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Treatment of Textile Waste Effluents Using Moringa Oleifera Lam

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Abstract: Waste effluents samples collected from African textile manufactures ltd (ATM) located in Challawa Kano state, was studied for the effectiveness of using *Moring Oleifera lam* (Zogale) seed powder in its treatment. The effect of oil extraction (of the seed) and pH – correction of the effluents on the treatment was also studied.It was observed that Moring seed powder can be used as a primarycoagulant beforeor after the moringa oil extraction.The moringa seed exhibit no effect on the pH value of the treated effluents as no significant change on the coagulation property after pH – correction of the effluents was observed. Metals content was determined using AAS method.It was observed that the mean reduction in concentration of the metals in the treated to raw ranged from 49% (Mn), 46% (Cr), 40% (Fe), 33% (Zn), 33% (Ca), 28%(Pb)23% (Mg), 1%(Co), the percentage decrease in turbidities before or after oil extraction ranged between 80% to 93%.*Moringa oleifera* seed powder can be used effectively in the pretreatment of textile waste effluents before its final discharge into the surface water.

Keywords: Effluents, Challawa, Moringa Oleifera, Turbidity, Coagulation, Extraction, Textile

1. Introduction

The environment is under increasing pressure from solid and liquid wastes emanating from industries.These areinevitable by-products of the manufacturing processes that cause significant pollution unless treated in some way prior to discharge In some instances, liquid wastes are discharged in sewagesystems (indirect discharge) where it under goesfull scale treatment before returned to the environmentvia surface waters, [8].

Where effluents are discharged direct into streams and rivers, they need to be of higher quality as the environment is sensitive and susceptible to damage.

Municipal and Industrial waste waters are largely discharged without treatment into surface receiving water throughout the developing world, [8].

Physico – chemical and biological methods can be applied for treatment of waste waters and the most common physico – chemical method used for purification, after physical treatment and pH correction, is coagulation by iron and Aluminium double salts.This methods canbe preceded by aeration in order to remove sulphides, [9]. Instead of coagulation, electro – coagulation with iron anodes or flotation and electro – floatation can be applied too, [7]. Efficiency of waste waters pretreatment by coagulation significantly influence their final purification results. There are a number of studies focused onefficiency of the coagulation process with different salts indicating that coagulation with high doses of lime assited by non-Ionic polyelectrolyte at pH2 resulted in a 63% reduction of chemical Oxygen Demand (COD), [1].

After coagulation (flotation) waste waters are purified using biological method (usually by active sludge) such a three-step purification process does not always brings desirable result, [2]. Sometimes the fourth step (absorption on the organics carbon) must be applied, which results in removing 70-95% of the remaining organic compounds,[4]. Ozonation as a pretreatment process before biological purification has been studied intensively in recent years. During the first biological purification the majority of biodegradable components were removed, which resulted in reduction of ozone demand in the second step.

Ozonation resulted in furtherreduction of organic contents, abatement their molecular mass and toxicity-improving their biodegradility, [3].

Advanced oxidation process (AOPs) based on the generation of hydroxyl/radicals, are an increasingly popular method applied to thepurification of many industrial effluent, [9].

Waste water from textile industry consists of variety of pollutant such as dyes, detergents, solvents, heavy metals inorganic salts and fibers. In general Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) ration of textile industrial effluents ranges 3 to 4, meaning that effluent is moderately biodegradable. The main recalcitrant component of textile industrial waste water is dye, [8]. The presence of small fraction of dye in water is highly visible due to the color and affects the aesthetic merit of streams and other water sources. Also presence of dye interfere with penetration of light in the water bodies and may affect the aquatic biota, [5]. Furthermore some dye or their degradation products have proven to be toxic,mutagenic or carcinogenic in nature. Thus the removal of dye from effluents has been a top priority.

The aim of this study is to find out the effectiveness of Moringa seed powder in the treatment of textile waste effluents which could be an important alternative to the various chemical methods highlighted for the pretreatment. The coagulant properties of the seeds are due to a series of low molecular weight cationic water extract of M. oleifera seed. The crushed seed powder when added to water yielded water soluble proteins that possessed a net positive charge. These positively charged proteins attract the negatively charged particles and bacteria. The solution therefore acts as a natural cationic polyelectrolyte during treatment and acts as a coagulant, [6].

2. Methodology

All glass wares and plastic containers used in this work were thoroughly washed with detergent, soaked in potassium dichromate solution and then rinsed with tap water, finally rinsed with deionised water and dried in oven before use.

(i) Sample collection:

Dry *Moringa oleifera* seeds were collected from the municipal local government area of kano state, Nigeria. The seedswings and coats from selected good quality *Moringa oleifera* seeds were removed and the kernel grinded to a fine powder and was subsequently stored in a clean plastic container and used in the treatment processes. The raw textile effluents were colleted from African Textile Manufacturers Limited (ATM) located in Challawa Industrial Estate on Suhail Akar Lane, Kumbotso Local government Area of kano State, Nigeria. Waste water sample were collected using plastic container (2 liter capcity) on daily basis (in the morning, afternoonand evening).

(ii) Extraction of oil from the seed powder:

Oil was extracted from the seed sample using a soxlet extractor the sample was wrapped in a whatman filter paper with n-hexane as the extracting solvent. The extraction was carried out continuously for 16 hours, the oil was recovered by distilling off n-hexane.

(iii) Preparation of seed suspension and turbidity reduction

Two grams (2g) of the seed powder was weighed andmixed with 100cm^3 of distilled water in a screw capped glass bottle, shaken vigorouslyfor 1 minute and allowed to stand for 10 minutes, [9]. This suspension was filtered through a piece of muslin cloth, and the filtrate was used within 1 hour for the treatment.

Turbidity test was performed by adding appropriate concentration of *Moringa oleifera* stock solution into 100cm^3 of sample. The mixture was agitated vigorously with a glass rod for 1-2 minutes stirred slowly for an additional 5 minutes and then left to stand for an hour in the 120cm^3 capacity measuring jar. The turbidity of each sample was recorded before and after the procedure, [3].

(iv) Sample digestion:

Sample collected was thoroughly shaken for homogenous distribution and about 100cm^3 was transferred into a beaker 5cm^3 of conc. HNO_3 (70%, S.G 1.413) was added. It was heated gently to evaporate to about 20cm^3, 5cm^3 of Conc.HNO_3 (70%, S.G. 1.413) was added again and the beaker was covered with a watch glass and heated to obtain a gentle refluxing action. Heating was continuously carried out with addition ofConc.HNO_3 (70%, S.G. 1.413)until digestion was completed shown by a light coloured clear solution,2cm^3 of Conc. HNO_3(70%, S.G.1.413) was then added and warmed slightly to dissolve any remaining residue. The content was washed down with waterand then filtered into a 100cm^3 volumetric flask and made up to the mark with distilled water. The solution is then aspirated into the AAS and the absorbance value taken, [10].

(v) Instrumentation:

A digital spectrophotometer (HACH DR/ 2010) Alpha 4 atomic absorption spectrophotometer, and flame photometer model clinical PFP7 were used.

Manufacturer's instructions regarding apparatus and operational procedures were strictly followed.

The absorbance of each set of standard solution was used to plot the calibration curve and the absorbance of the sample was interpolated from the calibration plot to get the corresponding concentration**.**A digital turbidimeter (Hach ratio/XP) was used for the determination of turbidity. A clean sample was insertedinto the cell holder and after few seconds the result was read and recorded in Nephlomeric turbidity unit, [10].

3. Results and Discussion

Table 1. *Results of Turbidity Reduction.*

Seed Concentration	Before Oil Extraction		Seed Concentration	After Oil Extraction	
(mg/1)	Mean Turbidity (NTU)	PH	(mg/1)	Mean Turbidity (NTU)	PH
0.00	1968.0±0.1	9.2±0.01	0.00	1968.0±0.1	9.2±0.01
700	394.6±0.1	9.2±0.01	700	390.0±0.1	9.2±0.01
750	313.3±0.1	9.2±0.01	800	311.0±0.1	9.2±0.01
800	275.3±0.1	9.2±0.01	850	253.0±0.1	9.2±0.01

Seed Concentration (mg/1)	Before Oil Extraction		Seed Concentration (mg/1)	After Oil Extraction	
	Mean Turbidity (NTU)	PH		Mean Turbidity (NTU)	PH
850	161.6±0.1	9.2±0.01	850	150.3±0.1	9.2±0.01
* 900	134.3±0.1	9.2±0.01	900	135.5±0.1	9.2±0.01
950	154.3±0.1	9.2±0.01	950	137.3±0.1	9.2±0.01

*= Optimum seed concentration giving lowest conc.

Table 2. *Showing Important Parameters.*

PARAMETERS	SAMPLES		
	Raw Effluent	Treated Before Oil Extraction	Treated After Oil Extraction
PH	9.20±0.01	9.20±0.01	9.20±0.01
Conductivity (μs)	214.24±0.1	122.42±0.1	114.3±0.1
Turbidity (NTU)	1968.00±0.1	134.30±0.1	135.50±0.1
TSS (mg/l)	165.58±0.1	1.837±0.1	1.762±0.1
TDS (mg/l)	151.62±0.1	20.87±0.1	18.37±0.1
COD (mg/l)	24.50±0.1	-	-

Table 3. *Metals Concentration (GG^{-1}) in Effluent.*

Samples	Fe (mg/l)	Zn(mg/l)	Ca(mg/l)	Co (mg/l)	Cr (mg/l)	Mg (mg/l)	Mn (mg/l)	Pb (mg/l)
A.	0.01±0.001	0.090 ±0.001	0.040 ±0.001	0.028 ±0.001	0.13±0.001	0.013 ±0.001	0.15±0.001	0.025±0.001
B.	0.06 ± 0.001	0.060 ±0.001	0.027±0.001	0.025 ±0.001	0.07±0.001	0.01±0.001	0.076±0.001	0.018±0.001
C.	0.11 ± 0.001	0.200±0.001	0.140±0.001	0.030±0.001	0.165±0.001	0.019±0.001	0.160±0.001	0.048±0.001
D.	0.09 ± 0.001	0.070 ±0.001	0.080±0.001	0.005±0.001	0.09±0.001	0.007±0.001	0.005±0.001	0.004±0.001

A=raw material effluent, B= Textile effluent treated with moringa seed soln. (900mg/dm^3), C=Textile effluents treated with ash, D = Moringa seed powder.

Table 1: shows the mean turbidity reduction for the textile effluent s samples treated with the seed suspension before and after oil extraction. It was found that optimum sees concentration of 900mg/l gives the Lowest turbidity of 134.3±0.1 NTU and 135.5±0.1NTU respectively, a significant reduction from initial (raw) turbidity value of 1,968±0.1 NTU achieving 93% reduction in turbidities. Thereforeboth the seed power and pressedcake can be used.

The result also show constant PH-value of (9.2±0.01) hence morning seed has certain advantage of not changing PH value of the raw effluent after treatment (it does not contain hydrolysable substance).

Table 2: Indicate reduction in conductivity by 43% and 47% before and after oil extraction respectively. total suspended solid (TSS) by 98.89%and 98.93%, total dissolved solid (TDS) by 86.2% and 87.9% respectively. The oil extraction slightly increased both conductivity and TDS reduction but turbidity and TSS remains virtually same.

From the result of AAs analysis (table 3). It was observed that themean reduction in concertration of metals in the treated tothe raw ranged from 49% Mn), 46%(Cr), 40% (Fe) 33%(Zn), 33%(Ca) 28%(Pb), 23%(Mg) and 11%(Co) moreover chromium, iron, and manganese experienced the highest reduction

4. Conclusion

The result obtained in the study revealsthat moringaoleifera seed powder and it spressed cake displayed all aroundactivity in turbidity and mentalsreduction when used inthe treatment of textile waste effluent.

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