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MICROBIAL AND HEAVY METALS ANALYSIS OF SEWAGE FROM TAIF CITY, SAUDI ARABIA

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ABSTRACT

The study was conducted to analyzed microbial and heavy metals of sewage from Taif city, Saudi Arabia to observe the relationship between treated and untreated sewage in the aspects of microbial and heavy metals content. The results suggested that there was remarkable difference in the microbial and heavy metals content of treated and untreated sewage, where untreated sewage contain large number of microorganisms and high concentration of heavy metals.

Keywords: Sewage, sludge, microorganisms and heavy metals.

INTRODUCTION

Soils, aquatic sediments, waste streams, ground water, surface water and all environment frequently are contaminated with sewage, which contain huge numbers of microorganisms such as bacteria including *Arthrobacter* sp., *Bacillus* sp., *Clostridium* sp., *Escherichia coli, Favobacterium* sp., *Mycobacterium* sp., *Pseudomonas* sp., *Salmonella* sp., *Shigella* sp., *Staphylococcus* sp., *Vibris* sp. and some fungi as *Alternaria* sp., *Aspergillus* sp., *Cephalosporium* sp., *Chrysosporium* sp., *Coniothyrium* sp., *Epicoccum, Fusarium* sp., *Gliocladium* sp., *Mucor* sp., *Nigrospora* sp., *Paecilomyces* sp., *Penicillium* sp., *Trichoderma* sp., sewage also contain different kinds of viruses such as polio viruses, Echorvirus, new enteroviruses, hepatitis A, Rotavirus and some portozoa such as *Entamoeba histolytica, Giardia lamblia.* Sewage also contain helmitss such as *Enterobius vermicuaris, Ascaris lumbricoides, Nector amerlcans, Taenia saginata* (Volk, *et. al.*, 1986; Hasehm, 1995; Madigam *et. al.*, 2002; Tortor *et. al.*, 2001, Abdulfutin *et. al.*, 2002, Aldufor *et. al.*, 2003). Sewage also contain higher concentrations of heavy metals such as aluminium, calcium, cobalt, copper, iron, lead, Manganese, Nickel, Selenium and Zinc (Keefer *et. al.*, 1986; Hashem, 1998, 2000; Alexander, 1999; Combest 1991; Sayler *et. al.*, 1991).

MATERIAL AND METHODS

Sewage liquid and sludge treated with untreated were collected using plastic autoclaved, screw-cap bottles. Samples were kept in ice box taken to the laboratory for microbial and metal analysis, samples were taken from primary, secondary and tertiary treatment and also from treated and untreated sludge.

The soil dilution plate method was used for microbial isolation, Czapek's agar and nutrient agar media were used for fungal and bacterial isolation, respectively. The plates were incubated at 30°C for 5 days for bacterial isolation and at 27°C for one week for fungal isolation. Fungal and abcterial genera and species were identified according to Raper and Fennel, Zycha and Siepermann, 1989, Booth, 1971; Ellis, 1971; Barnett and Hunder 1972; Ramirez, 1982 and Bauchanan and Gibbons, 1974). Metal analysis were carried out according to the method described by Hashem (1995) and analyzed using atomic absorption flame spectrophotometer.

RESULTS AND DISCUSSION

Fifteen fungal and six bacterial species were isolated (Table - 1). *Aspergillus niger, Penicillium chrysogenum, Escherichia coli, Clostridium* sp., *Salmonella* sp., and *Shigella* sp. were the dominating microorganisms in the sewage from all samples with 100% frequency. *Aspergillus flavus, Penicillium notatum, Arthrobacter* sp. and *Bacillus* sp. were with 80% frquency, while the other fungal and bacterial genera showed frequency of 40%. The concentration of Al, Cd, Co, Cu, Mn, Ni,

Table - 1 : Genera and species of microorganisms isolated from sewage samples

Genera and species	Samples					Frequency %
	1	2	3	4	5	
Aspergillus flavus	+	+	+	+	-	80
Aspergillus niger	+	+	+	+	+	100
Cladosporium sp.	+	-	-	+	-	40
Fusarium sp.	-	-	+	+	-	40
Mucor sp.	+	-	-	+	-	40
Nigrospora sp.	-	+	-	+	-	40
Paccilomyces sp.	-	-	+	+	-	40
Penicillium chrysogenum	+	+	+	+	+	100
Penicillium citrinum	-	-	+	+	-	40
Penicillium notatum	-	+	-	+	-	40
Pestalotia sp.	-	+	+	+	-	80
Rhizopus sp.	-	-	+	+	-	40
Trichocladium sp.	-	-	+	+	-	40
Trichoderma sp.	-	-	+	+	-	40
Ulocladium sp.	-	+	-	+	-	40
Arthrobacter sp.		-	+	+	-	80
Bacillus sp.	-	+	+	+	-	80
Clostridium sp.	+	+	+	+	+	100
Escherichia coli	+	+	+	+	+	100
Salmonella sp.	+	+	+	+	+	100
Shigella sp.	+	+	+	+	+	100

1- Primary treatment; 2- Secondary Treatment; 3 - Tertiary treatment;
4- Untreated sludge; 5 - treated sludge

Pb and Zn were summarized in Table -2 and were found higher than earlier findings in some Saudi Arabaia soils and sewage (Hashem, 1993, 1998 and 2002).

There are many kinds of sewage wastes applied to the soil and agricultural lands, including both raw liquid sewage, and liquid or solid products that have passed through various stages and kinds of microbial and chemical treatment (primary, secondary and tertiary treatments). The more prolonged the microbial, the reactive organic, materials will have been decomposed and the more stable the residual solids will be (Leeper, 1978). Decomposition of sewage sludge by microorganism resulted in released carbondioxide, methane, ethane and other volatile

Table - 2 : Total content of heavy metals in sewage (μgg^{-1})

Element	1	2	3	4	5
Al	202	192	21	366	142
Cd	70	65	51	95	62
Co	85	80	63	113	80
Cu	551	503	404	713	578
Mn	166	152	132	335	211
Ni	143	133	101	153	105
Pb	133	111	86	183	106
Zn	611	431	301	723	435

1- Primary treatment;
2- Secondary Treatment; 3 - Tertiary treatment;
4- Untreated sludge; 5 - treated sludge

gases which even at low concentrations are toxic to plants and other microorganisms, concern with environmental pollution has lead to many inquiries on the microbial utilization of sewage wastes. The sewage wastes contain various inorganic materials in addition, first, the industrial wastes are the source of much of the heavy metals, second, miscellaneous grits and muds, which enter unavoidably as washings from streets, all of these factors, biological treatment, different chemical additive, different contamination with industrial wastes at grits and muds, play apart in the large differences in composition exhibited whenever analyses are collected from miscellaneous sources. Attention is drawn to the possible danges from microbial and heavy metals in applied sewage wastes. The concentrations of heavy metals in sewage waste for land application would result in long term phytotoxic effects and food chain contamination. Microbial transformation and assimilation of heavy metals are well known (Binsadiq, 2002), the results of heavy metals concentrations in Table - 2, lower than that the ideal concentrations of some heavy metals in sewage wastes (Meteal and Eddy, 1979). Such heavy elements as in the present study in sewage waste were only slightly available to crops, but suggested that may they might accumulate in the soil and contaminating air and ground water.

Sewage wastes generally contains relatively high concentrations of heavy metals and several pathogenic microorganisms which will affect the soil properties and plants grow and become a major public health and environmental problems.

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