The analysis of water samples in different industrialization units of District Buner, Khyber Pakhtunkhwa, Pakistan

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Abstract

Present study was carried out to analysis the pollution load in industrial effluent in different localities of District Buner, Khyber Pakhtunkhwa Pakistan. The samples were collected from Daggar, Elai, Swari, Bajkata, Arbela and Deana Baba for various physical and chemical parameters. The average temperature for different samples ranges from 24.5 to 32.2°C, pH 6.37 to 8.48, electrical conductivity 0.258 to 0.548, total suspended solids 119.1 to 166.8 mg/L, total dissolved solids 143 to 1050 mg/L and biological oxygen demand were 72.5 to 363.5 mg/L. The average concentration of Nickel ranges from 0.010 to 0.157 mg/L, Cadmium 0.003 to 0.044 mg/L, Lead 0.21 to 1.31 mg/L, Chromium 0.021 to 0.052 mg/L, Copper 0.748 to 1.136 mg/L, Zinc 0.003 to 0.097 mg/L, Iron 0.010 to 4.509 mg/L, and Manganese were 0.014 to 0.164 mg/L.

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Introduction
Water covers almost three-quarters of the planet earth (Anonymous 1992) and its pollution is a major global problem causing the deaths of more than 14,000 people daily (Nasrullah et al., 2006; Reston 2001). The pollutant that contaminates the water bodies discharges directly or indirectly into water bodies (Nasrullah et al., 2006) by point and non point source without adequate treatment to remove the harmful compounds (Hogan 2010). Water pollution not only affects individual species and populations, but also to the natural biological communities (Anonymous 1992).

The rapid industrialization has direct and indirect adverse effect on our environment (Reston 2001). Industrial effluents are the main source of water pollution. Untreated water near the point of disposal, create foul smell and bad odor (Kulkarni 1979). The net result is large scale pollution of the water bodies which may act as a source of water supply for domestic use of inhabitants of localities. This loss of water quality is causing health hazards and death of human, livestock and death of aquatic lives, crop failure and loss of aesthetics (Anonymous 1992).

In Pakistan industrial estate establishment was started with the introduction of 1st five years plane 1955-1960, which laid emphasis on the establishment of large estates in the country. In most of the cities and industries in Pakistan are without wastewater treatment facilities. In Khyber Pakhtunkhwa, no proper treatment facilities are available (Nasrullah et al., 2006). High levels of pollutants mainly organic matter in river water cause an increase in biological oxygen demand, chemical oxygen demand, dissolved solids, total suspended solids and fecal coliform (Kulkarni 1979). They make water unsuitable for drinking, irrigation or any other use (Hari et al., 1994). Present study was carried out in Marble industries in District Buner to identify water pollution and to determine the physico-chemical characteristics of the industrial effluents.

District Buner is located between 34° 11’ and 34° 43’ N latitude and 72° 13’ and 72° 45’ E longitude in Khyber Pakhtunkhwa Province of Pakistan. District Buner is surrounded on the north by Swat District, on the west by Malakand Agency, on the south by Mardan District and on the east by Hazara Division. The total area of District Buner is 1,865 km² and with a total area of and a population of 506,048 individuals (Anonymous 2010).

Materials and methods
The samples were collected from six marble industrialization units Elai, Daggar, Swari, Dewana, Ambela and Bajkata in District Buner for analysis of various physical and chemical parameters such as temperature, pH, electrical conductivity (EC), total suspended solids (TSS), total dissolved solids (TDS), biological oxygen demand (BOD) and heavy metals. The results were compared with the standard values of National Environmental Quality Standards for industrial effluents. For the analysis of heavy metals viz Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn), Nickel (Ni), Cadmium (Cd), Lead (Pb), and Chromium (Cr) Atomic Absorption Spectrophotometer were used.

Results and discussion
Industrial effluents are the main source of water pollution (Hogan 2010). Present study shows that the temperature values for various samples ranged from 24.5 to 32.2°C, pH from 6.37 to 8.48, Electrical conductivity from 0.258 to 0.548 dSm⁻¹, total suspended solids from 119.1 to 166.8 mg/L, total dissolved solids values from 143 to 1050 mg/L and Biological oxygen demand from 72.5 to 363.2 mg/L. These effluents on entering fresh water make the O₂ depleted, causing suffocation of fish and other aquatic fauna and flora resulting in the death of aquatic life. The average values for different parameters are presented in Table 1. The concentration of Nickel ranges from 0.010 to 0.157 mg/L, Cadmium 0.003 to 0.044 mg/L, Lead 0.21 to 1.31 mg/L, Chromium 0.021 to 0.052 mg/L,
Copper 0.748 to 1.136 mg/L, Zinc 0.003 to 0.097 mg/L, Iron 0.010 to 4.509 mg/L, and Manganese were 0.014 to 0.164 mg/L. Investigated heavy metals from different samples are presented in Table-2.

**Table 1.** The average values for different parameters.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Temp (°C)</th>
<th>pH</th>
<th>EC (μS/cm)</th>
<th>TSS (mg/L)</th>
<th>TDS (mg/L)</th>
<th>BOD (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elai</td>
<td>26.9</td>
<td>6.37</td>
<td>0.275</td>
<td>166.8</td>
<td>143</td>
<td>72.5</td>
</tr>
<tr>
<td>Daggar</td>
<td>27.2</td>
<td>7.45</td>
<td>0.258</td>
<td>191.1</td>
<td>1050</td>
<td>383.5</td>
</tr>
<tr>
<td>Swari</td>
<td>24.5</td>
<td>7.47</td>
<td>0.510</td>
<td>140.3</td>
<td>209</td>
<td>183.9</td>
</tr>
<tr>
<td>Dewana</td>
<td>25.0</td>
<td>8.48</td>
<td>0.276</td>
<td>148.1</td>
<td>223</td>
<td>77.8</td>
</tr>
</tbody>
</table>

The unserious behavior of local marble industries owners and wrong drainage of the wastes of marble industries in Bunker has not only endangered and threatened the aquatic biodiversity of local rivers but up to some extent the life of Human life as well as the natural beauty and filed crops. The people of remote areas use polluted water for domestic animals and for their own drinking (Nasrullah et al., 2006).

**Table 2.** Heavy metal contents (mg L⁻¹) of selected samples.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Ni</th>
<th>Cd</th>
<th>Pb</th>
<th>Cr</th>
<th>Cu</th>
<th>Zn</th>
<th>Fe</th>
<th>Mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daggar</td>
<td>0.099±0.001</td>
<td>0.010±0.001</td>
<td>0.48±0.05</td>
<td>0.021±0.02</td>
<td>1.087±0.5</td>
<td>0.003±0.000</td>
<td>4.509±0.85</td>
<td>0.115±0.09</td>
</tr>
<tr>
<td>Elai</td>
<td>0.058±0.006</td>
<td>0.044±0.009</td>
<td>0.21±0.015</td>
<td>0.032±0.008</td>
<td>0.777±0.016</td>
<td>0.026±0.000</td>
<td>0.136±0.028</td>
<td>0.095±0.009</td>
</tr>
<tr>
<td>Swari</td>
<td>0.010±0.000</td>
<td>0.029±0.002</td>
<td>0.81±0.02</td>
<td>0.033±0.003</td>
<td>0.966±0.012</td>
<td>0.004±0.000</td>
<td>0.037±0.001</td>
<td>0.114±0.009</td>
</tr>
<tr>
<td>Bajkata</td>
<td>0.017±0.001</td>
<td>0.007±0.000</td>
<td>1.82±0.19</td>
<td>0.052±0.02</td>
<td>0.748±0.025</td>
<td>0.097±0.006</td>
<td>0.010±0.001</td>
<td>0.164±0.004</td>
</tr>
<tr>
<td>Arbela</td>
<td>0.157±0.002</td>
<td>0.003±0.000</td>
<td>2.84±0.05</td>
<td>0.039±0.000</td>
<td>1.136±0.05</td>
<td>0.048±0.001</td>
<td>0.045±0.007</td>
<td>0.014±0.000</td>
</tr>
<tr>
<td>Deana Baba</td>
<td>0.110±0.001</td>
<td>0.018±0.006</td>
<td>1.31±0.27</td>
<td>0.042±0.009</td>
<td>0.774±0.058</td>
<td>0.025±0.000</td>
<td>0.235±0.002</td>
<td>0.073±0.001</td>
</tr>
</tbody>
</table>

Mean value ± SD value

The marble industries in Buner are involved in the local river water pollution. Polluted water contains pathogenic bacteria, viruses, protozoans and other infectious parasites. Toxic organic pollutants include a large number of chemicals, such as pesticides and PCBs, many of which are no biodegradable or slowly degraded, biologically magnified and carcinogenic (Reston 2001).

Marble Sediment destroys spawning and feeding grounds for fish, reduces fish and shellfish populations, destroys pools used for resting, smothers eggs and fry, and fills in lakes and streams, and decreases light penetration, thus endangering aquatic plants (Nasrullah et al., 2006). The concentration of many pollutants in groundwater is often higher than that in the most contaminated surface water supplies. Many of the chemicals are tasteless and odorless at concentrations believed to pose a threat to human health. The major groundwater pollutants are chlorides, nitrates, heavy metals, and toxic organics (Hari et al., 1994). Groundwater usually moves slowly through an aquifer, it may take years for pollution to show up in areas adjacent to sources of contamination. Once an aquifer is contaminated the pollutants may remain for centuries (Nasrullah et al., 2006).

The major source of surface and ground water pollution is untreated industrial effluents that discharge directly into water bodies resulting in serious surface and ground water pollution. This loss of water quality is causing health hazards and...
death of human beings, livestock and death of aquatic lives, crop failure and loss of aesthetics. This problem is aggravated by lack of awareness, lack of wastewater treatment facilities, lack of financial resources and the inefficient environmental laws. From the present research study, it can be concluded that although the results are somewhat inline with the safe limits of NEQS as well as WHO but the toxic level of harmful materials can mix up with the ground water if no precautionary measures were taken for filtering of the industrial effluents. Water pollution requires ongoing evaluation and revision of water resource policy at all levels.

References


