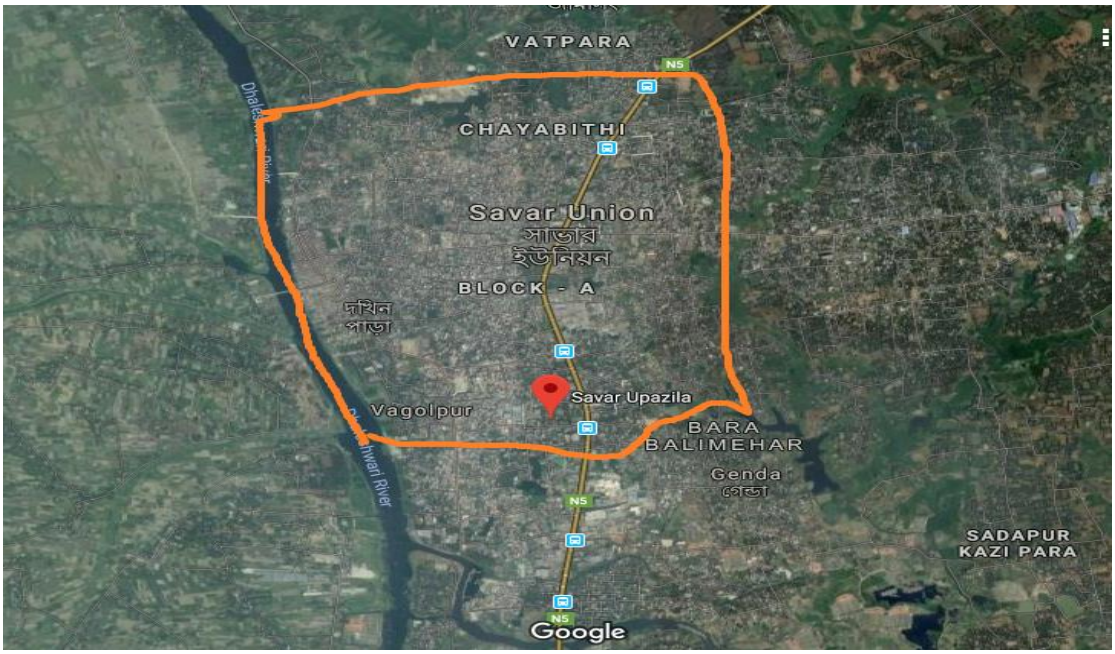

Figure 3: Sampling Area (Savar Union)

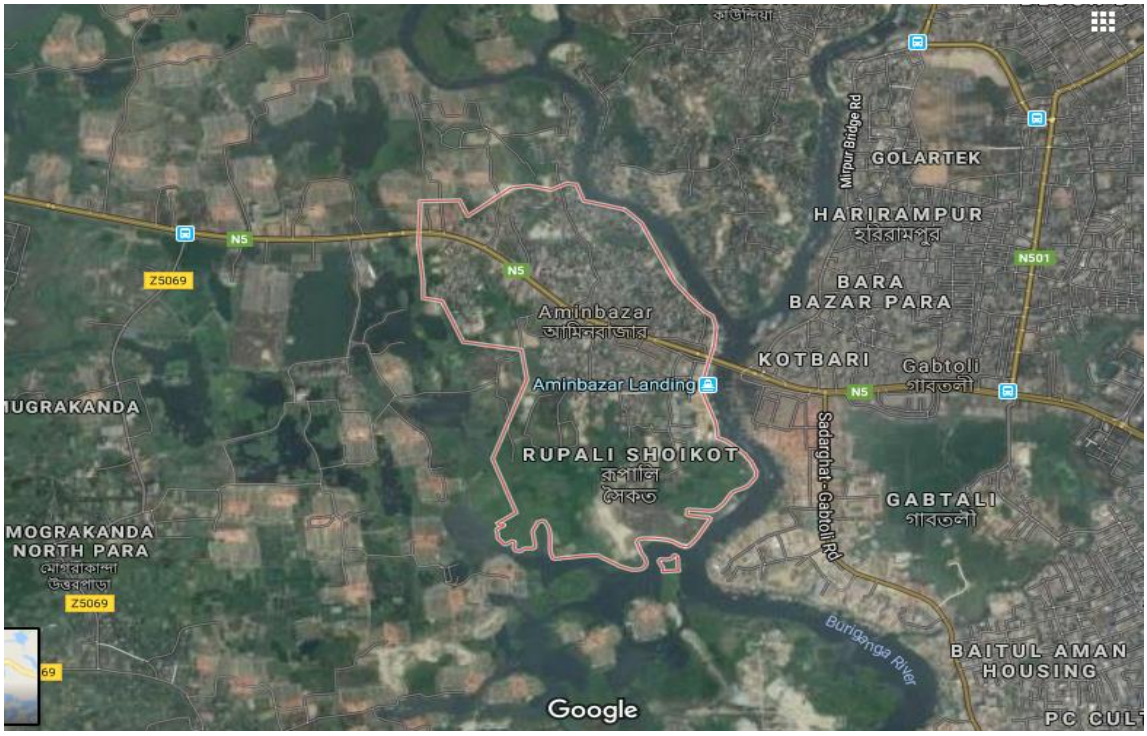

Figure 4: Sampling Site (Amin Bazar Union)

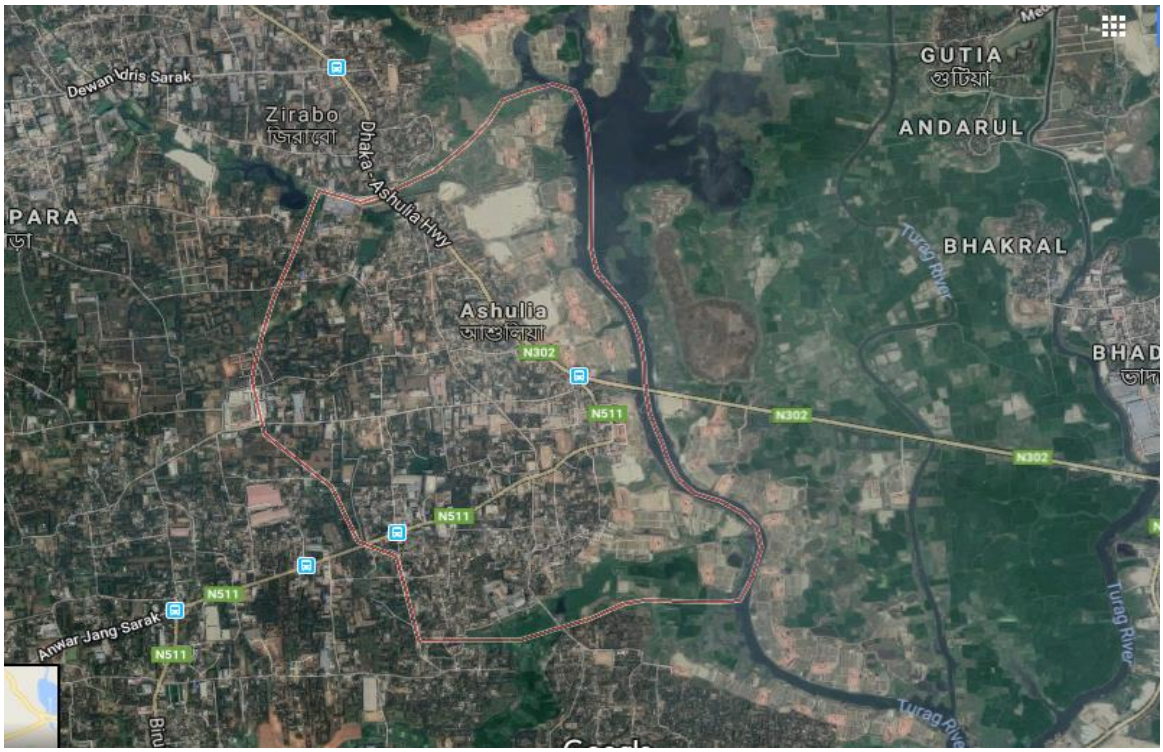

Figure 5: Sampling Site (Ashulia Union)

Table 3.1 Major industries in the sampling sites of soils sample collection that are source of contamination

Selected Unions	**Location of Sampling**	**Actual sources of contamination in these area**
Savar Union	1.NearAkijGroup,Ulail. 2.NearArapara lake area. 3.Syntec Garments,Madhakhar 4 Near Marksman phamrmaceuticals, Industries 5.Near BaddaBatpara,Badda 6.Near Roadside to porabari field 7.Roadside of Mollickertek Bazar 8.Roadside of Indiatec ,Sadahpur 9.Near Apex Gum industries, Genda 10.Near S.M tannery,Savar	Garments and Textile Factories, Dyeing Factories, Tannery Industries, Food and Beverage Industries, Pharmaceuticals
Amin Bazar	1.Near Borodeshi Bazar 2. Adjacent to Motaleb Enterprise 3.Near AlifTextile,Bordha 4. Near Amin Md. Garments ltd. 5. Close to Uttara Food Industries. 6.Close to Showkhin Food Ltd. 7.Near India-Herbal pharmaceuticals ltd. 8. Near Kazi Tannery Industries Ltd. 9. Near Factors dyeing Ind. 10. Near Transcom beverage Ind.	Garments and Textile Factories, Dyeing Factories, Tannery Industries, Food and Beverage Industries, Pharmaceuticals

Ashulia Union	1.Near Italian Tannery Industries 2.Close to Ashuli-Dhaka Highway Crop Field. 3.Near Natural Denims Knitwear Ind. 4.Close field to Ashulia bazar. 5.Crop Field of Modolpara. 6.Near Electro Food Ind. 7.Close to MP's pond 8.Near Incepta Pharmaceuticals 9.ArounIdrisSarak. 10.Rabiba Dyeing Industries.	Garments and Textile Factories, Dyeing Factories, Tannery Industries, Food and Beverage Industries, Pharmaceuticals
Dhamsona Union	1.Dhawleshari River point 2.Uralkandacanal,Ranasthal. 3.Desinger Fashion Ltd. 4.Adjacent crop field of Ghoailbari 5.Roadsde field of Dhamsona Bazar. 6.Akh Food products industries. 7.Indursindghicanal,Goailbari. 8.Crop field of Unilpara 9.Roadside of Gourichanda 10.Westernside Point of Dhawleshari.	Garments and Textile Factories, Dyeing Factories, Tannery Industries, Food and Beverage Industries, Pharmaceuticals

3.7 Collection of soil samples

Soil samples were collected from the surface layer at a depth of 0-15 cm from fields of each location with an auger using auger sampler method. Plant roots and other extraneous materials were removed from the collected soil samples, air-dried, grinded and passed through 2-mesh sieve. The samples that were collected kept in plastic bags. All the soil samples were put into the individual polythene

bag with distinct marking and tagging and labeling, were brought to the Soil research Lab, Soil Resources Development Institute (SRDI), Regional Office, Farmgate, Dhaka for soil and water analysis.

3.7.1 Digestion of soil samples:

The collected soil samples weighing 1.0 g were transferred into a dry clean digestion vessel. Then 5 ml of Nitric acid (HNO_3) was added to the vessel and allowed to stand it overnight with covering the vessel to vapor recovery device. On the following day, the digestion vessel was placed on a heating block and was heated at a temperature slowly raised to 120° C for 2 hours. After cooling, 2 ml of hydrogen per oxide (H_2O_2) was added into it and kept for few minutes. Again, the vessel was heated at 120°C. Heating was momentarily stopped when the dense white fumes occurred, after which the volume was reduced to 3-4 ml. The digest was cooled, diluted to 50 ml with de-ionized water and filtered through Whitman No.#42 filter paper into plastic bottle. The soil samples were digested at digestion laboratory, Soil research wing, Soil Resource Development Institute (SRDI), regional office, Farm gate, Dhaka.

3.7.2 Soil analysis

Collected soil samples were analyzed for both physical and chemical properties and the soil samples were analyzed using the standard techniques as follows:

Table 3.2 Methods used in soil analysis

SL No.	Soil Properties (Soil Sample)	Methods Used in Analysis
01	**pH**	Measured by Glass Electrode meter (Jackson. 1973).Soil-water at 1:2.5 ratio was used.
02	**Mn,Fe and Pb**	Directly in Atomic Adsorption spectrophotometry (AAS) (Nortel and Lindsay-1978) and Was extracted by O.OSM DPTA Solution (pH-7.3).
03	**P**	Calorimetrically Measured(Stannous Chloride as reducing agent).(Somers and Olsens.,1989).Sample was extracted by P.SM $NaHCO_3$ (Ph-8.5)
04	**As**	Allowed to digested HNO_3-$HCLO_4$ (5:1) for four hours at 125°C and Then 10ml water sample + 3ml 32% HCL + 1ml 10% KI Digested upto one hour at 25°C and Measured by HG-AAS (Peterson,2002)

3.8 Secondary Data collection

Data related to health were collected from upazila health complex, Savar and Data of production were collected from upazila agriculture office, Savar.

3.9 Statistical analysis

The composed data guts of heavy metals of collected soils were gathered in MS Excel sheet and calculated by using MSTAT-C software.

Figure 6: Sampling site contaminating near textile wastage disposal area, Ashulia

Fig 7: Soil collection from the industrial area crop field, Aminbazar

Figure 8: Soil sampling sites in dhamsona union, Savar

Figure 9: Usage of contaminated by human in Amin bazar of savar upazila

4.1 SOIL SAMPLE ASESSMENT

4.1.1 pH value of soil sample

The value of pH is significant in the study area; therefore there is an impact of pH value in the study area. The value of pH in the soil ranges from 7.66 to 5.35 (Table 4.1-4.4) in the sapling area. In the analysis the highest value of pH (7.66) found in the Tannery area of savar upazila. Also the lowest value of pH was found in the Food and Beverage area of Aminbazar area (5.35). In the study it was found that most soil are highly composed of acidic condition that is below the mark 7.0, meanwhile the value of pH above 7.0 were found in some of the soil .

Table 4.1 The value of pH in different industrial sites of Savar upazila.

Industries Types of collected soil sample	**Ashulia**	**Savar**	**Amin Bazar**	**Dhamsona**
Tannery	7.18	7.66	5.51	7.09
Pharmaceuticals	7.10	7.47	6.05	5.99
Textile	6.79	6.45	6.06	6.40
Food and Beverage	6.37	7.28	5.35	7.37
Dyeing	6.77	6.75	6.21	7.00
SD	0.28	0.45	0.46	0.51
CV (%)	5.97	7.25	7	5.66

The average value of pH ranges are in the Tannery> Dyeing> Textile> Pharmaceuticals> Food and Beverage area. The value ranges at Ashulia from 7.18-6.37, in the area of Dhamsona it ranges from 7.37-5.99, In Aminbazar it was 6.75-5.35 and at Savar ranged 7.66-6.21.

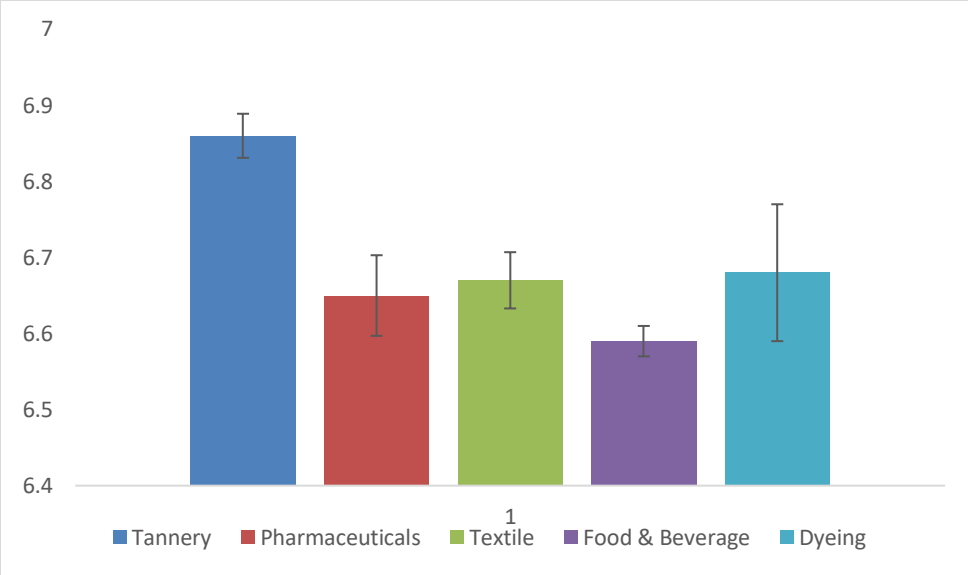

Figure 10: Mean value of pH in the collected soil sample

The desirable pH range for optimum plant growth varies among crops. While some crops grow best in the 6.0 to 7.0 range, others grow well under slightly acidic conditions. Soil properties that influence the need for and response to lime vary by region. Knowledge of the soil and the crop is important in managing soil pH for the best crop performance (Soil pH guide, 2013). The value of standard Deviation ranges from 0.51 to 0.28 and also CV value was less than 7.25 in all cases.

4.1.2 Phosphorus value of soil:

As previous, phosphorus value is significant in the study area; therefore there is a impact of phosphorus value in the study area. The value of phosphorus in the sampled soil was in the range of 18.95mg/Kg to 28.94 mg/Kg. In the analysis the top value of phosphorus in the soil were found in the soil of Tannery area of Ashulia (28.94mg/kg), Meanwhile the lowest value of phosphorus were found in the soil of Dyeing area of savar (18.95mg/kg).

Table 4.2: The value of P (mg/kg) in different sites of Savar upazila.

Industries Types of collected soil sample	Ashulia	Savar	Amin Bazar	Dhamsona
Tannery	28.94	25.83	22.90	25.65
Pharmaceuticals	28.33	27.76	24.65	25.28
Textile	28.89	26.23	25.05	28.59
Food and Beverage	29.49	26.72	24.65	24.06
Dyeing	27.95	18.95	27.01	22.65
SD	0.53	3.14	1.31	1.97
CV (%)	5.03	3.66	9.74	3.31

The abundance of the value of P found in a chronological order as Textile> Pharmaceuticals>Food and Beverage>Tannery >Dyeing area.

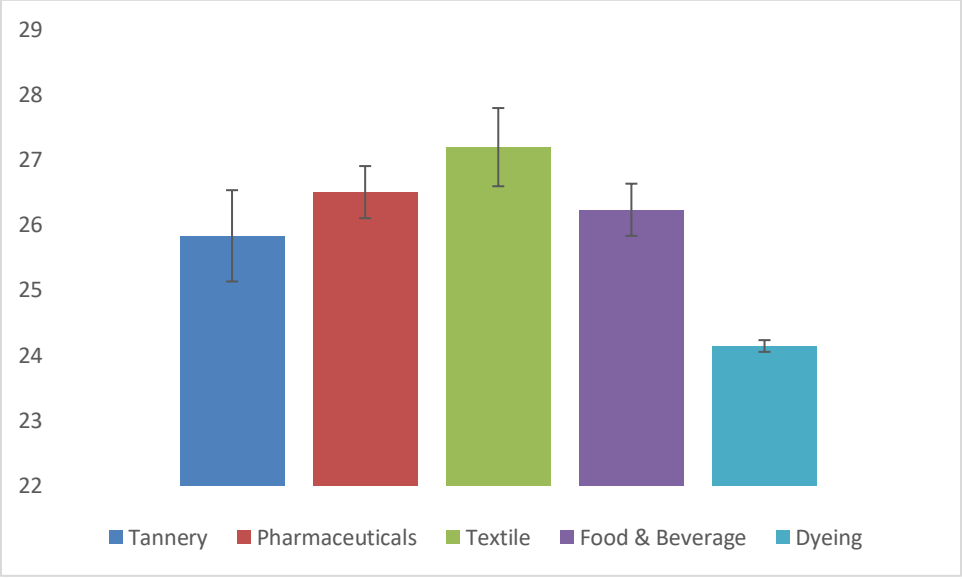

Figure 11: Mean value of Phosphorus in the collected soil sample

The value ranges at Ashulia from 29.49 mg/kg from 27.95 mg/kg (Table 4.1), In the area of Dhamsona it ranged from 28.59-22.65 mg/kg (Table 4.4), at Aminbazar

it was 27.01-22.90 mg/kg and at Savar ranged 27.76-18.95 mg/kg (Table 4.4). The P Value was enriched in the soil sampled area as it shows that there is higher opportunity of having contamination as of different activity. The value of standard Deviation ranges from 1.97 to 0.53 and also CV value was less than 5.03 in all cases.

4.1.3 Iron (Fe) Value of soil

In the study area, the value of Fe is significant; therefore there is an impact of Fe value in the study area. The value was significant in the samples collected from Aminbazar. Fe value in the analyzed soil sample was in the range of 140.6 mg/kg to 78.0 mg/kg. The top value were found in the soil area that was collected from the Pharmaceuticals arena of Ashulia union of Savar upazila. Again the lowest value was found in the arena of food and Beverage arena of Savar union of Savar upazila.

Table 4.3: The value of Fe (mg/kg) in different sites of Savar upazila.

Industries Types of collected soil sample	**Ashulia**	**Savar**	**Amin Bazar**	**Dhamsona**
Tannery	122.2	88.75	92.53	105.9
Pharmaceuticals	140.6	94.00	84.03	101.1
Textile	124.8	85.00	92.12	94.39
Food and Beverage	115.5	78.40	85.31	89.88
Dyeing	109.0	82.20	88.05	79.10
SD	9.83	5.30	3.44	9.2
CV (%)	9.69	7.25	7.24	5.93

The availability of these content of Fe were in a chronological order of pharmaceuticals>Tannery>Textile>Food and Beverage>Dyeing area.

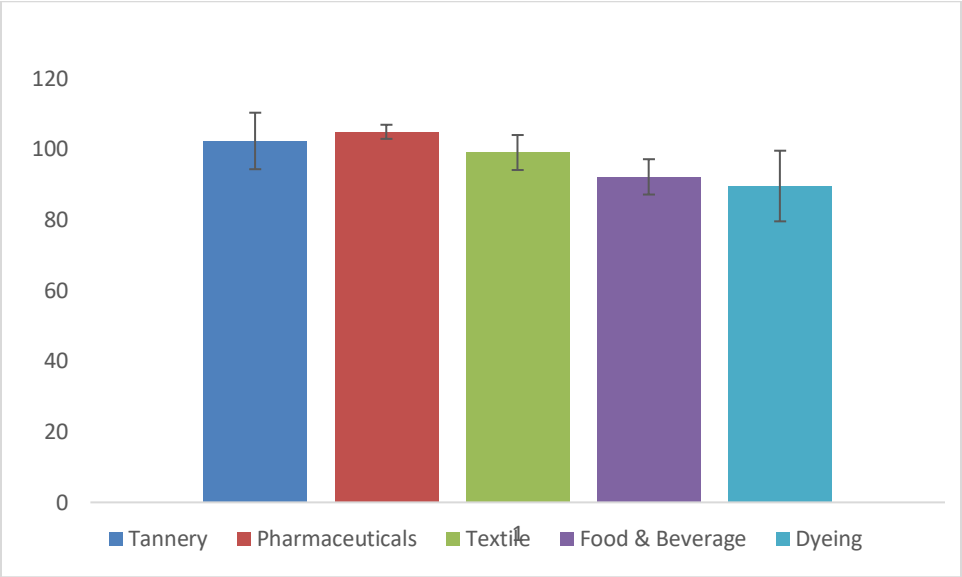

Figure 12: Mean value of iron (Fe) in the collected soil sample

The value ranges in Ashulia from 140.6 mg/kg from 109.0 mg/kg, in the area of Dhamsona it ranges from (79.10-105.9) mg/kg, In Aminbazar it was (92.53-88.05) mg/kg and In Savar ranged 94.00-78.0mg/kg. The value of standard Deviation ranges from 9.83 to 3.44 and also CV value was less than 9.69 in all cases.

4.1.4 Manganese (Mn) value in Soil Sample

It was found that the value of Manganese is significant in the study area, Therefore there is a impact of Manganese value in the study area. The content was in the range of 64.86-33.96mg/kg.

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Table 4.4: The value of Mn (mg/kg) in different sites of Savar upazila.

Industries Types of collected soil sample	Ashulia	Savar	Amin Bazar	Dhamsona
Tannery	60.31	59.55	56.58	52.01
Pharmaceuticals	54.25	43.33	41.50	46.74
Textile	54.85	43.28	46.95	56.90
Food and Beverage	58.01	38.75	64.86	41.19
Dyeing	50.39	39.90	53.30	33.96
SD	3.39	4.33	8.01	7.96
CV (%)	5.06	5.72	7.02	9.53

The top most soil were in the arena of Food and Beverage based Industrial area of Aminbazar valued 64.86 mg/kg since it was 33.96mg/kg at Dhamsona where the area was not significantly industrial but a number of Dyeing industries were present and sample were collected from that consideration.

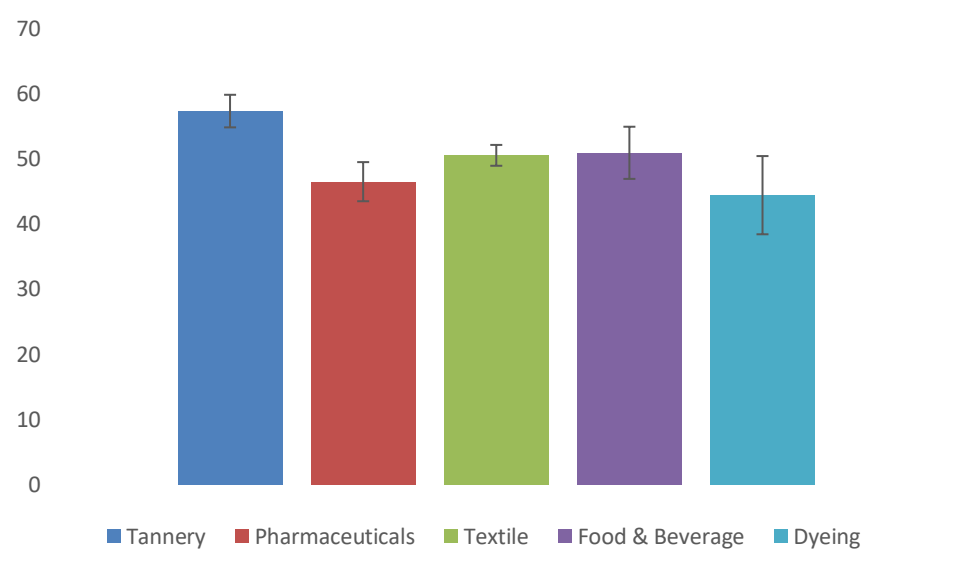

Figure 13: Mean value of Manganese in the collected soil sample

The analyzed soil sample were in the context of Mn as following chronological order as Tannery>Textile>Food and Beverage>Pharmaceuticals >Dyeing area. The value ranged at Ashulia from 60.31 mg/kg from 50.39 mg/kg, in the area of Dhamsona it ranged from 56.90-33.96 mg/kg, In Aminbazar it was 64.86-41.50 mg/kg and at Savar ranged 59.55-38.75 mg/kg. The value of standard Deviation ranges from 7.96 to 3.39 and also CV value was less than 9.53 in all cases.

4.1.5 The value of Lead (Pb) content in Soil Sample

The value of lead is significant in the study area, Therefore there is an impact of Lead value in the study area .The content were in the range of 41.58-24.55 mg/kg.

Table 4.5: The value of Pb (mg/kg) in different sites of Savar upazila.

Industries Types of collected soil sample	**Ashulia**	**Savar**	**Amin Bazar**	**Dhamsona**
Tannery	31.52	33.00	41.58	37.00
Pharmaceuticals	28.41	32.30	38.09	33.01
Textile	26.39	29.20	37.20	28.51
Food and Beverage	25.67	26.54	35.71	24.55
Dyeing	27.43	30.46	37.72	30.31
SD	2.04	2.30	1.77	3.99
CV (%)	7.49	8.03	1.96	6.53

The top most soil were in the arena of Tannery based Industrial area of Amin bazar valued 41.58 mg/kg since it was 24.55 mg/kg in Dhamsona where the area

was not significantly industrial but a number of Food and Beverage industries were present and sample were collected from that consideration.

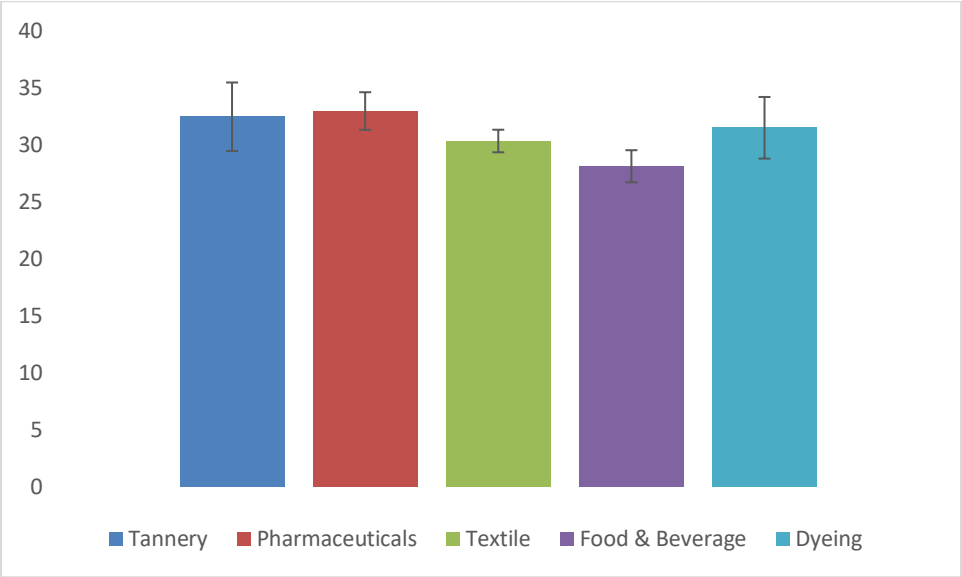

Figure 14: Mean value of Lead (Pb) in the collected soil sample

The analyzed soil sample were in the context of following chronological order as Pharmaceuticals>Tannery> Dyeing >Textile>Food and Beverage area. The value ranged in Ashulia from 31.52 mg/kg from 25.67 mg/kg, in the area of Dhamsona it ranged from 37.0-24.55 mg/kg, At Aminbazar it was 41.58-35.71 mg/kg and At Savar ranged 33.0-26.54 mg/kg. The value of standard Deviation ranges from 3.99 to 2.04 and also CV value was less than 8.03 in all cases.

4.1.6 The value of Arsenic content in Soil Sample

Arsenic was found in significantly, therefore there is an impact of Arsenic value in the study area. The value ranged from 6.26-4.50 mg/kg. The value that was found analyzing the collected soil sample were in the top most range in the soil that was collected from Tannery areas of Aminbazar 6.26mg/kg and the lowest value was in the soil of Food and Beverage area of Dhamsona 4.50mg/kg.

Table 4.6: The value of As (mg/kg) in different sites of Savar upazila.

Industries Types of collected soil sample	Ashulia	Savar	Amin Bazar	Dhamsona
Tannery	5.53	6.10	6.26	5.75
Pharmaceuticals	5.06	5.60	6.11	5.60
Textile	4.90	5.10	5.39	4.77
Food and Beverage	4.67	4.85	5.21	4.50
Dyeing	5.02	5.30	6.05	5.53
SD	0.27	0.43	0.42	0.49
CV (%)	4.74	6.64	4.35	5.24

The value of these sample were in upmost in the following order Tannery> Pharmaceuticals> Dyeing> Textile> Food and Beverage area soil.

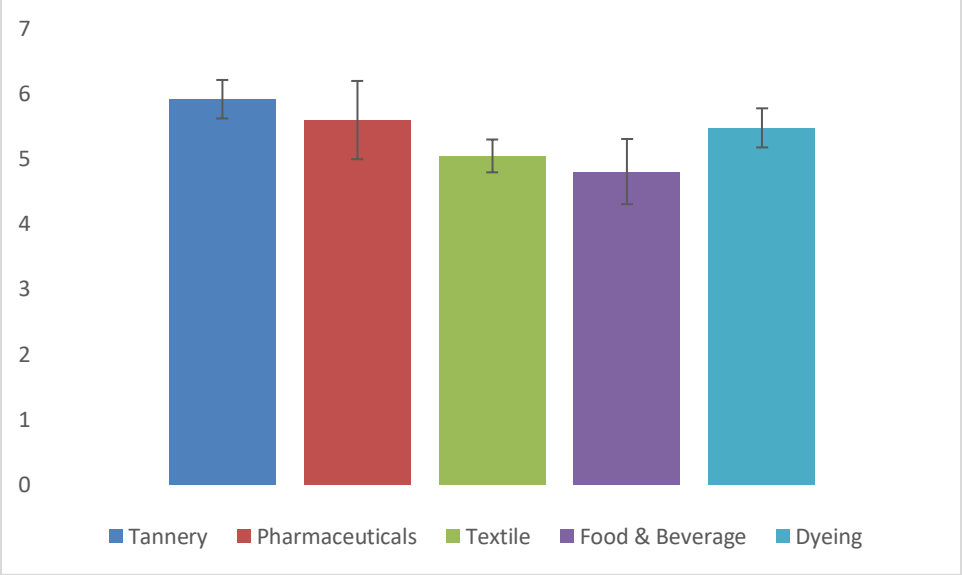

Figure 15: Mean value of Arsenic (As) in the collected soil sample

The value ranged at Ashulia from 5.53-4.67 mg/kg, In the area of savar it ranged from 6.10-4.85 mg/kg, at Aminbazar it was 6.26-5.21mg/kg and at Dhamsona ranged from 5.75-4.50 mg/kg. The value of CV was in between 4.35 to 6.64.

SUMMARY

Soil is one of the most important factors of environment. During the conduction of the study soil samples were collected from different selected areas of savar upazila (Savar, Amin bazar, Ashuilia and Dhamsona union) to assess the impact of these industrial waste that is discharged by the industries located in theses region on environment and agricultural productivity. A total number of 40 soil samples were collected from the target site (Tannery, Pharmaceuticals, Textile, Food and beverage and Dyeing industries) in the selected area. Later, the collected samples were analyzes targeting the parameter like pH, DO, P, As, Fe, Mn, Pb, Cr and Cd. The pH value in the soil sample was range from 5.51 to 7.66 that indicates the soil of that arena is slightly acidic to neutral. Top value of pH was found in the tannery area of savar that is 7.66 and minimum value was found at Amin bazar area and the value was 5.51 that's indicates the soil is slightly acidic at Amin bazar. The average value of pH ranges are in the order of Tannery> Dyeing> Textile> Pharmaceuticals> Food and Beverage area.

Phosphorus value was in a range of 29.49 mg/kg to 18.95 mg/kg at Ashulia. Soil of food and beverage site was enriched with P content and soil of savar Dyeing region is in moderately enriched with Phosphorus. But overall P is higher in the soil of Ashulia. The abundance of the value of P found in a chronological order as Textile > Pharmaceuticals> Food and Beverage> Tannery > Dyeing area.

The value of Ferrous (Fe) was found 140.6 mg/kg to 78.0 mg/kg. The mean value of Fe at Ashulia, Savar, Amin bazar, Dhamsona was 122.2 mg/kg, 85.06 mg/kg, 88.40 mg/kg and 94.07 mg/kg. The value was higher in the soil of Ashulia. The availability of these content were in a chronological order of pharmaceuticals>Tannery>Textile>Food and Beverage>Dyeing area.

Mn value was ranged from 64.03 mg/kg to 33.96 mg/Kg. The mean value of Mn at Ashulia, Savar, Amin bazar, Dhamsona was 55.56 mg/kg, 44.96 mg/kg, 52.63

mg/kg, 46.21 mg/kg. The analyzed soil sample were in the context of following chronological order as Tannery>Textile>Food and Beverage >Pharmaceuticals >Dyeing area.

Pb (Lead) value in soil was in a range of 38.09 mg/kg to 25.67 mg/kg. The mean value of Pb at Ashulia, Savar, Amin bazar, Dhamsona was 27.88mg/kg, 30.3 mg/kg, 38.06 mg/kg, 30.67mg/kg. The analyzed soil sample were in the context of Pb in following chronological order as Pharmaceuticals>Tannery> Dyeing >Textile>Food and Beverage area.

The value of Arsenic (As) was in the range of 6.26 mg/kg to 4.50 mg/kg. Mean value of As at Ashulia, Savar, Amin bazar, Dhamsona was 5.03mg/kg, 5.39mg/kg, 5.8mg/kg, and 5.26 mg/kg. The value of these sample of As value were in upmost in the following order Tannery>Pharmaceuticals>Dyeing>Textile>Food and Beverage area soil.

CONCLUSION

In each cases the soils of Savar, Amin Bazar, Ashulia was challenging as an agricultural soil as they exceeded the value of normal soil. Meanwhile the soil of Dhamsona found comparatively good to others sampled arena. pH was high comparatively in tannery arena, Phosphorus was higher in the textile porn arena while Fe, Pb, As was high in Tannery and pharmaceuticals arena. The study also revealed that study area more or less equally contaminated with heavy metals like Cadmium, Chromium, Lead, Arsenic and Manganese etc. that are discharging with the byproduct of the industries. Which are causing uptake in plant through soil. Point to be note that, there has a low opportunity to define the daily vegetables produced soil is contaminant or not! This may be the cycle of human health hazards that are ultimately causing by the Industrial waste discharge in adjacent environment.

RECOMMENDATIONS

Author's recommends is-

1. Industries must have required capacity to recycling their byproducts and discharges.
2. Law must be implemented to the groups those who are involved in this type of action so that in future, people thinks further before doing this types of job.
3. In every cases of industry implementation, Ministry of Environment must give a certificate to regulate and proper investigation should be done to define that authority are doing the same task for that they are issued the certificate.
4. AEO, UAO can play a vital role to stop the usage of waste water in irrigation, rendering the impact to the farmers and United Nations health organization can play the role to stop the usage of this water in daily need.
5. Authority must do the proper monitoring and sampling, later test should be done to control the environment pollution.
6. Further study should be done investigate the crisis so that clear and more deep information of impact may found.

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Appendix I. Ranges of Maximum Allowable Concentrations (MAC) fortrace metals in agricultural Soils (mg kg^{-1}).

SL. No.	Metal	MACa
1.	Cd	1–5
2.	Cr	50-200
3.	Ni	20–60
4.	Pb	20–300
5.	Mn	1500-3000

Appendix II: Guidelines for contaminated soils – suggested range of values (mg kg^{-1} on air dried soils, except for pH).

Parameter	Typical values for uncontaminated soil	Slight contamination	contaminated
Cadmium	0-1	1-3	3-10
Chromium	0-100	100-200	200-500
Lead	0-500	500-1000	1000-2000
Nickel	0-20	20-50	50-200
Manganese	0-500	100-200	200-500

Source: information compiled from the text book, "A textbook of environmental science" (part 1). Sattar, M.A. 1996. Mymensingh.