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Determination of Ammonia, Nitrate and Nitrite concentrations in Sea Water Samples Mixed with Waste Water in Misurata, Libya

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ABSTRACT

Concentrations of ammonia, nitrate and nitrite and four physicochemical parameters (temperature, conductivity (EC), total dissolved solids (TDS) and pH) were determined in sea water samples mixed with waste water sources from Jannat and Yadar waste water channels in Misurata city, Libya. Sea water samples have been studied at a different distance from the point of the convergence of the sea water with the waste water sources. The concentrations of ammonia, nitrate and nitrite and physicochemical parameters have been calculated. The analyzed samples showed mean concentrations (mg/l) range of 7.5 ±0.34 to 14.0 ±0.74, 0.1 ± 0.005 to 0.31±0.02 and not detected for nitrate, nitrite and ammonia respectively. The data showed the variation of the investigated parameters in samples as follows: temperature 13.1±0.85 to 17.6±0.98 ºC pH 7.39±0.35 to 7.67±0.55, conductivity (EC) 48.18±1.1 to 53±1.8 ms/cm^3 and total dissolved solid (TDS) 31.32±0.75 to 34.45±0.81 mg/l.

Keywords: *Waste water, Ammonia, Nitrate, Nitrite, Conductivity.*

1. INTRODUCTION

Wastewater discharge from sewage and industries are major component of water pollution, contributing to oxygen demand and nutrient loading of the water bodies, promoting toxic algal blooms and leading to a destabilized aquatic ecosystem (Morrison et al., 2001; DAWF and WRC, 1995). High or low pH values in a sea have been reported to affect aquatic life and alter toxicity of other pollutant in one form or the other (DWAF, 1996). Low pH values in a river for examples impair recreational uses of water and effect aquatic life. A decrease in pH values could also decrease the solubility of certain essential element such as selenium, while at the same time low pH increases the solubility of many other element such as Al, B, Cu, Cd, Hg, Mn and Fe (DWAF, 1996).

Nitrogen - one of the most commonly occurring elements in nature - forms many inorganic ionic species, of which the most important are nitrate, nitrite and ammonium ions. The main anthropogenic sources of nitrates in the environment are municipal and industrial wastes and artificial fertilizers. Nitrogen oxides present in the air and originating from natural and anthropogenic sources (combustion, transportation) after the reactions with water come back to the earth surface in the form of acid rains (Walna et al., 2004). Nitrites appear as intermediates in the nitrogen cycle. They are unstable and, depending on conditions, are transformed into nitrates or ammonia. Their presence in water can be a result of water processing or use of nitrite salts as corrosion inhibitors. Nitrites are commonly used in preservatives. To surface waters they get from the same sources as nitrates, i.e. in municipal wastes, industrial wastes, and mining wastes and with water flowing in from artificially fertilized fields. The sources of ammonium ions in surface waters are reactions of biochemical decomposition of organic nitrogen compounds, reduction of nitrites and nitrates by hydrogen sulfide, iron (II), humus substances (or other reducing compounds) and, first of all, municipal wastes, industrial wastes and animal farm wastes. Nitrogen compounds enhance eutrophisation of surface waters. Organic nitrogen compounds undergo biochemical decomposition into nitrites later oxidized to nitrates (Michalski and Kurzyca, 2006).

In this study we investigated ammonia, nitrate and nitrite concentration and four physicochemical parameters value (temperature, conductivity, total dissolved solids (TDS) and pH) in sea water samples in presence of waste water from Jannat and Yadar waste water channel in Misurata city, Libya.

2. EXPERIMENTAL

2.1 Sample area and Sample collection

Sea water samples were collected at a depth of 30 cm from the surface of sea water and at a distance of 10, 40, 70, 100 and 130 m from the point of the convergence of the sea water with the waste water sources from Jannat and Yadar waste water channels (after filtration and removal of solid constituent) in Misurata city, Libya in July 2012. Sea water samples were collected in plastic containers previously cleaned by washing in non-ionic detergent, rinsed with tap water and later soaked in 10% HNO3 for 24 hours and finally rinsed with deionised water prior to usage.

2.2 Sample Analysis

a. Determination of Ammonia, Nitrate and Nitrite in the Water Samples

The concentration of ammonia, nitrate and nitrite were determined using Dr. Lange Cadas 100 UV/VIS spectrophotometer**.** Ammonia was determined using direct Nesslerzation method (Boutwell Jr., 1957), nitrate was determined using Phenol disulfonic acid method (Hora and Webber, 1960) while nitrite was determined using Diazo method (Kumar et al. 1993).

b. Determination of Physicochemical Parameters

Physicochemical parameters of the samples were determined by using standard procedures (Rani and Thatcher, 1992; APHA, 1992; Pelezar, 1986; Jain and Jain, 2007; Jayalakshmi et al., 2011).

1. PH: pH is termed as negative logarithm of the hydrogen ion concentration. The pH is determined by digital pH meter which gives direct values of pH.
2. Conductivity: The conductivity is determined by using digital conductivity meter.
3. Temperature: A mercury filled centigrade thermometer calibrated from 0 to 100 °C is used for temperature measurements.
4. Total dissolved solids: Fifty milliliters of water sample is filtered through ordinary filter paper and water is collected in the evaporating dish of known weight. Further it is heated and water is totally evaporated. Whatever dissolved solid matter is present gets accumulated at the bottom of evaporating dish. The evaporating dish is cooled and weighed. By weight difference method the total dissolved solids is determined.

3. RESULTS AND DISCUSSION

3.1 Concentration of Ammonia, Nitrate and Nitrite in the Samples

The concentrations of nitrate and nitrite in all samples varied between 7.5 ±0.34 to 14.0 ±0.74 mg/l for nitrate; 0.1 ± 0.005 to 0.31±0.02 mg/l for nitrite (n=3) as shown in Table 1. High concentration of nitrate and nitrite were observed at the distance of 10m from the point of the convergence of the sea water with the waste water sources from Yadar waste water channel and at the distance of 10m from the point of the convergence of the sea water with the waste water sources from Jannat waste water channel respectively, while low concentrations were observed at the distance of 130m from the point of the convergence of the sea water with the waste water sources from Jannat waste water channel and at the distance of 130m from the point of the convergence of the sea water with the waste water sources from Jannat waste water channel respectively. The levels of nitrate less than the WHO limits of 45 mg/l and exceed the South Africa guideline of 0.25 mg/l (Akan et al. 2008) and Nitrite level in this study was found below the acceptable drinking water standard i.e. 3.29 mg/l (U.S., 1997). In this research, ammonia was not detected in all samples.

3.2 Physicochemical Parameters of the Samples

a. pH

pH is the hydrogen ion activity and a measure of acidity and alkalinity in aquatic bodies. Substantial variations were recorded in the pH level. Always the average values of pH in all distance in two channels were between 7.39±0.35 to 7.67±0.55 (n=3). The lowest pH value of 7.39±0.35 was recorded at the distance of 100m from the point of the convergence of the sea water with the waste water sources from Yadar waste water channel and the highest pH value at the distance of 10m from the point of the convergence of the sea water with the waste water sources from Yadar waste water channel as shown in

Table 1: Concentration of nitrate, nitrite and ammonia in water samples of Misurata city

Channel	Sample number	At distance (m)	At depth (cm)	Nitrate (mg/l)±SD	nitrite (mg/l)±SD	Ammonia (mg/l)±SD
Jannat	1	10	30	12.8±0.55	0.31±0.02	N.D.
	2	40	30	11.2±0.45	0.29±0.015	N.D.
	3	70	30	10.6±0.36	0.29±0.017	N.D.
	4	100	30	9.1±0.39	0.15±0.004	N.D.
	5	130	30	7.5±0.34	0.1±0.005	N.D.
Yadar	1	10	30	14.0±0.74	0.29±0.016	N.D.
	2	40	30	13.2±0.62	0.28±0.018	N.D.
	3	70	30	12.2±0.51	0.28±0.015	N.D.
	4	100	30	10.0±0.48	0.22±0.012	N.D.
	5	130	30	8.2±0.35	0.15±0.013	N.D.

N.D. = Not detected
SD = Standard deviation for n=3

Table 2. pH usually has no direct impact on consumers. It is one of the most important operational water quality parameters.

b. Temperature

Temperature in the water is important for its effects on the chemistry and biochemical reactions in the organisms. Based on the results it was noted that the temperature fluctuated in between 13.1±0.85 to 17.6±0.98°C (n=3). The lowest value (13.1±0.85°C) was found at the distance of 130m from the point of the convergence of the sea water with the waste water sources from Jannat waste water channel and the highest temperature value (17.6±0.98°C) at the distance of 10m from the point of the convergence of the sea water with the waste water sources from Yadar waste water channel as shown in Table 2.

c. Electrical Conductivity and Total Dissolved Solids

Electrical conductivity of water is also an important parameter for determining the water quality. It is a measurement of water's capacity for carrying electrical current and is directly related to the concentrations of ionized substance in the water.

Levels affected by the electrical conductivity of water are a direct function of its total dissolved solids, organic compounds and temperature. From the results it was evident that the highest value of 53±1.8 ms/cm^3 was obtained at the distance of 10m from the point of the convergence of the sea water with the waste water sources from Jannat waste water channel where as the lowest value of 48.18±1.1 ms/cm^3 was obtained at the distance of 130m from the point of the convergence of the sea water with the waste water sources from Yadar waste water channel as shown in Table 2. The mean conductivity values for all the sampling point were higher than the WHO guideline values of 1000 μS/cm^3 for the discharge of wastewater through channel into stream (Akan et al. 2008).

Conductivity is not a problem in itself and just above certain level does not mean that the water will cause illness. The fluctuations in electrical conductivity correlated positively with the total dissolved solids which are the common indicators of polluted waters. Total dissolved solids ranged from 31.32±0.75 to 34.45±0.81 mg/L (n=3) as shown in Table 2. These values obtained for TDS in all the sampling points were lower than WHO standard of 2000 mg/l for the discharged of wastewater into surface water (Akan et al. 2008).

Table 2: Physicochemical parameters of water samples of Misurata city

Channel	**Sample number**	**At distance (m)**	**At depth (cm)**	T °C	pH	EC (mS/cm^3**)**	TDS (mg/l**)**
Jannat	1	10	30	14.6±0.75	7.49±0.85	53±1.8	34.45±0.81
	2	40	30	13.5±0.81	7.57±0.75	50.43±2.1	32.78±1.1
	3	70	30	13.0±0.65	7.58±0.55	50.02±1.7	32.51±0.95
	4	100	30	13.4±0.55	7.54±0.45	49.20±1.5	31.98±0.88
	5	130	30	13.1±0.85	7.56±0.35	49.01±1.3	31.86±0.36
Yadar	1	10	30	17.6±0.98	7.67±0.55	52.79±2.5	34.31±0.75
	2	40	30	14.6±0.45	7.63±0.56	51.97±0.95	33.78±1.5
	3	70	30	14.1±0.35	7.45±0.55	51.56±0.85	33.51±1.2
	4	100	30	13.9±0.28	7.39±0.35	48.79±1.2	31.71±0.97
	5	130	30	13.8±0.66	7.50±0.45	48.18±1.1	31.32±0.75

REFERENCES

[1] Akan, J.C., Abdulrahman, F.I., Dimari, G.A. and Ogugbuaja, V.O. (2008). Physicochemical Determination of Pollutants in Wastewater and Vegetable Samples along the Jakara Wastewater Channel in Kano Metropolis, Kano State, Nigeria, European Journal of Scientific Research 23: 122-133.

[2] APHA, (1992). Standard Methods of Examination of Water and Waste Water, 18th edition, USA.

[3] Boutwell Jr., J. H. (1957). Direct nesslerization of blood and urine filtrates in the determination of urea (as ammonia), Clinical Chemistry, 3: 4205-4216.

[4] DAWF and WRC. (1995). South Africa Water Quality Guideline 1: Domestic water use (2nd edn) department of water affairs and forestry, Pretoria.

[5] DWAF. (1996). South Africa Water Quality Guidelines. 7: Aquatic Ecosystems (1st Edn) department of water affairs and forestry, Pretoria.

[6] Hora, F. D. and Webber, P. J. (1960). A source of serious error in the determination of nitrates by the phenoldisulphonic acid method and its remedy, Analyst, 85:567-569.

[7] Jain and Jain. (2007). Engineering Chemistry, 15th edition, Dhanapat Rai Publishing Company, New Delhi.

[8] Jayalakshmi, V., Lakshmi, N. and Charya, M.A. S. (2011). Assessment of Physico-Chemical Parameters of Water and Waste Waters in and Around Vijayawada, International Journal of Research in Pharmaceutical and Biomedical Sciences, 2: 1041-1046.

[9] Kumar, B. S. M., Srikanth, T. R. and Balasubramanian, N. (1993). Spectrophotometric determination of nitrogen dioxide in air, Fresenius J. Anal. Chem. 345: 592-594.

[10] Michalski, R. and Kurzyca, I. (2006). Determination of nitrogen species (nitrate, nitrite and ammonia ions) in environmental samples by ion chromatography, Pol. J. of Environ. Stud. 15: 5-18.

[11] Morrison, G. O., Fatoki, O. S. and Ekberg, A. (2001). Assessment of the impact of point source pollution from the Keiskammahoek sewage treatment plant on the keiskamma river, Water SA. 27:475-480.

[12] Pelezar, M. J., Reid, R. D. Chem, E. C. S. and Kreig, N. R. (1986). Microbiology 5th edition, Mc-Graw Hill Publication, New Delhi.

[13] Rani, F. H. and Thatcher, L. L. (1992). Methods for collection and analysis of water samples, U.S Govt. Office, Washington, USA.

[14] U.S. (1997). EPA: Integrated Risk Information System (IRIS), data base access. U.S. Environmental Protection Agency.

[15] Walna, B., Kurzyca, I. and Siepak, J. (2004). Local effects of pollution on the chemical composition of Precipitation in Areas Differing in the Human Impact, Pol. J. Environ. Stud. 13:36-42.