Ecotoxicological effect assessment of untreated waste water using Physico-Chemical Parameters

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Abstract— The Present study was aimed to estimate the impact of untreated waste water urban pollution on the immediate environment and the ecology of the receiving water bodies by using some major physicochemical parameters. During the study water samples from six locations represented as site one up to site six, were collected and analyzed for the selected physicochemical properties such as phosphate, nitrate-nitrogen, total dissolved solids(TDS),total suspended solids(TSS), Sulphide(S^{-2}), turbidity(Tu), Acidity or Basicity(pH), electrical conductivity(ECw), Biollogical oxygen demand(BOD_5), temperature(T^0), and selected heavy metals such as Chromium (Cr), Lead (Pb), Cadmium (Cd), Zinc (Zn), and Copper (Cu). Sampling stations included on pools, muddy bottoms and vegetative banks of the storm canal between 0 and1.5m depth along the canal and in the Blue Nile River stream crossing the city. The data were composed spatially from site1 up to site 6 and temporally represented as season one up to season four. The collected date subjected to statistical analysis to assess the level of pollution and exotoxicological condition of the environment. Most of the studied physicochemical parameters had significant deviation from the the provisional discharge limit at sampled sites. The level of physicochemical parameters shown a deteriorated water quality and the possible reason for this could be eutrophication resulting from agricultural practices in the nearby catchment area, industrial practices in the city, and domestic activity. To improve the present ecological conditions, in major, an appropriate disposal of municipal wastes is primarily recommended to safeguard the environment from substantial loads of pollutants and toxic substance.

Keywords —Biomonitering; Biochemical oxygen demand, Physicochemical, pollution, wastewater; pollutants;

INTRODUCTION

Municipal wastewater is a matrix consisting of raw sewage composed of micro-organisms, biodegradable organic materials and compounds, metals and other inorganic materials [1]. The removal of impurities present in wastewater in the form of suspended solids, organic substances, and nutrients and removal of pathogens are some of the basic purposes of wastewater treatment [11, 12, 13 and 16]. The discharges of waste water from industry, domestic and agriculture can cause an impact on ecology of the environment and toxicate the normal conditions in rivers and coastal waters [16]. Therefore, to protect the public health by safeguarding against the spread of pathogenic diseases, removing or intoxicating the toxic compounds this study is nececerly important [13].

Chemical parameters associated with the organic content of wastewater include the biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), and total oxygen demand (TOD) [23, 25 and 28]. Inorganic chemical parameters of wastewater are salinity, hardness, pH, acidity, alkalinity, composition of ions (iron, manganese, chlorides, sulfates, sulfides), heavy metals (mercury, lead, chromium, copper, and zinc), and nitrogen (organic ammonia, nitrite, and nitrate) [2, 3, 7]. Bacteriological parameters include coli forms, specific pathogens, and viruses [1, 17]. Therefore, understanding the untreated wastewater content is important to know the type of contaminants present in the discharges of untreated waste water [15, 16]. Environmental pollution is an inevitable consequence of economic development and as people's desire increas to improve their quality of life [13, 21]. Water quality detoraration is one of the potential environmental problems caused by the discharge of untreated municipal wastewater [16, 18]. And, ususaly untreated wastewater contain contaminants such as nutrients mainly nitrogen and phosphorus that can stimulate the growth of aquatic plants, which in turn results in eutrophication problem in rivers and coastal waters [11, 15].

Treatment of wastewater is important to prevent pollution of the environment and water bodies. Since, the health of aquatic ecology is essential for the health of humans, animals, and plants [1, 10, 13, and 34]. But, natural and anthropogenic factors; such as agricultural runoff, urbanization, industrialization, population increments are affecting negatively the health of aquatic environments [2, 14]. On the river ecosystem of the study area, the introduction of nutrients mainly nitrogen and phosphorus and potentially hazardous levels of trace metals were observed due to untreated municipal waste discharge [3, 21, and 36]. Generally, in many parts of the world an eutrophication problem in rivers and coastal waters are very common due to nutrient contamination [5, 7, and 30]. The nutrients nitrogen and phosphorus from agricultural runoff can stimulate the growth of aquatic plants, which in turn results in eutrophication problem [4, 20, and 31].

Threre are few researchs that has been conducted in Ethiopian rivers, lakes, ponds and other water bodies. However, information related to ecotoxicological assessment of physicochemical parameters of untreated waste water is very less. Therefore, this study aimed to fill the gap and to determine the ecotoxicological impact of untreated municipal waste water by assessing the level of selected physicochemical parameters.

1.1 Objective

The objective of this study was to assess the ecotoxicological fate of untreated waste water using the selected physico-Chemical prameters on the environment.

1.2 Importance of the study

The Blue Nile River (BNR) supports the life of many people whose livelihood dependent on the river; for domestic use, livestock, fishing and irrigations [21, 27, and 36]. Therefore an assessment of ecological health status and reviewing the impact of unteated waste water which joins the water body along the storm canal is important. These imformations will enable stalkholders to take an action for providing safe water for the community in the area and beyond them. As to Esayas E. and Mesfin B, 2017, work revealed that monitoring water quality by using macroinvertabrate on the Blue Nile River is need based for all Nile basin countries. Their findings figured out Nile River water rehabilitation and how to increase quality of the river water. Based on this and other related studies there were a study gap observed on ecotoxicological status of the present study areas. Therfore, this study is held on ecotoxicological effect of waste water using the physico-Chemical prameters. The study gives advanced base line information to alleviate the problems for stakhlders. Moreover, it is undeniable fact that to keep water quality; certain physical, chemical, and biological a characteristic of water has to be at standard level [13, 21, 29, 30 and 33].

2 MATERIAL AND METHODS

2.1 Descriptions of the study area

The study was conducted at Bahir Dar; the capital city of Amhara region. The study area starts from the Gudo Bahir, which is situated at western part of the city and ends at the eastern part by joining to the Abay (Blue Nile River). The storm canal covers about 90% of the municipal wastes of the city. Bahir Dar city is situated on the southern shore of Lake Tana at latitude of 110 35′N and longitude of 370 23′E. It is a rapidly expanding city. Shops, small industries and residences are present in all parts of the city. People in this area collect their excreta and domestic wastes using dry pit latrine. Most of the houses especially old residential houses found in the city are not sewered [21, 36]. Elevation in the area ranges from 1800 m.a.s.l in Sebatamit to 1917 m.a.s.l in Zenzelma. However, most of the city stretches over a predominantly flat land with imperceptible slope changes except for small rises in its eastern and western peripheries. The mean annual rainfall in Bahir Dar reaches about 1384 mm [21]. There is a considerable seasonal variation of this rainfall in which the highest is recorded in the summer 'kiremt'. The average temperature of the city was found in the range of 17 ^{0}C and 23 ^{0}C [21].

2.2 Sampling sites

The storm canal of the municipal waste water network serves also as the storm water sewer in the Bahir Dar city. According to the field studies and surveys conducted along a municipal wastewater canal in the study area, the areas are potentially polluted with high number of effluents (their exposure to municipal discharges). These sites were selected as study sites. Out of of the seven sampling sites were selected the last two sites were pooled in to one and the sites become sx in total (**Fig. 2.4.1**). At every sampling site the samples were collected from all possible microhabitats are pooled into single sample to undertake analyses. To maintain the consistency of sampling effort, a sample was generally obtained within one hour at each site and 20 minutes travel to the laboratory for every site, on a replication of three [19, 20]. And soon or later all the samples collected were analyzed following standard laboratory procedures [8, 9].
As mensioned in Esayas E and Mesfin B. 2017, from the sampling sites technically physicochemical parameters sampling were taken in separately; and in this paper only physicochemical data are publeshed. Water sampling protocol was based on the Rapid Bioassessment Protocols for use in streams and rivers or fresh water in general [6, 37].

2.3. The physicochemical measurements

The physicochemical parameters assessed were total dissolved solids (TDS) (mg/L), PH, Temperature (°C), Electrical conductivity (EC) (µs/cm), Nitrate-nitrogen (NO_3−N), (mg/L) and phosphate (PO_4^{3}−P) (mg/L) Sulphide, S^{-2} Turbidity, (NTU) BOD_5 (dg/L), and water smell. Total dissolved solids, pH, Temperature, turbidity, and water smell were measured *in situ* according to standard methods using hand instruments [23, 37]. Temperature was measured using Thermometer in ^{o}C. The power key of TDS meter was switched on, and the meter was also temperature adjusted; the instrument was calibrated to give a value of 14.7µS/m at room temperature. The probe was dipped below the surface of the wastewater and surface water. The key was then changed to TDS key and recorded. Time was allowed for the reading to be stabilized and reading was recorded. Turbidity was measured by turbid meter. Water smell tested through observation and on its smell, weather the wastewater had an objection to the noise or not and PH was measured by PH meter calibrated 1-14. For each of these five physicochemical parameters the data were registered at each sampling site
Before measuring and registering every data, cheek ups and calibration of the needed instruments were done. For the rest, inorganic substances and nutrients such as ECw, NO3−N, PO43−P, Sulphide, and BOD_5 for analysis, water samples were collected using clean polyethylene containers, chilled, and transported to laboratory within 24hr this was recommended time APHA [23, 37].
ECw were measured at 25 °C with electronic devices; and BOD5 was determined with the 5-day BOD5 test at 20 °C. NO_3−N was determined in filtered samples with the salicylic acid method and spectrophotometer analysis and PO_4^{3}−P was determined by oxidation of filtered samples using the same method. The tested samples were filtered in the laboratory through pre-rinsed 0.45 micrometer cellulose acetate filters, and filtrates were used to determine concentrations in mg l_1 of NO_3−N, and PO_4^{3}−P by spectrophotometers [23, 37]. The number of replication per parameter measures were three. Totally 12 data per parameter measures were used for each and individual physcico-chemical parameters.

2.4. Data Analysis

The data was analyzed using Statistical Analysis System (SAS). One-way ANOVA was computed for significant difference between the sample sites for the physico-chemical parameters [14].

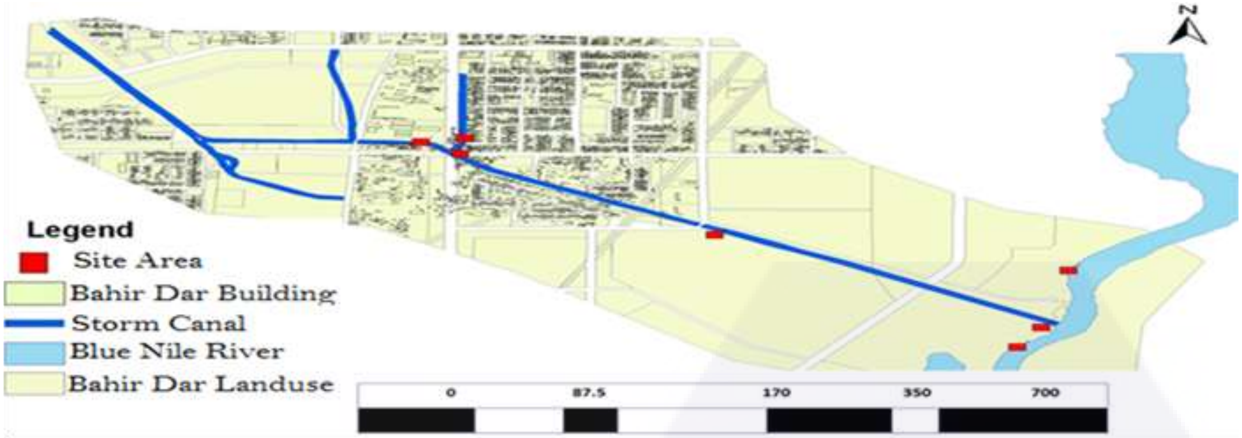

Figure 2.4.1 the study area; GIS map of Bahir Dar city [36]

3. RESULTS

3.1 Physico-Chemical Parameters

Concentration of PO_4^{3-} and NO_3^-: The maximum phosphate Concentration was recorded at site 2 (4.10± .00 mg/L), where as the minimum concentration was from site 6 (0.15± .01 mg/L) as shown in Table 2.4.2. The records of Statistical analysis (ANOVA) showed that phosphate concentratiton at site 2 was significantly higher than the phosphate concentrations recorded from other study sites of Bahir Dar city municipal wastewater; this was proven at different seasons (Table2.4.1). The maximum average nitrate-nitrogen concentration (1.09±.44 mg/L) was recorded at site 2. The minimum concentration recorded at site 6 (0.20 ± 01 mg/L). There was a significant difference between the mean nitrate-nitrogen concentrations of the study sites in all season.

Concentration of S^{2-} and TDS: The maximum sulphide concentration mean value was within ranges (0.01 ±.00 up to 0.16 ±2.1) as shown in Table 2. The highest mean value was found at site 1 while the lowest mean concentration was found at site 3. This was ture for all four study seasons.

The mean concentration of total dissolved solids (TDS) ranged 103.9 ± 2.9 up to 892.7±2.5 mg/l as shown in Table 2.4.2. The highest mean concentration (892.7±2.5 mg/l) was recorded at site 2 and the lowest (103.9 ± 2.9 mg/l) at site 4.

The maximum average ECw was recorded at site 3 (1175.6 ± 5.0 μs/cm).The lowest ECw was recorded at site 4 (172.8 ±7.2 μs/cm). The mean ECw measures of site 3 were significantly higher than the ECw measures of the rest of the sample sites as shown in Table 2.4.1 and 2.4.2.

Concentration of ECw and turbidity: The mean turbidity values at each six sampling sites of Bahir Dar city downstream ranged from 15.2 ± 0.5 up to 28.0±1.6 NTU. The maximum turbidity value was recorded at site 3 where the wastewater loses its transparency than the other sites (Table 2.4.1 and 2.4.2).

The maximum concentration of BOD_5 was recorded at site 3 (3.47 ±.29 dg/l) and the minimum value was recorded at site 6 near tannery (1.36 ±.35) (Table 2.4.2). The average temperature measures was ranged from its higest (23.5 ±.41 ^{0}C) at site 1 to its lowest (23.3 ±.3 0C) at site **6.** There was no significant difference among the studied sites and at the study seasons.

BOD5, pH and T^0: The mean pH concentration along a storm canal of Bahir Dar city downstream ranged from 5.96 ±.0.35 up to 7.60± .06 as shown in Table 2.4.1 and 2.4.2. The highest mean pH measurement was recorded at site 4 (7.60± .06) where as the lowest measurement was at site 3 (5.96 ± 0.35). High neutrality in pH was found at site 6 (7.16± 0.54).

Concentration of heavy metals: Chromium (Cr),

TABLE 2.4.1 COMPARISION OF *THE MEAN VALUE OF EACH PHYSICO-CHEMICAL PARAMETERS MEASURED AT FOUR STUDY SEASONS*

Parameters	Seasons			
	1	2	3	4
pH	6.79±0.30	6.76±0.34	6.82± 0.43	6.15±0.3
ECw	592.38	478.08	506.64	512.77
DO	6.91±0.71	3.51±0.65	6.80 ±0.17	6.90±0.6
PO_4^{3-}	1.69±0.02	4.78±0.04	3.14±0.01	2.11±0.0
NO_3,	0.74±0.03	1.42±0.02	0.99±0.04	0.69±0.0
Cr	0.07±0.01	0.05±0.02	0.07± 0.01	0.07±0.7
Pb	0.25±0.11	0.16±0.66	0.34±0.33	0.04±0.3
Cd	0.03±0.01	0.03±0.06	0.06±0.03	0.02±0.0
Zn	0.07±0.02	0.05±0.15	0.06±0.11	0.70±0.0
Cu	0.06±0.03	0.05±0.06	0.05±0.02	0.02±0.1
TDS	306.63±0.02	404.10±0.02	238.86±0.02	401.38±0.0
TSS	254.70±1.80	1245.00±18.3	1247.90±18.30	1249±18.3
S^{2-}	0.03±0.01	0.026±0.01	0.13±0.01	0.07±0.02
Tu	32.63	41.21	14.22	14.23
BOD_5	2.32± 0.53	2.48± 0.33	2.65± 0.38	2.62± 0.39
T	23.50±0.33	23.25±0.01	23.36±0.10	23.53± 0.3

KEY: Are given on Table 2.4.2.

Lead (Pb), Cadmium (Cd), Zinc (Zn); and Copper (Cu); Heavy metals are not usually eliminated from aquatic systems by any known means; therefore, the above heavy metals were observed and measured in the study sites.

The mean concentration of Cr, Pb and Cd was (0.01± 0.00-0.24 ± 0.06), (0.02±0-0.10±0.03 mg/l) and (0.02±0-0.04±0mg/l, respectively. Which is below the provisional discharge limit values (1mg/l) listed in FEPA 2005, however, most of these heavy metals toxicity is according to their mobility and chemical forms in water [19]. Their availability or exceeded concentration may cause an adverse toxic effect on Human health and the eco-system discharge limits set by the federal Environmental Protection Authority [21, 22].

acceptable provisional discharge limit values [21]. But, Cu is toxic to aquatic plants at concentrations even below 1.0 mg/l and also a concentration near to this level can be toxic to some fishes. Therefore, the heavy metals concentration fate in the study areas shows that the presence of heavy metals will have a chance to toxicate aquatic lifes (plants, animals). The TSS levels in a range from (254.67±1.81- 1245.01±10.30mg/l) which is higher than the provisional limit values.

TABLE 2.4.2 THE MEAN VALUE OF EACH PHYSICO-CHEMICAL PARAMETERS MEASURED AT THE SIX STUDY SITES

Parameter	*Site 1*	*Site 2*	*Site 3*	*Site 4*	*Site 5*	*Site 6*
pH	6.47±0.54	6.10±0.54	5.96± 0.35	7.60±0.06	6.50±1.43	7.16±0.54
ECw	1030.50±1.70	403.00±4.41	1175.60±5.01	172.80±7.22	176.30±5.20	176.30±4.90
DO	6.91±0.71	3.51±0.65	6.80±0.17	6.90±0.67	7.01±0.70	5.10±0.80
PO_4^{3-}	2.05±1.13	4.10±.00	0.70±1.48	0.79±0.07	0.80±0.08	0.15±0.01
NO_3	0.52±0.31	1.09±0.44	0.52±0.20	0.51±0.07	0.50±0.07	0 .20±0.01
Cr	0.18± 0.03	0.11± 0.03	0.22 ± 0.06	0.24 ± 0.06	0.01± 0.00	0.21 ± 0.11
Pb	0.20 ± 0.11	0.07 ± 0.06	0.04 ± 0.03	0.04 ± 0.03	0.50 ± 0.11	0.04 ± 0.03
Cd	0.04±0.02	0.05±0.01	0.14±0.03	0.15±0.05	0.01± 0.00	0.14± 0.04
Zn	0.07± 0.33	0.05 ± 0.02	0.34 ± 0.11	0.66 ± 0.16	0.01 ± 0.00	0.03±0.02
Cu	0.06±0.03	0.07± 0.01	0.07 ± 0.02	0.05 ± 0.02	0.03± 0.01	0.05± 0.16
TDS	413.10±2.70	892.70±2.50	407.10±0.62	103.90±2.90	105.30±2.90	104.20±2.90
TSS	1245.01±10.3	1254±18.39	1251.70±18.3	1245.69±10.3	1245.22±15.3	1245±10.30
S^{2-}	0.16±2.10	0.02±0.10	0.01±0.00	0.03±0.01	0.10±0.15	0.07±0.05
Tu	27.60±3.70	15.20±0.50	28.01±1.60	26.50±1.50	27.90±1.60	28.01±1.60
BOD_5	3.42±0.68	3.17±0.29	3.47±0.29	1.91±0.25	1.78±0.39	1.36±0.35
T	23.50 ±0.41	23.35±0.30	23.40±0.29	23.40 ±0.05	23.40±0.29	23.30±0.30

KEY: Physico–chemical properties estimation methods and measurement units: pH (scale 1-14), ECw (µ Siemens cm-1): (BOD5, DO; PO_4^{3-}, and NO3-, (mg.L-1) T (0C), and heavy metals (Cr, Pb, Cd, Zn, Cu) mg/l, on TDS (ppm), TSS (ppm), while as pH by pH meter, Electric Conductivity by Conductivity Meter, Nitrates by Phenol sulfonic method, Dissolved Oxygen by Winkler's method, Total Dissolved solids by Gravimetric method, and Cr, Pb, Cd, Zn, and Cu or the Heavy metals measured atomic absorption spectrophotometer [38]

Zn and Cu concentration are 0.01 ± 0.00-0.66 ± 0.16 and 0.07 ± 0.02-0.03± 0.01mg/l respectively and these ranges are in an

4. DISCUSSION

In this study, the maximum PO_4^{3-}, phosphate concentration was recorded at site 2. Both WHO and World Bank Group in different years often suggested the limit value of PO_4^{3-} should be less than 1mg/l to keep drinking water and other water body to keep from eutrophication. But in the present study at site 1 and site 2 the value was by far higher than the recommended value (Table 2.4.2.). This indicates that the level of phosphate contamination at municipal wastewater of Bahir Dar city was relatively significant indicating that disposal of phosphate from domestic and industrial sewage as a washing powder, intensive rearing of livestock and the use of phosphate containing particles is very high. The pattern of NO_3^- in the downstream sites showed a general decline from site 3 to site 6. According to (World Bank, 2006), the processed waste water limit value for NO_3^- was 50 mg/L.

The concentration of NO_3^- in all the studied sites was below the limit value. This is an indication of lack of oxidation due to absence of nitrogen fixing bacteria that can convert ammonia into nitrite. But in the present study at site 1 and site 2 the value was by far higher than the recommended value (Table 2.4.1).

Generally, the concentration of most heavy metals showed elevation at many study sites than their provisional limit values [21, 35]. This is indicats the impact is increasing due to the industrial waste effluents on the study sites. Therefore, the fate shows that the presence of heavy metals in the study sites will be have given a chance of being toxic to aquatic life (plants, animals).This indicates that the level of phosphate contamination at municipal wastewater of Bahir Dar city was relatively significant indicating that disposal of phosphate from domestic and industrial sewage as a washing powder, intensive rearing of livestock and the use of phosphate containing particles is very high. This causes eutrophication effect in drinking water and the nearby water body in the area.

Hydrogen sulphide is formed under conditions of deficient oxygen in the presence of organic materials and sulphate [13, 25 and 39]. This could be a possible reason for the sulphide measured in the effluents analyzed. Sulphide concentrations determined were lower than the discharge limits set by the Environmental Protection authority [13]. Similar study was done by (Zinabu and Zerihun, 2002) on the effluents showed the mean value of S^{2-} lower than the limit value. In this study also the mean value scored showed that the S^{2-} contamination was insignificant to affect the biodiversity of municipal wastewater of Bahir Dar city. Among the sites studied, the average TDS recorded was significantly different at site 2 than the rest of the sites. In general high mean value of TDS scored at site 2 could be due to the sediment deposits including materials such as eroded soil, leaves, and twigs was reported [24, 36].

ECw is a measure of waters ability to conduct an electrical current through dissolved ions. These ions include sodium, calcium, potassium, magnesium, iron, aluminum, chloride, sulfide, carbonate and bicarbonate [12, 15]. According to the WHO 2005 standard for turbidity, the limit should apply for Rivers and other drinking waters are 5 NTU. The maximum turbidity value scored where the water body loses its transparency. In this study a turbidity mean value scored (15.2 ± 0.5 up to 28 ± 1.6) was higher than the standard limit. This high turbidity value is due to the site is normally deprived off vegetation cover during sampling periods and the lack of vegetation cover in such site make the soil susceptible to wind and water erosion . Similar trends of high turbidity value in Awash River due to wind and water erosion was observed [13, 24].

Among sites studied, the mean pH values of site 3 (5.96 ±0.35) and site 4 (7.60± .06) were significantly different than the pH values of the rest of the sample sites. The average pH values in most rivers in Addis Ababa is 7.39 which is 6.06 in Kebena river and 7.5 in little Akaki river and the mean average pH value of river Beressa lied ranges mean 7.05 to 8.5 similarly with rivers in Addis Ababa, except effluents of the hot water from the industrial process near the river discharged [19, 27]. The High values of pH are associated with water points that receive wastes from human activities; the lower value is due to acidic wastes discharged. Accordingly this study showed that the range found was no significant effect on the overall biodiversity. The range is safe according to the standard stated by WHO for dirking water or irrigation. But at low pH (<6.5) the stream can poison Biodiversity. Accordingly in this study site 2 and site 3 the mean value of pH scored (< 6.5) and the stream biodiversity were in susceptible to the poison.

If effluent with high BOD_5 levels is discharged into a stream or river, it will accelerate bacterial growth in the river and consume the oxygen levels in the river. The oxygen may diminish to levels that are lethal for most fish and many aquatic insects. As the river re-aerates due to atmospheric mixing and as algal photosynthesis adds oxygen to the water, the oxygen levels slowly increase downstream. In this study at all the sites and the BOD_5 level was significantly abovethe standard [13, 28, 31, and 34]. According to (Wetzel *et, al.*, 2001) the increased concentration of water parameters like pH and conductivity, and high organic input, and thus low dissolved oxygen concentrations were due to bacterial respiration. The average temperature measures of Bahir Dar city was ranged from its highest (23.5 ±.41 ^{0}C) to its lowest, hence, regarding tempreture there was no significant difference among the studied sites and at the study seasons.

5. Conculusion

The present study indicated significant pollution of municipal waste water by ortho-phosphate, nitrate-nitrogen, TDS, BOD_5, electrical conductivity and turbidity among the sites. The high nitrogen level would be harmful to the immediate environment and the receiving water bodies, since it stimulates eutrophication. High phosphate also has poisoning potential for aquatic life. According to (WHO; 2006), there are major phosphate contaminations in rivers. For sustainable management of municipal wastewater, environmental protection agencies at different levels and other concerned administrative and/or nongovernmental bodies should take strict as well as technical measures. Enforcement of law and propagating environmental education to the community with special target will be suggested.

Based on this it is recommended that for sustainable management of municipal wastewater, environmental protection agencies at different levels and other concerned administrative and/or nongovernmental bodies should take firmed action as well as technical measures. To achieve these goals the following points could be considered.

- It should be an urgent pre requisite to require Wetland construction; at discharging sites of waste water into Blue Nile River for the benefit of environemtal contaminsnts phytoremedation.

- The disposal of any kind of wastes should include proper design elements and meet local standards on pollutant discharge limits of effluent set by Federal Environmental Quality Standards of Ethiopia in, 2005.

- The infrastructure of wastewater canal in regulating the effectiveness of a constructed wetland and site-specific conditions of domestic wastewater treatment should be redesigned.

- Public awerness: as it was observed that some people use the river water for domestic purposes, drinking for cattle and for irrigation so the local communities should be aware of the pollutants to keep the river from being susceptible for chemicals and toxic substances gradually.

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7. Conflict of Interests

The author has not declared any conflict of interests

REFERENCES

[1] Canter, L.W. (2000). Sources and Characteristics, in Wastewater A Treatment, ed. by Liu D. H.F., Liptak B., G., CRC Press LLC, New York.

[2] Antonious GF .(2015). Decontamination of pesticide residues for sustainable agriculture. JSM Environ Sci and Ecology 3: 1014

[3] Walsh, C.J. (2000). Urban impacts on the ecology of receiving waters: a framework for assessment, conservation and restoration. Hydrobiologia, 431(2), pp.107-114.

[4] Artemiadou, V. & Lazaridou, M. (2005). Evaluation Score and Interpretation Index for the ecological quality of running waters in Central and Northern Hellas. *Environmental Monitoring and Assessment*, 10, 1–40

[5] Belmar, O.; Velasco, J.; Martínez-Capel, F. & Marín, A.A. (2010). Natural flow regime, degree of alteration and environmental flows in the Mula stream (Segura River basin, SE Spain). *Limnetica*, 29(2), 353-368.

[6] Benejam, L.; Angermeier, P.L.; Munné, A. & García-Berthou, E. (2010). Assessing effects of water abstraction on fish assemblages in Mediterranean streams. *Freshwater Biology*, 55: 628-642.

[7] Blasco, J.; Sáenz, V. & Gómez-Parra, A. (2000). Heavy metal fluxes at the sediment-water interface of three coastal ecosystems from south-west of the Iberian Peninsula. *Science of the Total Environment*, 247, 189-199.

[8] Bonada, N.; Dallas, H.; Rieradevall, M.; Prat, N. & Day, J. (2006a). A comparison of rapid protocols used in 2 regions with Mediterranean climates, the Iberian Peninsula and South Africa. *Journal of the North American Benthological Society*, 25(2), 487–500.

[9] Bonada, N.; Prat, N.; Resh, V.H. & Statzner, B. (2006b). Devolopments in aquatic insect biomonitoring: A Comparative Analysis of Recent Approaches. *Annual Reviews of Entomology*, 51, 495– 523.

[10] Beasley V. (2009). One toxicology ecosystem health and one health. Vet Italy 45: 97-110.

[11] Council of the European Communities (2000). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. *Official Journal of the European Communities,* L327, 1-72.

[12] USEPA (US Environmental Protection Agency). (2014). Office of the Chief Financial Officer (2710A) Publication Number: EPA-190-S-14-001.

[13] WHO (World Health Organization). (2005). Children's health and the Environment. A global perspective, a Resource manual for the health sector, Edited by Pronczuk, J.G.

[14] SAS Institute. (2003). SAS/STAT Guide, Release 0.03 Edition, SAS Inc., SAS Campus Drive, Cary, NC 27513, USA

[15] Wetzel, R.G.; Likens, T. H.; Richoux, P.; Bournaud, M. and Usseglio-Polatera G.E. (2000). Limnological Analyses, third ed. Springer, New York.

[16] Metcalf, k. and Eddy, Inc. (2003). Wastewater Engineering Treatment and a Reuse. Germany.

[17] Metcalf, W. and Eddy, P. (2003). Wastewater Engineering: Treatment and Reuse. 4th ed. Mc Graw-Hill, New York.

[18] Kyambadde, J. (2005). Optimizing Processes for Biological Nitrogen Removal in Nakivub Wetland, Uganda. Royal Institute of Technology, Department of Biotechnology. Doctoral Thesis, Stockholm, Sweden.

[19] Itanna, F., 2002. Metals in leafy vegetables grown in Addis Ababa and toxicology implementations. Ethiopia Journal of Health Development 16, 295–302.

[20] Hassan, S.; Thomas,R.; Shaban,A. And Khawlie M. (2005). Phosphorus and nitrogen in the water of the El-kabir river water shed in Syria and Lebanon lake reservoir,V.10

[21] FEPA (Federal Environmental protection Agency). (2005). Assessment Report on the Status of The Akaki Rivers water pollution Addis Ababa. Ethiopia.

[22] Waite, I.R.; Herlihy, A.T.; Larsen, D.P.; Urquhat, N.S.; Klemm, D.J. (2004). The effects of macroinvertebrate taxonomic resolution in large landscape bioassessments: an example from the Mid-Atlantic Highlands, U.S.A. Freshwater Biol. 49 (4), 474–489.

[23] Wetzel, R.G.; Likens, T. H.; Richoux, P.; Bournaud, M. and Usseglio-Polatera G.E. (2000). Limnological Analyses, third ed. Springer, New York.

[24] Zinabu Gebre-Mariam and Zerihun Desta. (2002).The chemical compostion of the effluentfrom Awassa Textile factory and its effects on aquatic biota. *SINET: Ethiop.J. Sci., 25(2):263-274*

[25] Jarup, L., (2003). Hazards of heavy metal contamination. British Medical Bulletin 68, 167–182

[26] Metcalf, W. and Eddy, P. (2003). Wastewater Engineering: Treatment and Reuse. 4th ed. Mc Graw-Hill, New York.

[27] Worku Legesse; Giller, P.S., and O'halloran,J. (2000). Physicochemical and Biological assessment of the Kebena River, Addis Ababa, Ethiopia. Department of zoology and animal ecology, National University of Ireland, cork

[28] World Bank Group, (2006). Processed waste water limit values for discharges to water bodies.

[29] Whiles, M.R., Brock, B.L., Franzen, A.C. and Dinsmore, S.C. (2000). Stream invertebrate communities, water quality and land-use patterns in an agricultural drainage basin of North Eastern Nebraska, USA. Environmental Management, 26(5): 563-576.

[30] Villegas-Navarro, A., Ramirez, M.Y., Salvador-S, M.S. and Gallardo, J.M. (2001). Determination of Wastewater LC_{50} of the Different Process Stages of the Textile Industry. Ecotoxicology and Environmental Safety, 48:56-61

[31] USEPA. (2005). Use of biological Information to better define designated aquatic life uses in state and tribal water quality standards. EPA 822-R-05-001. Office of water, U.S. Environmental Protection Agency, Washington, D.C.

[32] Shu, L., Wait, T.D., Bliss, P.J., Fane, A., and Jegathessan.V. (2005) .Nanofiltration for the possible reuse of water and recovery of Sodium chloride salt from textile effluent, Desalination, 172.235-243.www.elsevier.com/locate/desal.

[33] Karr, J.R. (2003). Biological integrity and ecological health. In: Fundamentals of Toxicology. Second edition, pp 245-249 (Newman, M.C. and Unger, M.A., eds.). Lewis Publishers, Boca Raton, Florida

[34] Karr, J.R. and Chu, E.W. (2000). Sustaining living rivers. Hydrobiologia 422/423: 1-14

[35] Barbour, M.T., Swietlik, W.F., Jackson, S.K., Courtemach, D.L., Davies, S.P., and Yoder, C.O. (2000). Measuring the attainment of biological integrity in the USA: a critical element of ecological integrity. Hydrobiologia, 422/423: 453-464

[36] Esayas, E. and Mesfin, B. (2017). Environmental impacts assessment of waste water using macro-invertebrate; *International Journal of Scientific & Engineering Research, Volume 8 Issue 6, june 2017, ISSN: 2229-5518.*

[37] APHA. (1998). Standard methods for the examination of water and waste Water. 20th ed. Publisher, Washington. APHA/American Water Works Association /Water Environment Federation.

[38] Singh, K.P., Mohon, D., Sinha, S., Dalwani, R., 2004. Impact assessment of treated/untreated wastewater toxicants discharged by sewage treatment plants on health, agricultural, and environmental quality in wastewater disposal area. Chemosphere 55, 227–255.

[39] WHO (World Health Organization), (1994). Quality Directive of Potable Water, Geneva, second ed., p. 197