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The Effect of *Moringa olifera* on Some Physical and Chemical Parameters of Water and Wastewater

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Abstract: The objective of the current study is to determine the efficiency of the *Moringa olifera* seeds in removing some of the pollutants present in the water where it was taken three sources for the study where he took two exporters of industrial waste water for the factories of sugar and textile located within the boundaries of the province of Babylon and a sample surface water for Shatt Al-Hilla River in province of Babylon too where study the physical and chemical properties of different sources before and after treatment with the solution of *Moringa olifera* seeds powder in different doses (10, 20, 30 mL).

Key words: Chemical and physical parameters, river water, Shatt Al-Hilla River, wastewater, textile and sugar factories, *Moringa olifera* seeds

INTRODUCTION

Water is a very important resource for human lives and it is required by almost every living organism. In pure state, this resource is becoming very limited due to the many anthropogenic means of contamination which arise from the different sources of industrial, commercial and agricultural activities made over the years. Water pollution was becoming one of the most serious problems for all the world. Water pollution has contributed to negative impacts on the human health and environmental (Briggs, 2003).

Early findings of (Crapper *et al*., 1973; Miller *et al*., 1948) showed that the chemical materials were using for water purification can cause serious effects for human lives if an error occurs in their administration during the treatment process, they were finding that a high levels of aluminum in the brain it is caused Alzheimer's disease. However, there was not conclusive evidence linking between aluminum with Alzheimer's (Davis, 2007).

So, we need to use of non-chemical materials for treatment the water which would be available locally in most developing countries. The purification of turbidity for the water by using natural materials is not new idea (Bina *et al*., 2010). Seeds of moring a have been found to be one of the most effective for purification of the water which was used as coagulant material and was compared with aluminum sulphate (alum) (Anonymous, 2002). The high cost, pH alteration and production toxic materials during the treatment have been obtained by using chemical coagulant while MO was made as coagulant material which is biodegradable, non-toxic, low cost and easy to use (Meneghel *et al*., 2013). *Moringa oleifera* is one of the most widespread and rapidly growing plants at low altitudes in the entire tropical belt including arid zones and it can grow in the soil that is having low humidity (Ndabigengesere *et al*., 1995). Most parts of the *Moringa olifera* plant (seeds, roots, barks, leaves and flowers) can be used as food or with medicinal purposes (Anwar *et al*., 2007).

Moringa olifera seeds powder is having coagulating properties, so that, it can be used in several forms at water treatment like turbidity, total dissolved solids, alkalinity and hardness (Arnoldsson *et al*., 2008).

Many studies were made by using the powdered of *Moringa olifera* seeds (MO) as coagulant materials for water and wastewater treatment and it was found the (MO) don't have any side and toxic effects (Nand *et al*., 2012; Shan *et al*., 2017). *Moringa oleifera* can be used as a natural coagulants flocculants alternative to the aluminum and other metallic salts.

The results obtained show that powder from seed kernels of *M. oleifera* contains some coagulating properties at loading doses of 10 g/L and above that have similar effect as the conventional coagulum, alum (Francis and Amos, 2009).

Moringa oleifera presents a turbidity removal efficiency comparable to industrial coagulants and flocculants which points on its utility as a water treatment agent (Sanchez-Martin *et al*., 2012). The cakes of *Moringa olifera* seeds was help to remove the solid particles and some fungi and bacteria (Eman *et al*., 2014). The seeds cake of *moringa olifera* were having adsorption properties for heavy metals elements (Ndibewu *et al*., 2011; Meneghel *et al*., 2013). This study was aimed to investigate different properties of water quality (pH, Tur, DO, TDS, salinity, conductivity, chloride, nitrate and sulphate) using different doses of *Moringa olifera* seeds solution (10, 20 and 30 mg/L) on the water and wastewater samples.

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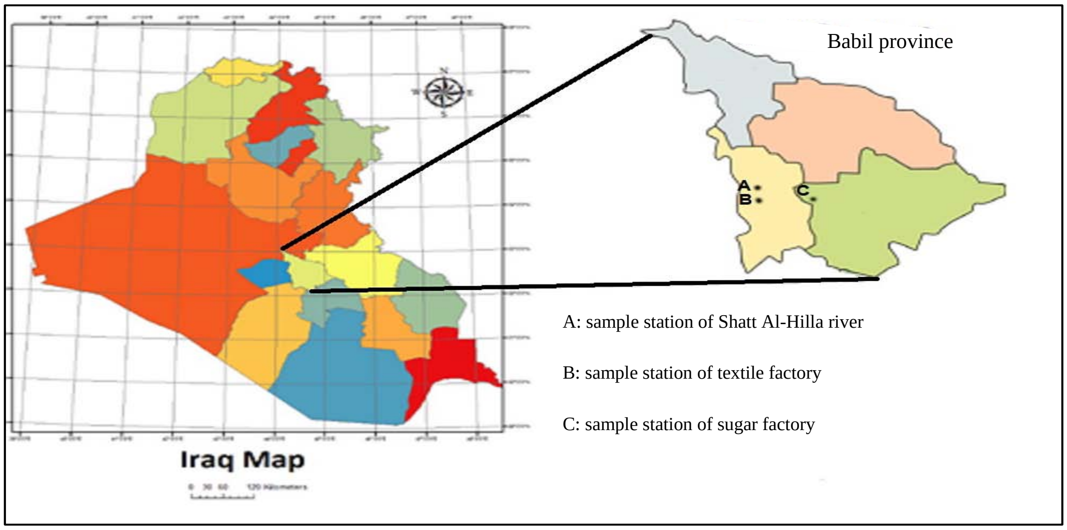

Fig. 1: The study area was showing the sampling points

MATERIALS AND METHODS

Sampling location: The water and industrial wastewater samples for this study were collected from three different sites which are “Shatt Al-Hilla River”, textile factory and sugar factory (stations: A, B and C, respectively) where shown in Fig. 1. “Shatt Al-Hilla” River is located at Al-Hilla city, Babylon Province, Iraq at the coordinates (32 29 22.37 N and 44 26 09.70 E). The studying of water quality for “Shatt Al-Hilla” river is considered very significant due to the high volume of the various wastes whether industrial or domestic that have been discharged in this river this leads to a deterioration the quality of river water. The second sample of wastewater in this study were collected from effluent unit of textile factory before treatment which is located at Al-Hilla city at the coordinates (32 26 48.35 N and 44 25 20.72 E) and the third sample was collected from the effluent unit of sugar factory before treatment which is located in Al-Hashimia city at the coordinates (32 22 56.45 N and 44 40 20.38 E). All the water and industrial wastewater samples were collected in (5L) plastic bottles. The plastic bottles were washed with distilled water before sampling and transporting them to the laboratory.

Preparation of *Moringa olifera* seeds solution: The seeds were dried at 40°C for two days, after which the external shell of the seeds was removed by the knife and after that the seeds were milled then the powder were passing in sieve (2.5 mm) in order to obtain fine powder. This method was adopted using. The fine seed powder was added to distilled water (0.5-5% concentration) which means 0.5-5 g/L. The solution was then passed on a soft filter paper to remove of the insoluble particulate and the leachate solution (10, 20 and 30 mL) were added to 250 mL for each samples.

Physical-chemical measurement: Each of the water and industrial wastewater samples were analyzed for eight parameters which were ion hydrogen concentration (pH), Electrical conductivity (Ec), Turbidity (Tur.), Total Dissolved Solids (TDS), Chloride (Cl), Nitrate (NO_3) and sulphate (SO_4) using standard procedures recommended by APHA (2003). Chemical analysis (before and after treatment) of the water and industrial wastewater were carried out at the laboratory of ecology collage for Al-Qasim green university.

RESULTS AND DISCUSSION

The results in Table 1 revealed that pH of the wastewater was not dramatically changed after treatment. Concentration of *Moringa oleifera* seeds has not shown any affect on the pH value for treated water. This finding agreed with the published observations (Amagloh and Benang, 2009). The normal pH value for water is in the range 6.5-8.5 (WHO., 2006). Thus, there was no additional step required to adjust the value of pH after treatment. It is suggested that *Moringa oleifera* seeds could be the best choice to the industry for wastewater treatment.

From Table 1, the data recorded was showed that the pH of the station (A) has not been dramatically removed after the treatment with *Moringa oleifera* seeds. Values of pH were lower than 8.5 or more than 6.5. This proved that *Moringa oleifera* seeds is not effecting values of pH in the samples of water and wastewater, agree with the findings of (Ghebremichael *et al*., 2005; Arnoldsson *et al*., 2018; Alo *et al*., 2012). Ndabigengesere *et al*. (1995) was showed that the *moringa olifera* seeds contained the protein components were released the hydroxide l $(OH)^-$ in water which was caused the (pH) value increased.

Table 1: Effect of different the different doses of *Moringa olifera* seed solution on physical-chemical properties at stations (A, B and C)

Sample/characteristics	Removing (%) at dose 10 mL of MO	Removing (%) at dose 20 mL of MO	Removing (%) at dose 30 mL of MO
Shatt Al-Hilla river			
pH	-4.60	-6.83	-7.390
Ec	2.72	11.16	36.740
Tur.	34.40	69.88	83.040
TDS	4.88	15.17	32.450
DO	-4.88	-9.76	26.830
CL	24.56	37.55	45.260
NO_3	33.33	50.00	66.670
SO_4	20.95	37.94	50.200
Textile factory			
pH	-6.94	-6.12	-3.401
Ec	38.90	3.97	2.240
Tur.	87.87	79.63	77.410
TDS	17.92	14.25	11.830
DO	-36.79	-16.05	-9.430
CL	40.77	11.19	4.429
NO_3	51.43	28.57	8.570
SO_4	56.29	30.46	19.420
Sugar factory			
pH	-3.59	-2.62	-0.960
Ec	87.86	77.40	75.230
Tur.	90.99	77.62	69.050
TDS	30.44	19.39	12.350
DO	-83.72	-51.16	-13.960
CL	14.97	14.80	13.940
NO_3	53.85	50.00	38.460
SO_4	45.29	27.63	13.820

Increasing moringa treatments led to reducing in values of conductivity. It can be concluded that higher loading dose other than the once used for Moringa in this research can be adopted to decrease conductivity for the water and industrial wastewater.

On the other side, turbidity has been decreased by using *Moring aoleifera* seeds. This finding agreed with the results of (Suhartini *et al*., 2013). The turbidity removal percentages after the treatment using 10, 20 and 30 mL, respectively, of *Moringa oleifera* seeds solutionwere 34.4, 69.88 and 83.04% for station A and 77.41, 79.63 and 87.87% for station B and 69.05, 77.62 and 90.99% for station C which is mean that best removal of turbidity could be occurred by using high concentration of *Moringa oleifera* seeds.

The values of TDS have been reduced from 758-512 for station A from 1200-545 for station B and 1150-560 for station C after the treatment with the different dose of *Moringa oleifera* seeds solution, TDS result was in agreement with (Meneghel *et al*., 2012) who showed that TDS had decreased after using the *Moringa oleifera* seeds.

DO concentration was significantly increased after using the *Moringa olifera* in treatment, DO value was upgrade to 10.4 mg/L for station A, to 7.5 mg/L for station B and to 7.9 mg/L for station C (Fig. 2-26).

After the treatment with *Moringa oleifera* seeds powder, chloride amount in water was decrease as the doses increases. This is explained by the presence of existing cations from *Moringa oleifera* seed powder which attract the negative chloride ions present in the

Fig. 2: *Moringa olifera* seeds

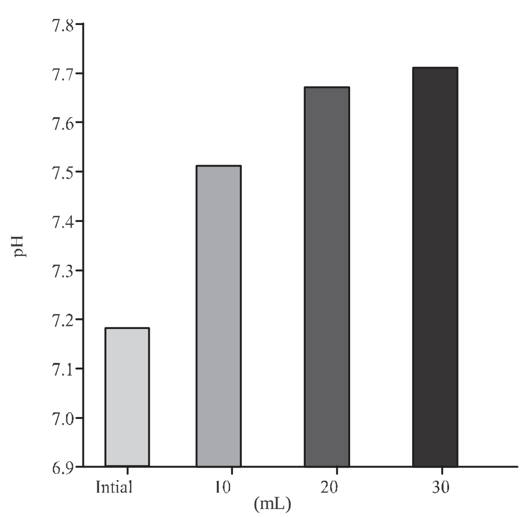

Fig. 3: Ion hydrogen value of Shatt Al-Hilla river

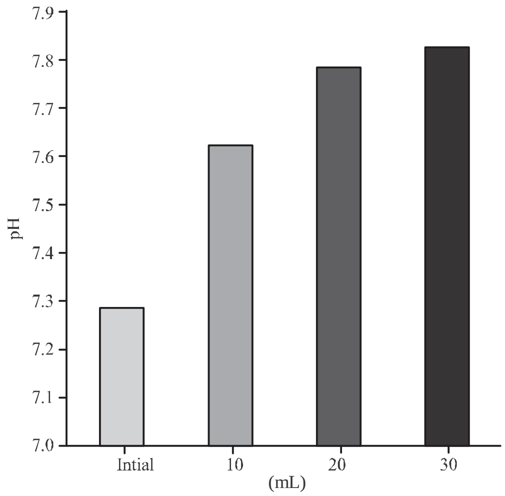

Fig. 4: Ion hydrogen value of textile

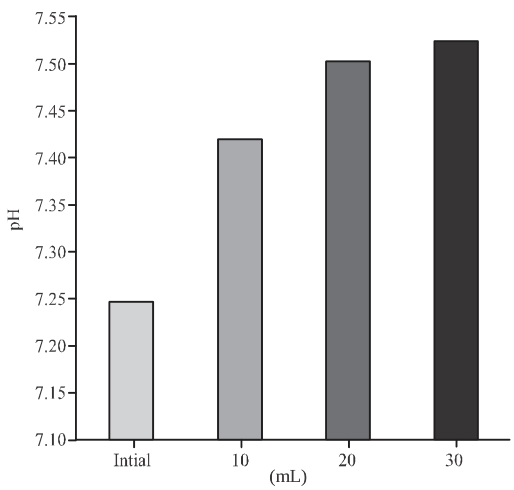

Fig. 5: Ion hydrogen value of sugar factory

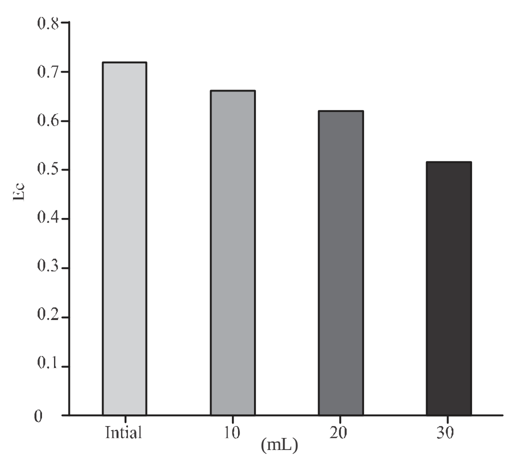

Fig. 6: Electrical conductivity value of Shatt Al-Hilla river

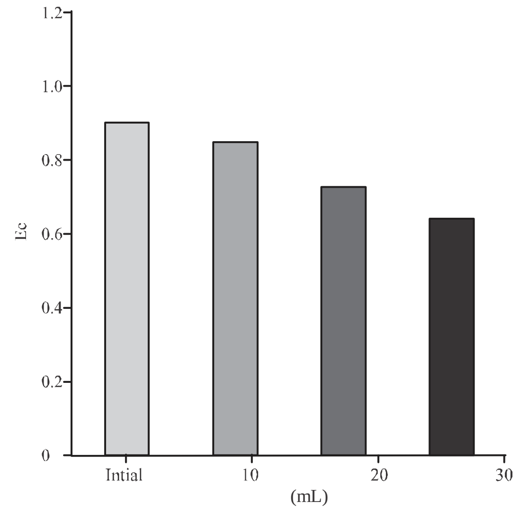

Fig. 7: Electrical conductivity value of textile factory

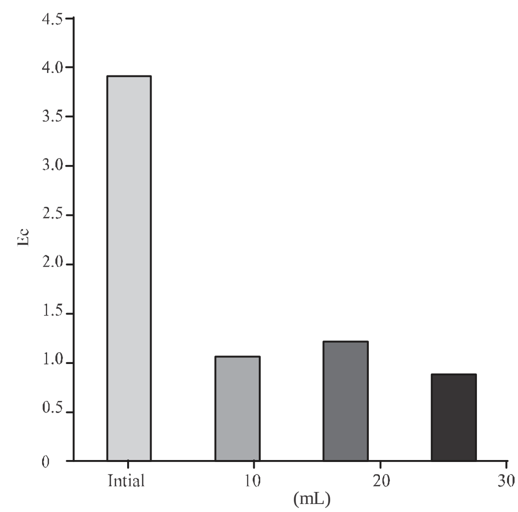

Fig. 8: Electrical conductivity value of sugar factory

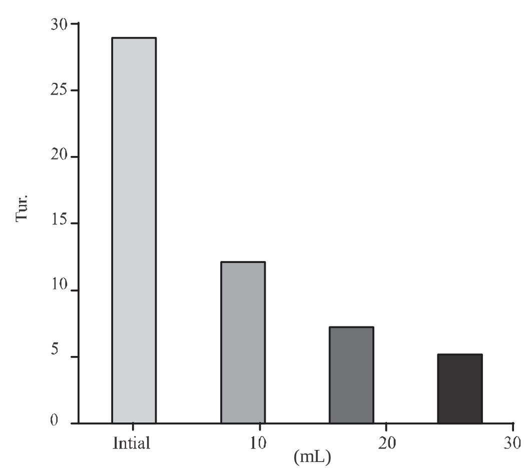

Fig. 9: Turbidity value of Shatt Al-Hilla river

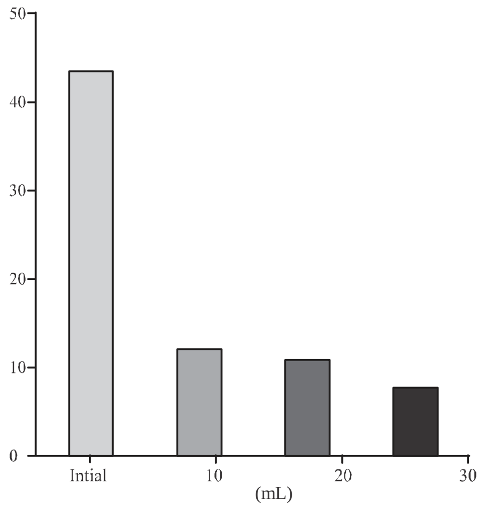

Fig. 10: Turbidity value of textile factory

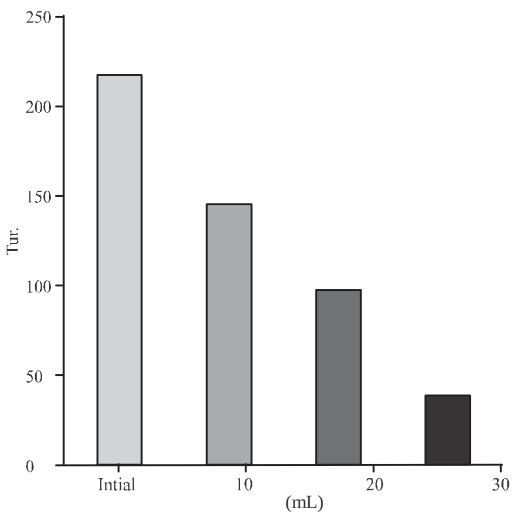

Fig. 11: Turbidity value of sugar factory

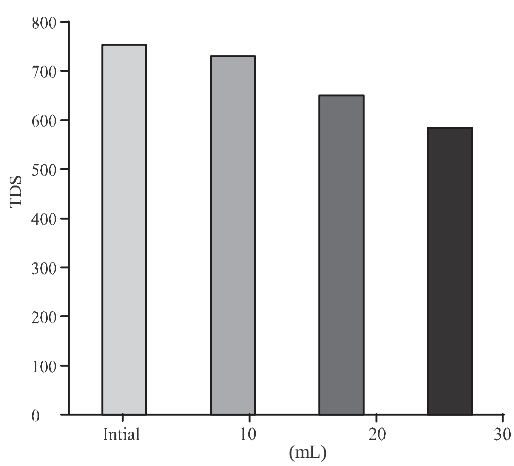

Fig. 12: Total dissolved solids value of Shatt Al-Hilla river

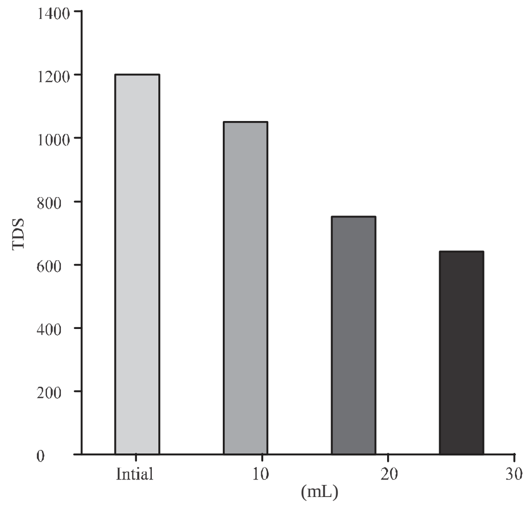

Fig. 13: Total dissolved solids value of textile

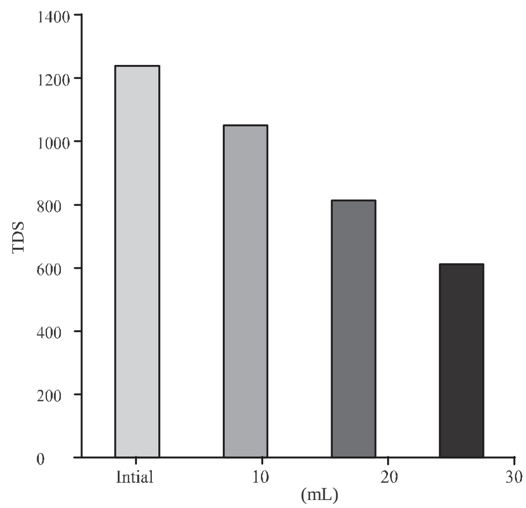

Fig. 14: Total dissolved solids value of sugar factory

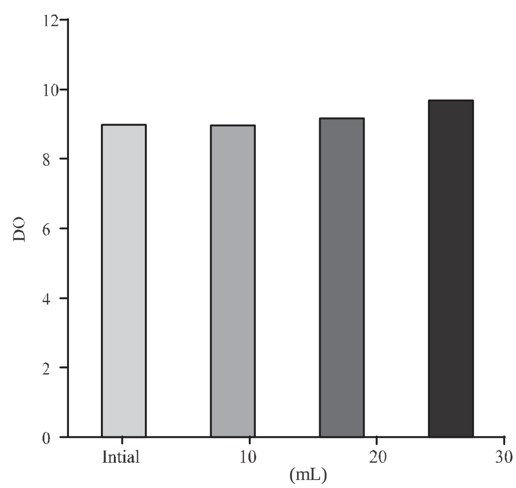

Fig. 15: Dissolved oxygen concentration value of Shatt Al-Hilla river

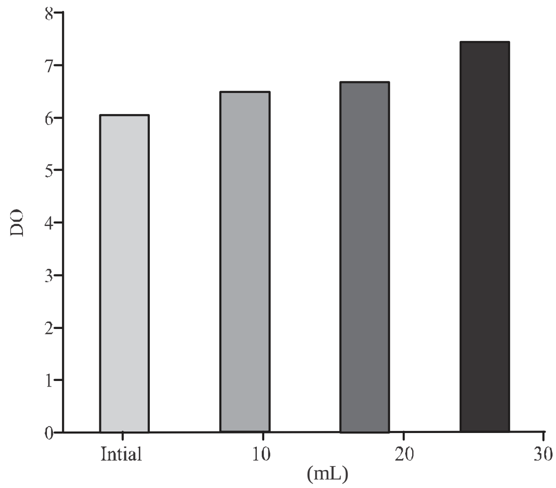

Fig. 16: Dissolved oxygen concentration value of textile factory

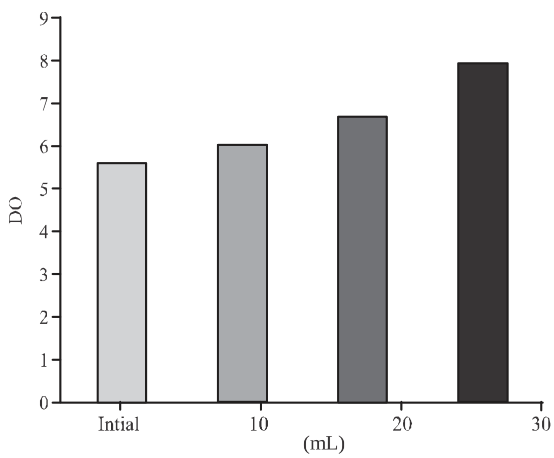

Fig. 17: Dissolved oxygen concentration value of sugar factory

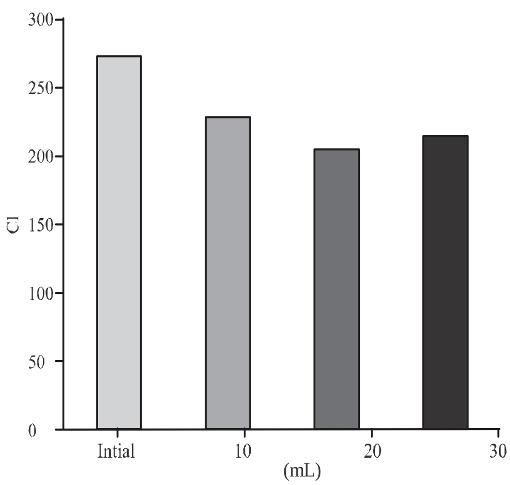

Fig. 18: Chloride concentration value of Shatt Al-Hilla river

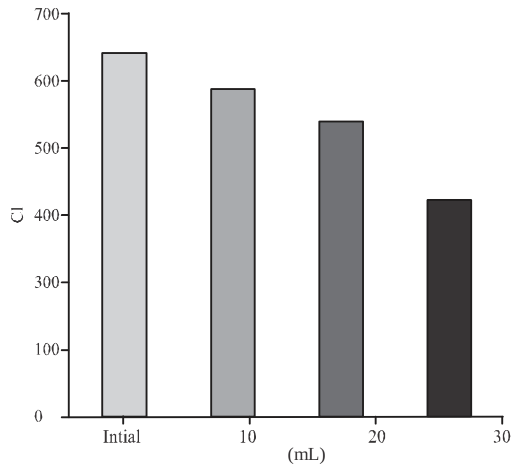

Fig. 19: Chloride concentration value of textile factory

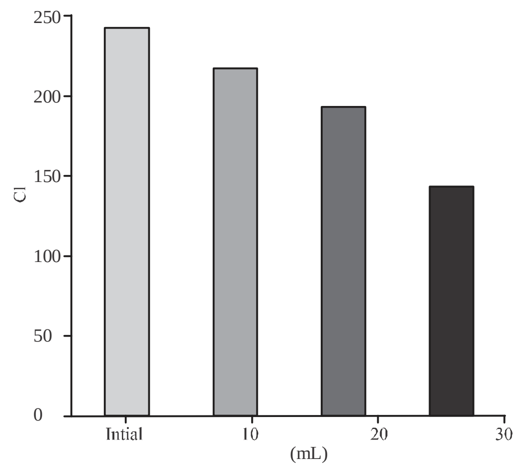

Fig. 20: Chloride concentration value of sugar factory

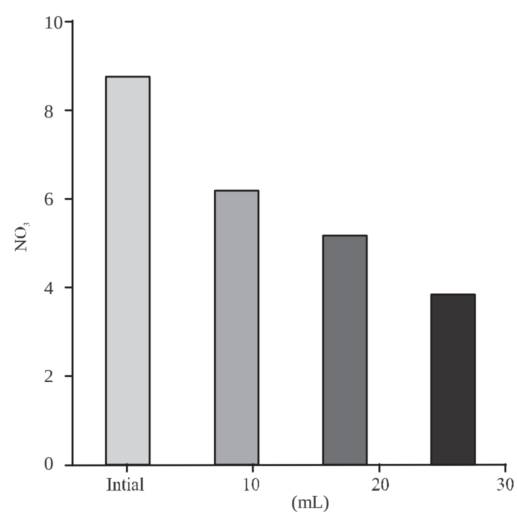

Fig. 21: Nitrate concentration value of Shatt Al-Hilla river

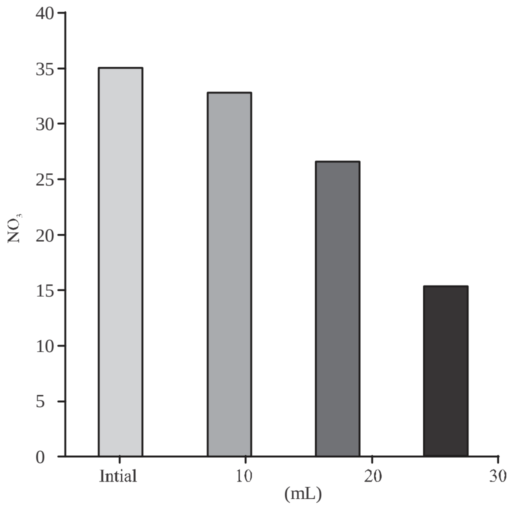

Fig. 22: Nitrate concentration value of textile factory

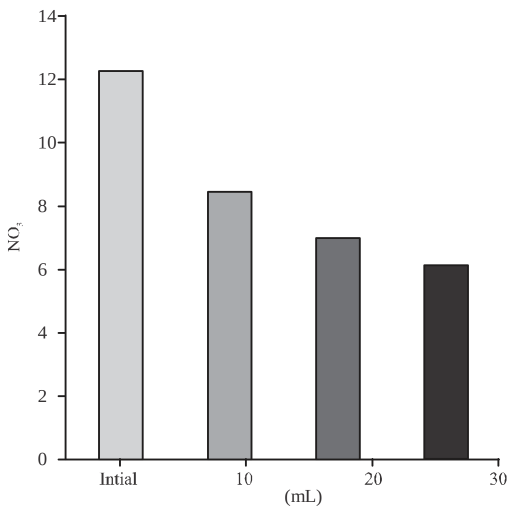

Fig. 23: Nitrate concentration value of sugar factory

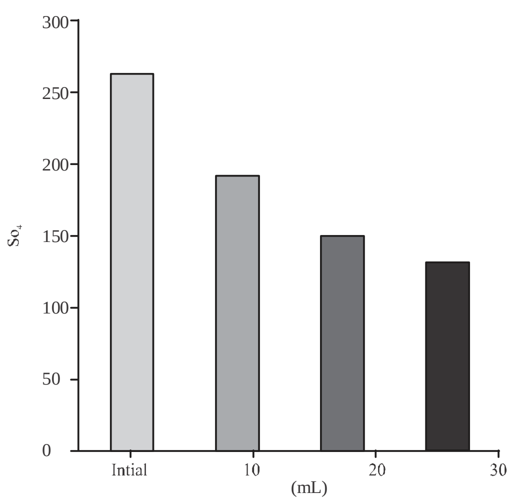

Fig. 24: Sulphate concentration value of Shatt Al-Hilla river

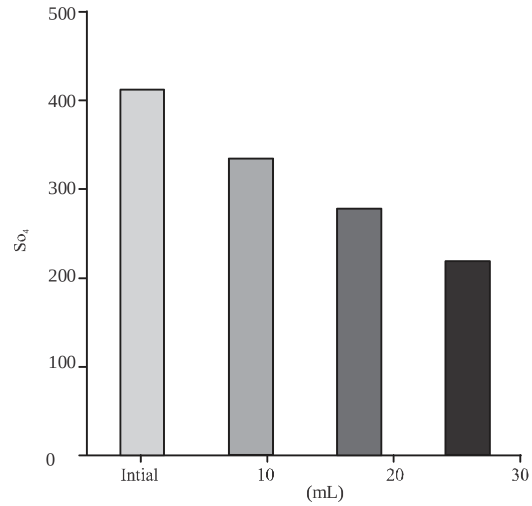

Fig. 25: Sulphate concentration value of textile factory

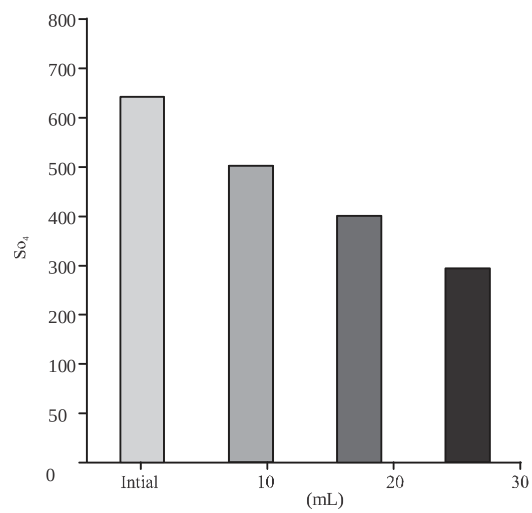

Fig. 26: Sulphate concentration value of sugar factory

water and neutralize the chlorides (Meneghel *et al*., 2013). Nitrate concentration has decreased after treatment with MO seeds solution for the different stations. The current study was showed that the highest percentage removal of nitrate after treatment with different doses (10, 20 and 30 mL) of MO were 66.67% for station A, 51.42% station B and 53.85% station C. Sulphate concentration has decreased after treatment with MO seeds solution for the different stations which was the best percentage removal in this study was 50.20% for station A, 56.3% for station B and 45.28% for station C.

CONCLUSION

The seeds of the Moringa plant are considered as effective material as the turbidity of sample increase. The seeds of the Moringa plant are inexpensive and can be used in water treatment. Industrial water has a significant impact on changes in the physical and chemical properties of surface water.

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