A STUDY ON SOME WATER QUALITY ASSESSMENT OF GAMOEYIEK CREEK WATER SAMPLE NEAR NORTH DAGON TOWNSHIP AND TREATED WITH *MORINGA OLEIFERA* L. (DANT-DA-LUN) SEEDS

Thin Thin Hlaing[1], Ohnmar Aung[2], Zaw Naing[3]

Abstract

In the present work, the Ngamoeyeik creek water sample was collected from North Dagon Township, Yangon Region. Some physicochemical properties (pH, turbidity, conductivity, chemical oxygen demand, biochemical oxygen demand, total alkalinity, total hardness, total suspended solids and total dissolved solids) of the creek water sample were determined by standard method. Elemental analysis of some trace elements (Cr, Mn, Fe, Cu, Zn, Pb, Cd, Mg, Ca, K, Na and As) of the creek water sample were measured by atomic absorption spectrophotometer (AAS). Bacteriological properties of creek water sample were investigated by AOAC method. The conventional treatment design for creek water was modified by coagulation and flocculation approach. In the lab study, the experiments with two parameters such as doses of *M. oleifera* seeds powder (1, 2, 3, and 4 g/L) and contact times (1, 2, 3 and 4 h) were conducted to study their effects on the flocculation process. This process showed in significant reducing of turbidity. The optimum conditions for water treatment by using *M. oleifera* (Dant-da-lun) seeds powder are 2 g/L dose and 1 h of contact time. After treatment the observed values of (pH, total suspended solids, total dissolved solids, Mn, K, Cd, Mg, total coliform and *E.coli*) are significantly reduced.

Keywords: TDS, pH, Turbidity, *M. oleifera* seeds

Introduction

Water is one of the most important compounds to the ecosystem. Better quality of water described by its physical, chemical and biological characteristics. But some correlation was possible among these parameters and the significant one would be useful to indicate quality of water, due to increased human population, industrialization, use of fertilizers in agriculture and man-made activity. It is therefore necessary that the quality of drinking water should be checked at regular time interval because due to use of contaminated drinking water, human population suffers from a variety of water borne diseases (Mohamed, 2018). The most important use of water in agriculture is for irrigation, which is a key component to produce enough food. Irrigation takes up to 90 % of water withdraw in some developing countries. Other uses are as a scientific standard for dinking, washing, transportation, chemical uses, heat exchange, fire extinction, recreation, water industry, industrial application and food processing (Choy, 2015). In future, even more water will be needed to produce food because the earth's population is forecast to rise to 9 billion by 2050. The availability and quality of water always have played on important part in determining not only where people can live, but also their quality of life .In rural and undeveloped countries people living in extreme poverty are presently drinking highly turbid and microbioligically contaminated water as they lack of knowledge of proper drinking water treatment and also not afford to use high cost of chemical coagulants. Chemical coagulants like Aluminium sulphate (alum), $FeCl_2$ is used in Municipal drinking water treatment plant for purification process (Hendrawati *et al*., 2016). This excess use of amount of chemical coagulants can affect human health e.g., aluminum has also been indicated to be a causative agent in neurological diseases such as pre- senile dementia. To overcome chemical coagulant problems it is necessary to increase the use of natural coagulants for drinking water treatment. Naturally occurring coagulants are usually presumed safe for human health. Some studies on natural coagulants have been carried out and various natural coagulants were produced or extracted form microorganisms, animals or plants.

[1] Dr, Lecturer, Department of Chemistry, Dagon University
[2] Dr, Lecturer, Department of Chemistry, Dagon University
[3] Dr, Associate Professor, Department of Chemistry, Dagon University

One of these alternatives is *Moringa oleifera* L. seeds. It is a native tree of the sub-Himalayan parts of North-west India, Pakistan and Afghanistan. *M. oleifera* is a perfect example of a so-called" multipurpose tree". Earlier studies have found *M. oleifera* to be non-toxic, and recommended it to use as a coagulant in developing countries. The use of *M. oleifera* has an added advantage over the chemical treatment of water because it is biological and has been reported as edible. *M. oleifera* seeds act as a natural absorbent and antimicrobial agent as their seeds contain 1 % active ployelectrolyte's that neutralize the negatively charged colloid in the dirty water (Sasikala *et al*., 2016). This protein can be therefore nontoxic natural ploypeptide for sedimentation of mineral particles and organics in the purification of drinking water. These seeds are also act as antimicrobial agent against variety range of bacteria and fungi. The seed contain number of benzyl isothiocynate and benzyl glucosinolate which act as antibiotic. It is believed that the seed is an organic natural polymer (Amaglo *et al.*, 2010).

M. oleifera L. is a highly valued plant, distributed in many countries of the tropics and subtropics Figure 1. Myanmar name of *M. oleifera* L. is Dant-da-lun. English name and botanical name are drumstick and *Moringa oleifera* Lam. Moringaceae is the family of *M. oleifera* L. and part of *M. oleifera* L. is used as seeds.

The aims of the present work, are to investigate the different parameters of water quality of Ngamoeyeik creek water sample treated with *M. oleifera* seeds powder and treated water sample can be suitably used or not for customers near the creek in crowded area.

Figure 1 (a) pods and (b) seeds of *Moringa oleifera* L. (Dant-da-lun)

Materials and Methods

Sample Collection and Storage

In this research, the water sample was collected from Ngamoeyeik creek near North Dagon Township. The sample was collected in polyethylene bottles which had been washed with a detergent and rinsed with water, diluted nitric acid solution and distilled water. Sampling site was recorded with GPS detector. The sampling site is represented in Figure 2.

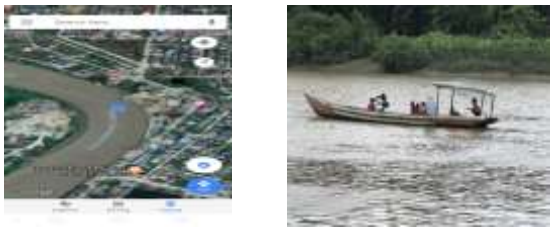

Figure 2 Satellite image and sampling site

Determination of Some Physicochemical Properties and Some Bacteriological Activities of Ngamoeyeik Creek Water Sample

In this research, all chemicals were used of analytical reagent grade. In all investigations, the recommended standard methods and techniques involving both standard and modern methods were provided. Some physicochemical properties (pH, turbidity and conductivity) of creek water sample treated with *M. oleifera* seeds powder were measured by digital meter (HANNA

instrument). Total suspended solids and total dissolved solids were determined by filtration and evaporation methods. Total alkalinity and total hardness were determined by titration methods. Some trace elements of water sample were detected by AAS method. Bacteriological properties of creek water sample were investigated by AOAC method (AOAC, 1990).

Coagulation and Flocculation Process

Coagulating material was added to the supernatants formed from sedimentation process, for determining the effect of the type, dose and time on the coagulation and flocculation of contaminants (turbidity).

Collection and Preparation of *M. oleifera* L. (Dant-da-lun) Seeds

Coagulating material used in this study is *M. oleifera* seeds were collected from Thanlyin Township, Yangon Region. Good quality of *M. oleifera* seeds were harvested when they were fully matured which was determined by observing if there were any cracked pods on the plants. The pods were plucked and cracked to obtain the seeds which were air dried for 2 week. The seeds are taken and removed its wings and coat from their seeds. Fine powder was prepared by using mortar and pestle and this powder was directly used as coagulant for water treatment (Ndabigengesere *et al*., 1995).

Effect of Different Doses on the Removal of Turbidity in Water Sample by Using *M. oleifera* Seeds Powder

1, 2, 3 and 4 g of *M. oleifera* seeds powder were added separately into the beakers containing 1000 mL of water sample. The mixtures in the beaker were stirred thoroughly for 1 h using glass rod. The suspension was left to stand without disturbance at 1 h and the supernatants formed were decanted and subjected to determine the turbidity. They are represented in (Figure 3).

Effect of Different Contact Times on the Removal of Turbidity in Water Sample by Using *M. oleifera* Seeds Powder

The dose 2 g of *M. oleifera* seeds powder were added separately into a beakers containing 1000 mL of water sample. The mixtures in the beakers were stirred thoroughly for 1 h using glass rod. The suspension was left to stand without disturbance at various time 1, 2, 3 and 4 h. The obtained supernatants were decanted and subjected to determine the turbidity (Figure 4).

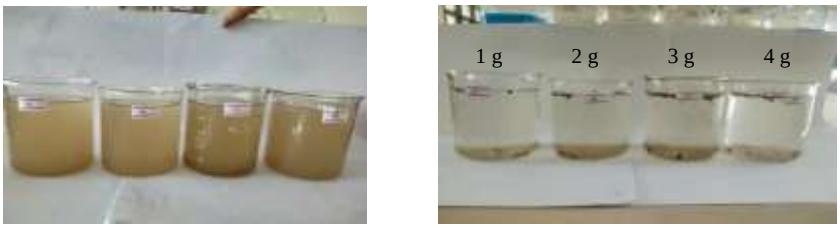

Figure 3 Water samples before and after treatment

Figure 4 Water samples before and after treatmen

Figure 5 Turbidity apparatus and pH meter

Results and Discussion

Collection of Water Sample from Ngamoeyeik Creek

In the present study, creek water sample was collected near North Dagon Township, Yangon Region on February 2019. The collected water sample was investigated by conventional methods as well as modern instrumental techniques.

Effect of Different Doses on the Removal of Turbidity in Water Sample by *M. oleifera* Seeds Powder

The percent removal of turbidity of water sample is 99.503 %, 99.590 %, 99.408 % and 99.560 %, respectively. The maximum reduction of turbidity was found to be 99.590 % in sample. According to the results, the effective dose of *M. oleifera* seeds powder in the removal of turbidity was found to be 2 g/L. These data are shown in Table 1.

Turbidity in creek water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms.

Table 1 Effect of Different Doses on the Removal of Turbidity in Water Sample by *M. oleifera* Seeds Powder

Doses (g L^{-1})	Removal of Turbidity (%)
1	99.503
2	99.590
3	99.408
4	99.560

Effect of different contact times on the removal of turbidity in water sample by *M. oleifera* seeds powder

In this study, the optimum dose 2 g L^{-1} of *M. oleifera* seeds powder was used for the removal of turbidity. The contact times were varied at 1, 2, 3 and 4 h. The percent removal of turbidity of water sample are 99.570 %, 99.361 %, 99.470 % and 99.343 %, respectively. The maximum reduction of turbidity was found to be 99.570 % in sample. According to the results, optimum contact time was 1 h. These data are shown in Table 2.

Table 2 Effect of Different Contact Times on the Removal of Turbidity in Water Sample by *M. oleifera* Seeds Powder

Time (h)	Removal of Turbidity (%)
1	99.570
2	99.361
3	99.470
4	99.343

Some Physicochemical Properties of Creek Water Sample Before and After Treatment by Using *M. oleifera* Seeds Powder

In the present study, creek water sample was collected from Ngamoeyeik creek, North Dagon Township. The collected water sample was investigated before and after treatment with *M. oleifera* seeds powder (2 g/L dose) by standard methods as well as modern instrumental techniques. In this research, pH values of water sample were determined as 7.24 and 6.5, respectively. The observed values of pH were within the WHO standards. These pH values are suitable for aquatic life. The turbidity values of water sample were recorded as (>1050) NTU and 4.3 NTU, respectively. According to the visualization and measurement results, the turbidity of water sample was reduced after treatment of *M. oleifera* seeds powder (Figures 3 and 4). So *M. oleifera* seeds powder removed 90 % to 99 % of turbid in the treated water. The observed values of conductivity of water sample were recorded as 3.30 µS/cm and 2.9 µS/cm, respectively. The observed values were lower than WHO standards. The values of biochemical oxygen demand of water sample were observed 1.0 and 2.0 ppm and chemical oxygen demand were detected 0.65 and 2.32 ppm, respectively. These results were slightly lower than the WHO standard. The values of total alkalinity and total hardness of water samples before and after treatment were measured 20, 10 and 204, 250 respectively. The observed values of total alkalinity were within WHO standard and total hardness were slightly greater than WHO standard. Total suspended solids were observed 18325 and 0.92 ppm and total dissolved solids were recorded as 14.5 and 2.624 ppm, respectively. High concentration of suspended solid can lower creek water quality by absorbing light. Suspended solids clog fish gills, reduce growth rates, decrease resistance to disease. All of these data are shown in Table 3.

Table 3 Some Physicochemical Properties of Ngamoeyeik Creek Water Sample Treatment with *Moringa oleifera* L. (Dant-da-lun) Seeds

Parameters	Observed values		WHO Standard (2017)
	Before treatment	After treatment	
pH	7.24	6.5	6.5-8.5
Turbidity (NTU)	> 1050	4.3	5-25
Conductivity (µS/cm)	3.30	2.98	600
COD	0.65	2.32	10
BOD	1.0	2.0	5.0
Total alkalinity (ppm of $CaCO_3$)	20	10	90-100
Total hardness (ppm of $CaCO_3$)	204	250	20-200
TSS (ppm)	18325	0.92	150
TDS (ppm)	14.5	2.624	500

Some Elemental Analysis of Creek Water Sample before and after Treatment by Using *M. oleifera* Seeds Powder

Elemental analysis is a process where a sample of some material is analyzed for its elemental. In this study, some elements (Cr, Mn, Fe, Cu, Zn, Pb, Cd, Mg, Ca, K, Na and As) were investigated by AAS method. Before and after treatment of water samples, the observed values of Cr, Fe, Cu, Pb were not measured in the present investigation. The values of Mn, Zn, Cd and As were determined as 0.046, 0.023, 0.043 and 0.01 respectively. After treatment, Mn, Zn, Cd and As were not detected. The values of Mg and Ca, before and after treatment of water samples were determined as 5.108, 4.804 and 18.11, 33.13 respectively. Before and after treatment of water samples, the observed values of K were as 217.9 and 21.52. The values of Na were recorded as 35.27 and 106.5. After treatment, some metals were not detected. These results are shown in Table 4.

Table 4 Some Elemental Analysis of Ngamoeyeik Creek Water Sample before and after Treatment with *M. oleifera* (Dant-da-lun) Seeds

Parameters	Observed values (ppm)		WHO Standard (2017)
	Before treatment	After treatment	
Cr	ND	ND	0.1
Mn	0.046	ND	0.4
Fe	ND	ND	0.3
Cu	ND	ND	1.0
Zn	0.023	ND	3
Pb	ND	ND	0.01
Cd	0.043	ND	0.003-0.005
Mg	5.108	4.804	50
Ca	11.18	33.13	65
K	217.9	21.52	8
Na	35.27	106.5	30-60
As	0.01	ND	-

ND = not detected

Some Bacteriological Properties of Ngamoeyeik Creek Water Sample before and after Treatment by Using *M. oleifera* (Dant-da-lun) Seeds

In this present study, before treatment of total coliform was found as 56 cfu/mL in sample. After treatment with *M. oleifera* seeds powder, the number of total coliform was recorded as 10 cfu/mL in sample. The results are presented in Table 5.

In this present study, before treatment of *E. coli* was found as 7 cfu/mL in sample. After treatment with *M. oleifera* seeds powder, the number of *E. coli* was recorded as 1 cfu/mL in sample. The results are presented in Table 5.

Table 5 Some Bacteriological Properties of Ngamoeyeik Creek Water Sample before and after Treatment by Using *M. oleifera* (Dant-da-lun) Seeds

Parameters	Observed values (cfu/mL)		WHO Standard (2017)
	Before treatment	After treatment	
Total coliform	56	10	0
E. coli	7	1	0

Conclusion

The water sample from Ngamoeyeik Creek at North Dagon Township, Yangon Region were collected and their physicochemical properties by conventional methods and modern instrumental techniques, elemental analysis by AAS method, bacteriological properties of before and after treatment by AOAC method using *M. oleifera* seeds powder. According to the overall results, it was concluded that *M. oleifera* seeds are the effective natural bioflocculants for water treatment process with low environmental risks. Therefore, *M. oleifera* seeds can be applied as environmental friendly biosorbent material for multi-purposes. This research program can contribute economically and environmentally entire society of Myanmar especially in the rural areas where no facilities are available for the treatment of drinking water.

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References

Amaglo, N. K., Bennett, R. N. and Lo Curto, R. B. (2010). *"*Profiling Selected Phytochemicals and Nutrients in Different Tissues of the Multipurpose Tree Moringa oleifera L., Grown in Ghana". *Food Chem.*, vol. 122, pp. 1047-1054

AOAC. (1990). "Official Methods of Analysis of the Association of Official Analytical Chemists". Ed. Helrich, K. Virgenia; 15th Ed. 1, AOAC Inc.

Choy, S. P. (2015). "A review on common vegetables and legumes as promising plant-based natural coagulants in water clarification". *International Journal of Environmental Science and Technology*, vol. 12 (1), pp. 367-390

Hendrawati, Y., Nurhasni, I. R., Rohaeti, E., Effendi, H. and Darusman, L. K. (2016). "The use of *Moringa oleifera* Seed Powder as Coagulant to Improve the Quality of Wastewater and ground Water*". IOP Conference Series, Earth and Environment Science*, vol. 31, p. 12033

Mohamed, S. A. R. (2018). "Application of Green Synthesis Ag-NPs from *Lawsonia inermis* (Henna) Plant as Antifungal & Non Toxic Nonmaterial in Drinking Water Purification". *Chemistry Research Journal*, vol. 3 (1), pp. 64-73

Ndabigengesere, A., Narasia S. K., and Talbot, B. J. (1995). "Active Agents and Mechanism of Coagulation of Turbid Waters using *Moringa oleifera*". *Water Research*, vol. 29 (2), pp. 703-710

Sasikala, S. and Muthuraman, G. (2016). "*A Laboratory Study for the Treatment of Turbidity and Total Hardness Bearing Synthesis Wastewater/ Ground Water Using Moringa Oleifera*". India: Chem, vol. 2, p. 112

World Health Organization. (2017). "*Guideline for Drinking Water Quality"*. Geneva, Switzerland: World Health Organization