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Physicochemical and Parasitological Assessment of Wastewaters in Quetta City, Pakistan with Special Reference to Their Toxic Impacts

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Abstract: In many parts of the world, health problems have often been caused by untreated wastewater. The objective of this study was to determine thephysicochemical and parasitological determination of wastewater in Quetta city, Balochistan.In the present study, samples of water were collected from different areas of Quetta city including domestic wastewater, city nala, irrigated water, Police line hospital(hospital 1) wastewater and Mission hospital (hospital 2) wastewater were examined. The physicochemical parameters such as,pH, conductivity, TDS (Total dissolve solid) and some metals *i.e.*, sodium and potassium values and the helminthes ova were calculated for each wastewater sample selected for the present study.The obtained results revealed that the parameters like pH, conductivity, TDS of all wastewater samples observed in the present study showed the values higher than the standard values suggested by WHO.While the values of sodium and potassium range from 20 to 30 mg/litrewere not more than theirstandard values. The helminthes ova were also being detected in each wastewater sample and citynala containing the high value of helminthes ova as compare to other samples. Thus, it had been concluded that all wastewater samples observed in the present study were highly contaminated and polluted, hence not fit to reuse. Therefore, it is recommended that don't reuse these waste water samples collected from different areas of Quetta city without treatment.

Key words: Wastewater · City Nala · pH · Conductivity · TDS · Sodium and Potassium

INTRODUCTION

Wastewater is referred to any water whose quality is being adversely abused by anthropogenic influence, which includes liquid waste discharged from domestic resources, industrial and agriculture, commercial areas containing a wide range of contaminate [1]. Wastewater includes liquid waste discharged from domestic homes, industries, hospitals or commercial processes. Domestic human wastes defined as human excreta, urine and the associated sludge also called Black water, the kitchen wastewater and wastewater generated through bathing is also called Grey water.

Hospital wastewater possess serious health hazard to the workers, public and air flora on the area. The hospital wastewater comprises of both liquid and dissolved material produced within the hospital environment[2]. Hospital wastewater composed of particles such as part of human fetus blood fluid, which are hazardous, infectious wastes, infective agents from laboratory wastewater from surgery, wastewater material that could cause damage to handling persons (knife, needle, broken glasses, scalps), pharmaceutical waster, this includes pharmaceutical products(drugs and chemicals) which is returned from the wards, contaminated or expired products, chemical waste that comprises of discarded solid or liquid and gaseous chemical and radioactive waste generated from invitro analysis of body tissues and fluid [3].

In many parched and semi arid countries there is a shortage of water so planners are forced to consider sources of water which may be used economically and effectively to increase further development. As the population increases both agricultural productivity and the living standard of the poor rural has been recognized, irrigated agriculture occupies about 17% of the world total

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arable land but the production from this land cover of 34% of the world area. Brackish water is marginal water (quality water) for agriculture use because of its high dissolved salt contents and the municipal wastewater is marginal quality water due to related health risk. The use of the marginal water requires very complex management practice and stringiest monitoring process than when the good quality water is used [4].

In 1989, WHO gave attention to the diseases caused mainly by helminthes contained in sludge and wastewater reused for agriculturalpurposes.Helminthes ova are one of the main targeted pathogens for water reuse in agriculture and aquaculture issued in 2006 by the World Health Organization. Diseases caused by Helminthes are simply referred to as Heminthiasis and are common in the society. The heminthiasis causing the following diseases: diarrhea, fever; fatigue, dehydration, enlargement of liver, swollenspleen, allergies, Eosinophilia in man, chest pain, anemia, bowel obstruction, mal-absorption, abdomen distended in children, headache itchy skin, itchy anus, itching red and teary eyes, elephnantiasis, lymphatic, filariasis, trichuriasisand ascariasis etc.

It is very important to clean the wastewater and return to environment so this cleaning is done through treatment plants in which various technologies has been processed to remove organic carbon, nutrients, inorganic salts, metals and pathogens. Such treatment plants are held in Iran, America and other developed countries. Internationally, the most important reuse of wastewater is agricultural irrigation. So there is a requirement to properly treat wastewater for such purpose, considering the removal of pathogens while leaving suitable amounts of nutrients and other elements to increase yield. Wastewater treatment process including waste stabilizing ponds which is very effected as this process remove all kinds of pathogens, that is 6 logs of bacteria up to 5 logs of viruses and all kinds of protozoa and helminthes ova [5]. Second is the reservoir which is similar to first one. Third is the wetland, in which helminths ova are removed by filtration through the soil and adhesion to roots, this process also removed nitrogen, phosphorus and heavy metals. Fourth one is the coagulation-flocculation to produce fit for agriculture reuse [6]. Fifth one is the rapid filtration process which removes helminthes ova and protozoa and removes 90% fecal coliforms, pathogens bacteria, enterovirus and 90-99% of helminthes ova [7]. The sixth one is the up flow anaerobic sludge blanket reactors, in these process helminths ova are remove from filtration. There are many other treatment plants but these are wildly used. Present work was therefore aimed to observe the physicochemical and parasitological determination of wastewater samples collected from the different area of Quetta City of ProvinceBalochistanin order to observe that whether all such waste water samples could be reused for various purposes.

MATERIALS AND METHODS

Sample Collection: Samples were collected during the period extends from August 2013 to December 2013at different areas of Quetta city including domestic wastewater, city nala wastewater, irrigated wastewater; police line hospital(hospital 1) wastewater and Mission hospital (hospital 2)wastewater were examined. Atleast one litre of wastewater sample was collected from each study area. Samples were collected during day time in plastic bottles and transfer to the chemistry laboratory of SardarBahadur Khan Women University Quetta for further analysis.

Physiochemical and Parasitological Analysis of Wastewater Samples: pH meterwas used for the determination of pH of all samples. Conductivity meter conductance was used to determine the Electrical Conductivity of Wastewatersamples. Conductivity meter was first calibrated using 0.01 KCl (potassium chloride) solutions. Conductivity meter is also used for the determination of TDS by following the same procedure, but the TDS values of different samples is determined by using TDS nob on conductivity meter. Sodium and Potassium concentrations were determined with the help of flame photometer. COD (Chemical Oxygen Demand) for all the samples has been determined by titration against Potassium per magnate ($KMnO_4$).

RESULTS AND DISCUSSION

The results of pH, Conductivity, TDS, Na,K, COD, helminthes eggs in different samples of wastewater were recorded and presented in Table 1 and Figures 1-7, respectively. The highest values of all these parameters were found in city nala that might be because it is more contaminated than the rest of the samples.

pH: The wastewater standard value of pH recommended by WHO is 6 to 9, but all samples analyzed in the present study showed values much higher than the recommended values. All samples are contaminated, but the largely contaminated is wastewater was actually city nala because its pH value was 11, which was greater than the rest of the samples as shown in Figure 1.

Table 1: Physicochemical and Parasitological Determination of Wastewater samples collected fromQuetta City

Samples	pH	Conductivity μScm^{-3}	TDS mg/l	Na mg/l	K mg/l	COD mg/l	Helminths Eggs Eggs/litre
Domesticwastewater	9.5	1418	2337	25	20	1280	158
City nala	11	1771	2473	30	26	1400	174
Irrigated wastewater	10.5	1642	2389	28	22	1200	169
Hospital 1 wastewater	10.25	1767	2470	29	25	1320	149
Hospital 2 Wastewater	9	1753	2345	26	23	1360	153

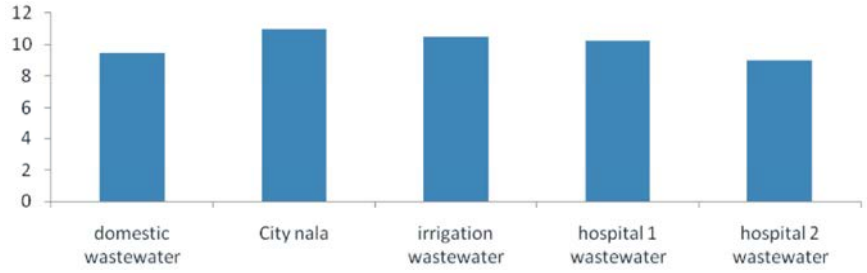

Fig. 1: pH values of waste water samples

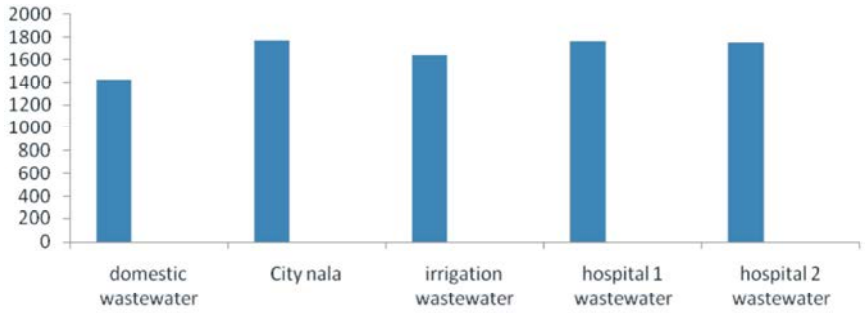

Fig. 2: Conductivity values of waste water samples (μScm^{-3})

Conductivity: The wastewater standard values of conductivity recommended by WHO is 1000µScm-3, but the conductivity recorded for all wastewater samples analyzed in the present study was above this standard value. The highest value of conductivity was reported from City nala that is 1771 μScm^{-3}, followed by hospital 1 that is 1767 μScm^{-3}>hospital 2 as 1753 μScm^{-3}> irrigated wastewater 1642 $\mu Scm^{-3}$and the least value was recorded for domestic wastewater that is 1418 μScm^{-3}, respectively as shown in Figure 2. Thus, city nala is highly contaminated in the sense of conductivity as compare to other wastewater samples.

Total Dissolved Solids (TDS): The wastewater standard values of TDS (Total dissolve solid) recommended by WHO was 2000 mg/l. But in the present study, TDS values recorded for all the samples was found to be higher than above mention range. The highest value of TDS was recorded for city nala,that is 2473mg/l, followed by hospital 1>irrigated wastewater> domestic wastewater, while least for hospital that is 2 2345mg/l (Figure 3). Therefore, again city nala is highly contaminated and the hospital 2 wastewater is least polluted in the sense of total dissolve solid.

Sodium and Potassium: In all samples, the value of sodium ranges from 25 to 30mg/litre, while the value of potassium ranges from19 to 26 mg/litre, respectively (see Figures 4 and 5). Among all the heavy metals in wastewater, the values of sodium and potassium were less and indicates that these samples containing less minerals, so this kind of wastewater is not fit to utilized for irrigation or not to be mixed with water channels.

COD(Chemical Oxygen Demand): The standard value of COD(Chemical oxygen demand) recommended by WHO is 1000mg/l. But in the present study, the recorded values of all the samples were higher than above mention range. City nala having the high COD value that is1400 mg/l, followed by hospital 2 that is 1360 mg/l>hospital l waste

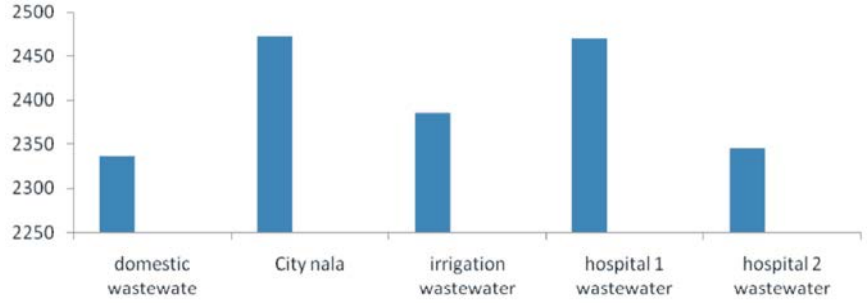

Fig. 3: TDS Values of waste water samples (mg/l)

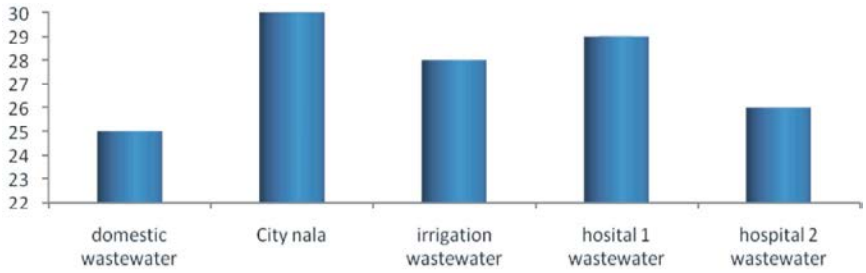

Fig. 4: Sodium concentration of waste water samples (mg/l)

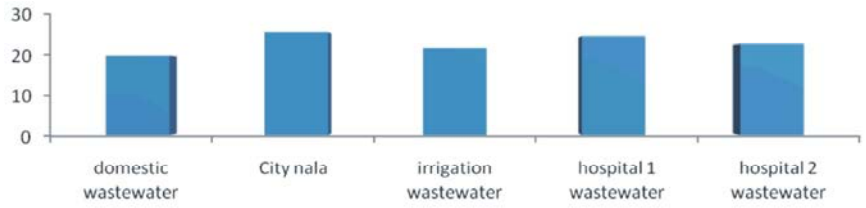

Fig. 5: Potassium concentration of waste water samples in mg/l

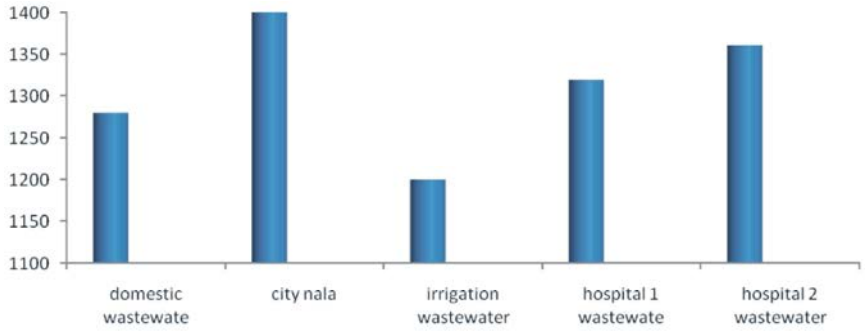

Fig. 6: COD (Chemical oxygen demand) values of waste water samples in mg/l

water that is 1320mg/l>domestic wastewater that is 1280mg/l and least in irrigated wastewater that is 1200 mg/l, as shown in Figure 6 respectively. Such highest value of COD is might be due to the use of chemicals by the biological contaminates present in the sample. Thus, it had been concluded that the wastewater of city nala is very contaminated.

Helminths Egg: The number of helminthes egg/litre in all the samples recorded in Table 1 and Fig. 7 respectively. The number of helminthes eggs were found to be large (174 eggs/litre) in water sample collected from Citynala, while the hospital 1water sample contain very less number of helminthes eggs that is 149 eggs/litre as shown in Figure 7, respectively. It means tha the lmin

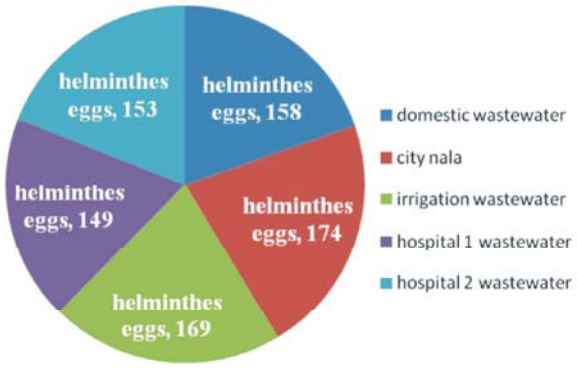

Fig. 7: Helminths ova of waste water samples (eggs/litre)

these egg were largely present in citynala wastewater but less in the hospital samples because the wastewater of hospitals also contains waste material from pharmacy laboratories that can kill microorganisms.

As all wastewaters discharge from the different areas of Quetta city is gathered in city nala, therefore, wastewater of city nala is highly contaminated and also contains large numbers of helminthes ova. However, the values of allselected physiochemical and parasitological parameters selected for the present study were also found to be high than standard values, therefore, all waste water samples analyzed from different areas of Quetta city were found to be highly contaminated or polluted, thence, the reused of all these wastewaters forthe cultivation of vegetables and grassesin Quetta city is highly hazardous to human health as well as also for other kind of herbivores animals which use such polluted grass fields.

RECOMMENDATIONS

As in the present study, the wastewater samples obtained fromthe different areas of Quetta city had been analyzed and proved to be highly contaminated, therefore, it is recommended that government should established a treatment process /plants for wastewater because it is financially not possible everyone to arrange their own treatment plant individually. The following safety measures should be conveyed by the Government to the local population such as, (1) First, to boil the water before drinking, so it may kill many microorganisms; (2) vegetables should be first washed properly with warm water and then cooked properly so that heating will be effective; (3) Avoid direct contact with wastewater, it can be mixed with oceans, rivers and streams, thence, its pollutant quantity per litre can be reduced; (4) as the discharge of waste water in large water bodies can badly effect the aquatic life, so inorder to avoid such aquatic pollution, government should take some serious steps for its treatment and discharge; (5)to conduct seminars and door to door counseling for the awareness of pollution in water and their bad impacts on human health specially in under developing countries; (6)Health organization should incorporate health education and clean the wastewater as a part of control program.

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