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PREVALENCE OF ARSENIC AND MICROBIAL CONTAMINATION IN DRINKING WATER-SILENT THREAT TO PUBLIC HEALTH OF TANDO ALLAHYAAR

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Abstract

Arsenic is a potent carcinogen and a well-known cause of threat for human life. It is stated internationally that the water borne illness is due to microbial and arsenic contamination in drinking water. The availability of contaminants was detected at Water Testing & Surveillance Laboratory, LUMHS, Jamshoro from the samples of drinking water from Tando Allahyaar. The current results were compared with World Health Organization (WHO) permissible limit and the outcomes was found at alarming level for the Tando Allahyar community which absolutely relies on surface and ground water for drinking purpose, which posed possible hostile health effect on local residents of the study area. This research is the step to evolve and develop a community based awareness and help to found spatial and time-based prevalence of biohazards in drinking water sources of the study area.

Keywords: Arsenic, drinking water, waterborne illness

INTRODUCTION

Tando Allahyar is the district in the province of Sindh at Pakistan. Intake of toxic metal through drinking water usually becomes the major cause of hazardous health effects fluctuating from shortness of breath to several types of cancers in human beings (1).
Arsenic (As) is documented for many public health issues in Bangladesh, India, China, Vietnam, Nepal and Myanmar (2). In Pakistan, Sindh the 10 to 50 ppb As contaminated drinking water was affects the life of 16 to 36% population (3). As in drinking water is reported for lung, liver, skin and bladder cancer (4). The As pollution is increased due to ore mining and processing industry, dye manufacture facilities, tanneries, thermal power plants, and application of certain insecticides, herbicides and pesticides wastes into drinking water, therefore the contamination level above the 50μg/L and exceeding 200μg/L in Sindh (5, 6). The gastroenteritis, diarrhea, kidney and skin disease found very commonly in three districts namely Thatta, Badin, and Thar, due to poor drinking water quality in three districts namely Thatta, Badin, and Thar, are southern Sind Pakistan (3).

The reason behind this outbreak is the shortage of eminence of water testing laboratories and lack of legal agency for quality drinking water as well as presently at Pakistan there is no guidelines following the WHO recommendations for drinking water consequently this contaminated water becomes the basis of diarrhea, vomiting, gastroenteritis, dysentery, kidney problems etc at Thatta, Badin, Thar (5, 6, 7). Keeping this observation in vision of this burning issue of health the antagonistic effect of contaminated water on human health becomes important to screen the concentration of this hazardous contaminant that polluted the drinking water.

MATERIALS AND METHODS

Water samples were collected randomly from the study area properly labeled and safely transported to Water testing & Surveillance laboratory for further analysis in ice box.

The following analysis was done:

- Turbidity through digital turbidity meter (PCCHECKIT, Germany).
- Electrical Conductivity (EC) Salinity, Total Dissolved Salts (TDS) and pH were measured with conductivity meter (Model no: sanso-direct con 200) (8, 9, 10).
- The Arsenic was determined by Arsenic kit method MERCK with detection range 0.005mg/L to 0.5mg/L (11).
- The bacteriological investigation was measured for total coliforms count (TCC) and Total Faecal coliforms (TFC), by processing samples in a laminar flow hood using sterilized culture media moreover the bacterial study was assessed by Most Probable Number (MPN) technique as per
Standard Methods for the Examination of Water and Wastewater (12).

RESULTS AND DISCUSSION:
In present study the turbidity of 10 water samples of Tando Allhyaar was found < 5 NTU due to the ground nature and depth of boring, furthermore the turbidity of water samples was noted much higher than the permissible limits set by WHO. The samples was found with no color and odor the results were according to the WHO recommendations. Whereas as the Electric conductance (EC), Salinity, TDS (Total Dissolved Salts) and Chlorides of the ground water samples was found with higher values beyond the suggested limits. Total dissolved solids (TDS) results were in the advised level for ground water for Matyari district water(11). Water samples of Chambar-naka, Fish market -1, Gandhi chowk, Mehran sugar mill, Mansoor colony, Khatri mohalla, Usmanabad town water were found arsenic in much higher concentration above 10μgL⁻¹ acclaimed by WHO (2011) shown in figure 03. The Presumptive coliform count per 100ml water method was used for bacteriological analysis, and results reveled that water samples was found with unacceptable grossly polluted shown in table 1, while the water samples from ground shows no growth of Coliform due of saline water and higher TDS level.

<table>
<thead>
<tr>
<th>Sampling Area</th>
<th>Source</th>
<th>Depth in feet</th>
<th>Color</th>
<th>pH</th>
<th>Turbidity NTU</th>
<th>µs</th>
<th>Sss</th>
<th>TDS mg/L</th>
<th>Salinity ppt</th>
<th>Chlorides mg/L</th>
<th>As mg/L</th>
<th>Presumptive coliform count per 100ml water</th>
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<tr>
<td>Shahbaz colony</td>
<td>MP</td>
<td>42'</td>
<td>C.L</td>
<td>7.57</td>
<td>&lt; 5</td>
<td>2810</td>
<td>1820</td>
<td>1.4</td>
<td>638</td>
<td>0.01</td>
<td>0</td>
<td></td>
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<td>MP</td>
<td>53'</td>
<td>C.L</td>
<td>7.80</td>
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<td>2090</td>
<td>1290</td>
<td>1.0</td>
<td>389</td>
<td>0.1</td>
<td>0</td>
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<td>Fish market -1</td>
<td>MP</td>
<td>76'</td>
<td>CL</td>
<td>7.77</td>
<td>&lt; 5</td>
<td>1030</td>
<td>630</td>
<td>0.5</td>
<td>141</td>
<td>0.1</td>
<td>18+</td>
<td></td>
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<td>Fish market-2</td>
<td>WS</td>
<td>7.79</td>
<td>&lt; 5</td>
<td>952</td>
<td>500</td>
<td>0.4</td>
<td>231</td>
<td>0.005</td>
<td>180+</td>
<td>0.005</td>
<td>180+</td>
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<tr>
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<td>&lt; 5</td>
<td>943</td>
<td>500</td>
<td>0.4</td>
<td>211</td>
<td>0.005</td>
<td>180+</td>
<td>0.005</td>
<td>180+</td>
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<tr>
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<td>8.06</td>
<td>12</td>
<td>557</td>
<td>340</td>
<td>0.3</td>
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<tr>
<td>Pak colony</td>
<td>WS</td>
<td>8.00</td>
<td>08</td>
<td>796</td>
<td>490</td>
<td>0.4</td>
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<td>0</td>
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<td>13</td>
<td>780</td>
<td>480</td>
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<td>212</td>
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<td>180+</td>
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<td>45’</td>
<td>C.L</td>
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<td>1640</td>
<td>1020</td>
<td>0.8</td>
<td>268</td>
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<td>0</td>
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<tr>
<td>Mehran sugar mill</td>
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<td>45’</td>
<td>C.L</td>
<td>6.92</td>
<td>&lt; 5</td>
<td>1919</td>
<td>1140</td>
<td>0.9</td>
<td>283</td>
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<td>C.L</td>
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<td>299</td>
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<td>58’</td>
<td>C.L</td>
<td>7.30</td>
<td>&lt; 5</td>
<td>2502</td>
<td>1940</td>
<td>1.4</td>
<td>331</td>
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<tr>
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<td>C.L</td>
<td>7.87</td>
<td>&lt; 5</td>
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<td>1090</td>
<td>0.8</td>
<td>263</td>
<td>0.025</td>
<td>0</td>
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<tr>
<td>WHO permissible limits</td>
<td></td>
<td></td>
<td></td>
<td>6.5 to 8.5</td>
<td>&lt; 5</td>
<td>15000u S/cm</td>
<td>500 mg/L</td>
<td>0.2 to 0.5 ppt</td>
<td>250mg /L</td>
<td>0.01 mg/L</td>
<td></td>
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</tr>
</tbody>
</table>

Table 1: Phyco-chemical Analysis of drinking water of TandoAllhyaar dist. Sindh Pakistan
Figure 1: District Population of study Area

Figure 2: Concentration of ECT, TDS, Chloride and Salinity
DISCUSSION

Water being the vital source for living creatures therefore concern with many health implications and becomes focus of scientific community globally.

In Pakistan public health is at risk due to polluted drinking water with heavy metals and microorganisms around the country not only polluted human health but also affects the aquatic life (11). The present results for the physical parameters were show similarity with previous reported results for ground water (14). In drinking water the normal WHO level for turbidity is 5 NTU which is usually associated directly with higher levels of disease-causing microbes and indirectly constitutes many health issues (15).

The sample water shows more EC due to excessive dissolve solids and other impurities and the level was noted above the WHO limit (1562 µS/cm), results shows similarity with previous published data for drinking ground water of Bahawalpur City, Pakistan (16). TDS concentration was found in present study above the permissible value consecutively elevated TDS concentration make water unsuitable for human drinking purpose which affect skin and cause rashes, and disturb body hair as well, stiffness of the joints, kidney stones, gallstones, and hardening of arteries, decreases the tastiness and causes gastrointestinal irritations in human and laxative effect mainly upon transits, Presence of chloride in drinking water affects indirectly upon health by
corrosion of pipes which can elevate the metal level of water (17). Arsenic in drinking water of exceeding 10 ppb (μg/L) of WHO limit, study led earlier reported that drinking water containing excess arsenic in eleven cities of Punjab (18), as arsenic in water foundations of nausea, vomiting, lower white and red blood cells production, damage blood vessels, disrupt the heart rhythm and cause uncomfortable tingling in hands and feet furthermore chronic exposure to arsenic become reason of many types of melanosis and cancer. The concentration of Arsenic (As) ranged amid 0.0045 to 0.0055mgL\(^{-1}\) equally in both seasons. Therefore chemicals and metals polluted the drinking water sources linked silently with many human ailments (19).

CONCLUSION

It was concluded from the present research work that availability of microbial and arsenic contamination was found high in the drinking water above the WHO permissible limits which could be root of various health issues and let the public health at peak of risks.

REFERENCES


