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# Study on Heavy Metals (Zinc and Lead) in Drinking Water of Tannery Area, Adjacent Areas and Outside Village Areas

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## Abstract

This study indicated the status of drinking water containing two heavy metals (Zinc and Lead) in case of the areas adjacent to tannery industries located in Dhaka city as well as outside areas. The drinking water was collected from both tube wells and taps, and then metals were determined using Flame AAS. Both Zinc and Lead content was found highest in the tap water of the area of tanneries named Hazaribagh expressing as 54 ppb and 200 ppb respectively. But in tube well water of this area, the amount of Zinc ranges from 31 ppb to 50 ppb but the Lead content was found as nil. Again areas far from tanneries, the lead content was found 138 ppb as highest.

**Keywords:** Heavy metals; Tannery; Ground water; Toxicity; Dhaka city

## Introduction

Drinking water is one of the most significant elementary needs for the survival of lifespan. Throughout the entire world more than one billion people are faced the deficit of sufficient nontoxic water and among those more than 800 million in village areas are at threat for drinking water [1]. Both natural and man-made deeds like erosion of minerals, leaching of deposited ore, extrusion of volcanic and removal of wastages are accounted for austere worsening of water quality [2]. Water bodies are getting adulterated uninterruptedly with metals because of removal of solid waste and effluent by industries as well as domestic dirt's [3]. Zinc is an indispensable trace element found in almost all food and potable water in the form of salts or organic complexes [4]. Taking drinking water having higher or lower content than the required has undesirable belongings on lives. By erosion of metals from rocks, solids however marginally soluble in water, it remains in little concentration but older galvanized metals pipes and well cribbing were coated with Zinc may be dissolved by lenient, acidic water [5]. In water the Zinc deliberation can be abundant as a result of leaching of Zinc from piping and fittings [6]. Increased Zinc can origin eminent health difficulties such as stomach cramps, skin irritations, vomiting, nausea, anemia, root trouble in pancreas, protein metabolism and further it can generate arteriosclerosis [7]. Again too diminutive Zinc in the diet also origin poorly developed sex organs, related mature in young people and generates birth faults for taking fewer quantity of Zinc during pregnancy [8]. 5 ppm in considered as the standard concentration for Zinc in drinking water [9]. It is a decent matter that there is no proof about Zinc for forming cancer in human [10]. Besides Lead, a commonest of heavy metals accounting for 13 mg/Kg of earth crust [11]. Lead is a comparatively corrosion resistant, compressed and malleable metal that has been used by human for at least 50,000years [12]. The children of 1 to 6 years age are predominantly prone to suffer from extreme Lead disclosure as the nervous and circulatory systems in young are not completely industrialized [13]. Even though toxicity of lead poison can cause the damage of under 4 years old child's healthy life [14]. Lead will tend to be deposited in the brains, bones, kidneys and other foremost organs [15]. Lead service lines (pipes) and Lead covering materials are well known basis of drinking water impurity [16]. Concentration of Lead in human blood has been connected to Lead in drinking water, a public health hazard [17]. Again throughout pregnancy, Lead can be organized from material bone stores in the blood, eventually crossing the placenta and affecting deadly enlargement [18]. In this observation, the Lead content could not be detected in case of the area of Hazaribagh situated at the southern part of Dhaka where 90% tanneries of the whole country have been established [19]. It may affect the lead content of drinking water in the area as Lead content is reduced by addition of lime and the lower pH distribution. The aims of this study are referred as-

- Analyzing the heavy metal status (Zinc and Lead) in drinking groundwater in case of the areas of tannery establishment.
- Making a comparison of these metals contained with drinking groundwater of both other adjacent areas of Dhaka city and outside village areas.
- Overall condition of encompassing metals in drinking water of the Capital city and nearest outside areas.

## Materials and Methods

### Sample collection

Among nine samples, five were collected from different locations of the tannery area of Hazaribagh, two samples were from adjacent areas of it and the rests are from Savar, an outside area of Dhaka city. Prewashed plastic bottles were used for water collection.

### Chemical analysis

The heavy metals were analyzed using Atomic Absorption Spectrometry Method (Shimadzu AA- 6800).

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## Results and Discussion

Concentrations of Zinc and Lead obtained in this analysis have been shown in Table 1. According to this table the Zinc concentrations were found as 49.5 ppb and 41.2 ppb for the two outside village areas far of tanning industries. For the locations of tannery establishment, this content was found as 44.5 ppb, 30.5 ppb, 46 ppb, 41 ppb and 54 ppb respectively. Zinc could not be detected in case of the drinking water collected from the adjacent areas of Hazaribagh. Also Table 1 expressed the Lead content as 134 ppb and 138 ppb respectively for village locations of collecting water samples and found almost nil for all water samples of tannery area. Again it reveals as BDL for the areas adjacent to the area of tannery establishment. Furthermore, Table 2 determines the comparison of the mean values of these two metal concentrations with the standards containing in safe drinking water for human being as well as public health. The results has expressed that the groundwater of different parts of the Dhaka city which are used as drinking water contain very less amount of Zinc. Again the Zinc content was found as nil in the southern parts of the city of Dhaka. Here BDL/nil refers the value of metal concentration under detection [20]. The WHO recommends 15-22 mg Zinc for adult humans daily. In this analysis, both the highest Zinc content was found in Saver area as 49.5 ppb and the lowest for the area of Hazaribagh as 3 ppb are lower than that of standard values set by EPA. Therefore, the drinking water of these areas has not satisfied the minimum need of Zinc content in our human body. In Hazaribgh area there are about 220 tanneries [21]. Chromium used in tanning process can affect Zinc by creating Zinc Chromate or chelate compound, thus could reduce the Zinc content in groundwater [22].

In case of Lead analysis, more than half of the samples are in the range of BDL values, while rest of the samples contains higher amount of lead than the permissible level. Lead content was also found as nil for the area of Hazaribagh. It is noted that this area has been included in the list of ten most polluted places of the world [23]. Using addition lime by the tanneries can be the reason for this case. Thus majority of Lead is either absorbed or precipitated before reaching the location of Hazaribagh [24]. In Table 2 obtained values have been compared with three standards (WHO, EPA and Bangladesh standard DOE, 2002) that revealed Zinc concentration was higher whereas that of lead was lower than standard value. Further Zinc content for the water samples was less compared to the DOE standard for Bangladesh and Lead exceeded the permissible limit.

| Samples | Amount of Zinc (ppb) | Amount of Lead (ppb) |
|---|---|---|
| Tannery Outside Area-1 | 49.5 | 134 |
| Tannery Outside Area-2 | 41.2 | 138 |
| Tannery Area- 1 | 44.5 | BDL |
| Tannery Area- 2 | 30.5 | BDL |
| Tannery Area- 3 | 46 | BDL |
| Tannery Area- 4 | 41 | BDL |
| Tannery Area- 5 | 54 | 201 |
| Tannery Adjacent Area-1 | BDL | 3 |
| Tannery Adjacent Area-2 | BDL | BDL |
| Mean ± SD | 34.08 ± 20.37 | 52.89 ± 80.8 |

**Table 1:** Concentrations of Heavy Metals (Zinc and Lead) in collected groundwater in case of the areas having Tanneries, nearest and outside village areas.

| Name of Metal (ppb) | WHO Standard[a] | EPA Standard[b] | Bangladesh Standard(DOE, 2002)[c] | Obtained Result(mean) |
|---|---|---|---|---|
| Zinc | - | 5000 | 5000 | 34.08 |
| Lead | 50 | 15 | 50 | 52.89 |

[a]WHO: World Health Organization (1998); [b]EPA: Environmental Protection Agency; [C]DOE: Department of Environment Bangladesh (2002)

**Table 2:** Comparison of some standards of drinking water of Zinc and Lead with present findings.

## Conclusion

As an essential, drinking water should contain the metals in a permissible level. The determination has found lower Zinc content for all the samples of Dhaka and higher Lead content for some areas of the city. This may have a negative impact on human health. The children and the pregnant women could be the worst sufferers. So, the authorities that supply the drinking water in the city like WASA must ensure the adequate amounts of Zinc content in water by ensuring proper treatment of water. Again they should refine the water before supplying for eliminating the neurotoxic Lead which obtained higher than the standard limit in this study. Also it is necessary to make people conscious about the quality of water before drinking. Further, the government could play a vital role in this case by offering free testing service to ensure the good quality water for drinking as well as preventing public health hazard.

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