

Wastewater Characterization in the Sultanate of Oman

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Abstract

This study focuses on characterizing the quality of domestic wastewater from six different sewage treatment plants (STP) in three regions in Oman: Muscat, Sohar and Salalah. The tested parameters are pH, electrical conductivity (EC), biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), ammonia, cations, anions, solids gravimetric tests (total solids (TS), total suspended solids (TSS) and total dissolved solids (TDS)), and microbial content. Results revealed that, the raw sewages in all STPs can be categorized as high strength concentration. The values of pH for raw sewage (RS) and treated effluents (TE) were in the range of 6 to 7.5 for the entire sampling points in the six selected STPs. The EC values of the TEs for the six STPs were within the Omani Standards (OS) range of 2000 to 2700 $\mu\text{s}/\text{cm}$. Both BOD₅ and COD values of TE were within the recommended limits by OS of 15 to 20 mg/L and 150 to 200 mg/L, respectively. Ammonia concentrations in TEs exceeded the acceptable range in most STPs. Fluoride, Chloride, Phosphate and Sulfate concentrations were within the acceptable ranges of OS. Nitrate concentration in TEs of two STPs exceeded the recommended limit. The average obtained values of the entire set of tested heavy metals were found within the stated limits by OS for TEs except for Mo. The TSS in TEs was above the acceptable range of 15 to 30 mg/L. However, the values of TDS for TEs were within the suitable range of 1500 to 2000 mg/L according to OS. The obtained values for E Coli were all acceptable except for one STP.

Keywords: *Oman, Wastewater, Characterization, Physical Analysis, Chemical Analysis, Biological Analysis.*

1. Introduction

Water resources in Oman can be divided into two main classes: natural and non conventional water resources. According to MRMWR [1], there are about 130,000 wells and 3,017 springs and 4,112 Aflaj in Oman. The non-conventional resources are: desalination of seawater, storage dams and recharge dams, treated wastewater and imported virtual water.

The current situation shows that the country will face water scarcity. The available water is 1,330 Mm³/year and the approximated annual consumption rate per capita is 500 m³ which causes extreme stress (population exceeded 2.5 million in 2003 census). The water demand exceeds renewable resources by 25% (378 Mm³). As a result, groundwater levels and Aflaj flows are declining and saline water intrusion in coastal aquifers started to appear.

On the other hand, there are more than 350 wastewater treatment plants (WWTPs) distributed on different areas of Oman. These WWTPs belong to government, private sector and individual owners. The total production was 37.4 Mm³ in year 2000 and is expected to be 97.8 Mm³ in year 2010. The available information indicated that Haya Water operates 10 WWTPs in the governorate of Muscat (Ansab, Al-Khudh, Shati Al-Qurm, Aamerat, Busher, Manumma, Muabaylah, Darsayt, Aynat and Japrooh). The total expected average production

capacity of these 10 WWTPs is about 41,800, 42,750 and 94,470 m³/day during years 2008, 2009 and 2010, respectively.

The quantities of the produced treated wastewater will increase during the period 2011 to 2016. Concurrently, an increase in demand by Muscat Municipality is expected. Thus, the average amount of the surplus of these waters will be between 17,943 m³/day in 2011 and 21,993 m³/day in 2016. Furthermore, observations indicate that the amount of water surplus decrease in the months of April to September and increase in the period from October to March because of the temperatures variation in northern Oman (Muscat Governorate).

The number of WWTPs supervised by the Ministry of Regional Municipalities and Water Resources (MRMWR) is around 41 plants. Figures from MRMWR [1] show that the capacity of the 41 WWTPs is expected to be around 38,010 m³/day.

There are many studies conducted to check the quality of treated effluents in different countries. These studies were concerned with certain parameters which may cause major effects to the environment and human kind. Orhon et al. [2] conducted experiments to evaluate the quality of domestic sewage in terms of major polluting parameters. The results approved the common understanding that wastewater quality is very much site-specific and should be determined for each case. Interpretations of conventional characterization results provided a rough indication of the treatability of wastewaters. Size distribution of pollutants may be a significant index for

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