EFFICIENCY OF AL-RUSTAMITYAH SEWAGE PLANT AND THEIR CONSEQUENCES ON THE POLLUTION OF DIYALA RIVER

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ABSTRACT
The present work initiated to evaluate the efficiency of Al-Rustamivah sewage treatment plant as reflected by the quality of final effluent that is thrown to Diyala river. Weekly samples of wastewater and final effluent were collected between November 1994 and end of January 1995 and analyzed for different chemical and biological features. Results have indicated that Al-Rustamiyah sewage treatment plant could not be able efficiently to purify the raw sewage. The mean values of suspended solids, BOD, COD Dichromate and Oil & grease effluents were felt to pass standard limits (98.4. 92.8. 125.2 and 39.1 ppm, respectively). The adverse possible effects of pollution on Diyala aquatic life have been also discussed in respect to final effluent quality.

INTRODUCTION
It is well known that the major pollution problems caused by treatment plants are those of water pollution. However, the effluents from these plants present a high pollution load if not treated efficiently before disposal, it would cause death of living organisms in river water. The treated wastewater quality is function of the treatment provided the rating strategy employed and the characteristics of raw wastewater. Subsequently, treated wastewater exhibits wide variation in quality (Bolton and Keine, 1961). One major of pollution is the organic load of final sewage effluents. A significant proportion of organic contaminates carried by sewers derives from urban run—off consisting of story writer from roads, motor ways and paved areas, in addition to industrial effluents when discharged to sewers (Eganhouse et al., 1981). The greatest impact of this load in the environment is the reduced diversity of invertebrates (Borowitzed, 1979; Fitzgerald, 1978).

The purpose of the present study is to elucidate the performance of Al-Rustamiyah sewage treatment plant and the quality of final effluents discharge to Diyala river in respect to water pollution.

MATERIELS AND METHODS
The first visit to Al-Rustamiyah sewage plant in Baghdad was made on 8th of November 1994 and observation were recorded. Samples of wastewater and final effluents weekly collected till 29th on January of 1995 sampling on storm and overflows were avoided. Duplicate samples were analysed for PH, BOD, COD Dichromate, suspended solids, total dissolved solids, Cl, SO4, PO4, NO3, NH4, Oil & grease, iron (Fe), copper (Cu), cadmium (Cd). Chrome (Cr), zinc (Zn), nikle(Ni) and lead(Pb) according to the standard methods for examination of water and waste water (American public health association, 1980).
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Observations Recorded

The foul-smelling sulphnetted hydrogen (H2S) was recognized in all time sampling before 3 Km from plant (or more on nd direction). It is well known that HS is produced by fermentation of organic sulphur compound or by bacterial reduction of sulphate. The amount of this gas depends upon strength, age, temperature and sulphate content of the se age. Methane was also produced in large quantities during aerobic action. Methane gas has high calorific value and collected in gas chamber and used for power production inside the plant. The se age treatment plant consists of different units orking together to cons cit the raw se age to sludge, which can be disposed of in land. Effluent s ith acceptable qualit\ here diapostoe to water course, and gases to the atmosphere. Therefore an dis order in one or more of thee units will reduce the efficienc of the plant. In such circumstances the sewage plant converts to a source of pollution. Therefore, the efficiency of each unit in Al-Rustamivh seage treatment plant as considered. It was obvious that the economic blockade imposed agnist Iraq and shortage of spare parts hae affected the sewage treatment plant in all cities of Iraq and Al-Rustamivh plant is one of them. Therefore, gas chamber, detergins and chlorine house unit had been total disqualified in this plant.

Analysis of Samples

Table (I) summarized the mean alues of all samples. Die qualifications ofwasteater and final et’fluents as l’ollow:

1-Ph

l’he PH alue ‘as nearl neutral (7.2 and 7.4 for seage ater and in the acceptable limits respectively). Hoever, these PH values canbe considered with in the acceptable limits of the Iraqi standards (6-9.5).

2-BOD and COD Dichromate

The ROD and COD the wastewater sere 253.5 and 271.6 ppm, respectively. After puritication they reduced to 92.8 and 125.8 ppm respecti el. hlo%e

3-Suspended and Total Dissolved Solids

The alue of suspended solids is one of the most important of all the for seage and treated effluents (Bolton and Klein. 1961). In this study the suspended solids was 216 ppm for the \’asteater and 98.4 ppm for the final et’fluent. I he removal of suspended solids from raw sev.age is indeed one of the indication of the efficienc. The carefully operated well designed treatment should remove about 50-90 percent. Although, the removal percent in Al-Rustamivh plant as 54.400 (Fig. I), but the suspended solids was oer the standard (60 ppm). The true solution of’ the astewater did not much been affected b treatment as might be expected h

4-Cl and SO4

Soluable Cl and SO4 ere high in both \’asteater and final effluents. The chloride content sas 464 and 381.7 ppm for astewater and final effluent, respectiek. The sulphate contents crc 851.4 and 792.1 ppm for wastewater and final effluent, respectively. These to alues of Cl and SO4 can he accepted according to the standard (1200 ppm).

5-NO, NO2 and NH
Table (1) Analysis of Wastewater and Final Effluents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Wastewater</th>
<th>Final Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH mg/l</td>
<td>7.2</td>
<td>7.41</td>
</tr>
<tr>
<td>BODS</td>
<td>253.5</td>
<td>92.8</td>
</tr>
<tr>
<td>COD Dichromate</td>
<td>271.6</td>
<td>125.2</td>
</tr>
<tr>
<td>Suspended Solids (S.S)</td>
<td>216</td>
<td>98.4</td>
</tr>
<tr>
<td>Total Dissolved Solids (T.D.S)</td>
<td>2009.3</td>
<td>1881.9</td>
</tr>
<tr>
<td>Chloride (Cl)</td>
<td>464</td>
<td>381.7</td>
</tr>
<tr>
<td>Sulphate (SO4)</td>
<td>851.4</td>
<td>792.1</td>
</tr>
<tr>
<td>Nitrate (NO1)</td>
<td>12.5</td>
<td>28.8</td>
</tr>
<tr>
<td>Nitrite (NO2)</td>
<td>2.86</td>
<td>3.64</td>
</tr>
<tr>
<td>Ammonia (NH3)</td>
<td>25.3</td>
<td>25.2</td>
</tr>
<tr>
<td>Phosphate (P04)</td>
<td>3.59</td>
<td>4.34</td>
</tr>
<tr>
<td>Oil &amp; grease</td>
<td>75.9</td>
<td>39.1</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>2.59</td>
<td>1.97</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>0.243</td>
<td>0.029</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>0.025</td>
<td>0.002</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>0.080</td>
<td>0.049</td>
</tr>
<tr>
<td>Chorme (Cr)</td>
<td>0.009</td>
<td>0.005</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>0.120</td>
<td>0.050</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.243</td>
<td>0.029</td>
</tr>
</tbody>
</table>
The concentration of NO3 and NO2 were increased the purification process. NO3 increased from 12.47 ppm in wastewater to 23.8 ppm in final effluent, and NO2 from 2.86 to 3.64 ppm. The ammonia (NH3) also increased did not decreased during treatment as a result of bacterial oxidation of ammonia to nitrates:

\[
\begin{align*}
\text{NH}_3 + 3\text{O} & \rightarrow \text{HNO}_2 + \text{H}_2\text{O} \\
\text{HNO}_2 + \text{O} & \rightarrow \text{HNO}_3
\end{align*}
\]

The NH3 contents were 25.3 and 25.2 ppm for wastewater and final effluent respectively. Phosphate concentration was 3.59 ppm and to 4.34 ppm in the final effluent. So it was over the acceptable limit (3). The reactions place in the aerobic of organic matter could increased phosphorus as below:

\[
\begin{align*}
\text{Organic-phosphorus. } \text{P} & \rightarrow \text{H}_3\text{P}0_4 \text{ (neutered by base present).}
\end{align*}
\]

Oil & grease

the wastewater samples content appreciable amounts of oil & grease (75.9 ppm). The oil & grease should be removed as much as possible in the earl stages of treatment. However, the concentration decreased to 39.1 ppm in final effluent but it was still much higher than allowable limit (4 ppm).

8-Heavy Metals (Fe, Zn, Cd, Ph, Cr, Ni, and Cu)
The major sources of heavy metals in sewage come from trade wastes. If heavy metals reach the ner in appreciable content, they will damage the aquatic life. The concentration of these metals were not high in wastewater (0.3 ppm) except for which was relatively higher than other (Table I). However, the concentration of all metals were reduced considerably after purification including Fe (1.47 ppm). The concentration of heavy metals in final effluents were less than the standards.

**DISCUSSION**
The main removal mechanisms for pollutants across wastewater treatment plant are solubilization, biological oxidation and accumulation in the sludge. While the water content (99.9% or more) disposed as effluent to water course. Although the present study concentrated on water pollution, the air pollution by H2S and methane has been clearly observed in the surrounded area as a result of dismantle of gas chamber in the sewage treatment plant. The emission of H2S, methane and CO2 would cause adverse affects on local environment and global climate. The detritus unit which is for removing the grits during the primary sedimentation. The destructive detritus unit could not able to purify the final effluent from suspended solids. Therefore, the percent as purification of suspended soils was 54.4% (Fig. 1), and the final effluent felt to pass the standard the high content of suspended solids could cause damage to pumps and other mechanical equipment in sewage plant. It would also causes damage to fishes in the river after discharge to the river.

The sewage treatment achieved by Al-Rustamiyah plant could not be able to reduce the organic content (BOD3 and COD) to standard values (40 and 100 ppm for BOD5 and COD respectively). In spite of the purification percentage were high for BOD5 and COD (Fig. 1). Eh enrichment of river water by organic matter would cause decreased the dissolved oxygen. Reducing the dissolved oxygen in river water would lead to putrefaction and foul odours due to INS formation.

Eh the high level of oil & grease in wastewater in wastewater samples were over the ability of treatments provided by Al-Rustamiah sewage treatment plant. Therefore, the purification percent was only 48.5%. The biological degradation of oil & grease (hydrocarbons) in river water would be very slow compared with other organic compound. Hence, the bad effects of oil & grease will continue for long time and extend to long distance from out let point. The ability of oil & grease to from oil layer over the water surface and would present the gas exchange between water and air. Chemicals coagulants can be used to settle out the oil &
CONCLUSIONS

The main conclusions which can be derived from this study would clearly refer to pollution of Diyala river which come from Al-Rustainiyah sewage treatment plant. Suspended may be in the form of non-polar and hence have a low water solubility such compound therefore, to adsorb strongly on suspended particulate matter (Herbs. 1977). This suggests that mechanical processes by sedimentation not a chive substantial removal of these materials from effluent as a result of stopping detritus unit from working. Many synthetic organic compounds, because of their low-polar and hydrophobic nature not onE adsorb onto suspended solids, but also partition into non—polar fate and lipid material present in raw sewage. This components of the raw sewage including mineral oils, grease, waxes and surfactants. some of which in varying degrees are resistant to degradation, could potentially represent an important mechanism for the concentration and transport of these materials to the riser water. "The principal concern in disposing of final effluents contaminated with organic pollutant, this would exposure the aquatic environment to adverse effects. In addition to exposure of the population to these substances either directly from the consumption of water or indirectly through the food chain, where biominification may accrue.

LITERATURE CITED


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