

## Bacteriological Treatment of Waste Water From Paint Industry Using *Moringa oleifera* Seed

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### Abstract

Wastewater treatments using conventional physical and chemical methods are normally hampered by high cost and causes side effect to human's health and the environment. Because of these problems, the use of natural coagulants for wastewater treatment has been adopted. However, lack of knowledge on the exact nature and mechanism on how these substances work made them less likely to compete with conventional treatments. In this study, low cost and highly available natural materials was used for the treatment of paint industry effluent, the aim is to use natural product such as *Moringa oleifera* seed to replace chemical coagulants currently used for wastewater treatment from paint industry. *Moringa oleifera* seed was grounded into powdered form, the seed samples at different concentration in mg/l (0.2, 0.4, 0.6, 0.8, and 1.0) each was made into a suspension and introduced into 2l each of the paint wastewater. The paint wastewater samples was stirred and allowed to settle and observed after 0 hr, 1 hr, 3 hrs, 24 hrs, 72 hrs, 168 hrs, and 337 hrs. From the results, *Moringa oleifera* seed tends to purify the paint wastewater at 72 hrs. It can therefore be recommended for the bacteriological treatment of wastewater from paint industry.

**Keywords:** Wastewater; *Moringa oleifera* seed; Paint industry; Coagulants; Treatment

### Introduction

One of the major problems of developing countries is improper management of vast amount of waste generated from various human activities [1]. The issue of wastewater treatment has not been taken serious and this water are often disposed into rivers and drainages and research has shown that 90% of all untreated wastewater is discharged directly into rivers, lakes or oceans in many developing countries [2] and some others used for agricultural activities. This has led to the pollution of the natural water sources and the environment, giving room for the breeding of some pathogenic organisms. Some activities like farming, fishing, and domestic water use which rely on these sources of water have been affected greatly. In many cases, industrial wastewaters not only drain directly into rivers and lakes but also contaminate groundwater aquifers and wells. These wastewaters also contaminate coastal ecosystems and contribute to growing marine dead zones [3]. The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed without danger to human health or unacceptable damage to the natural environment. In as much as wastewater treatment is very important to the society, processes involved are difficult and costly to operate as they have high energy, infrastructure and maintenance requirements and highly skilled labour, hence making them less attractive for low-income countries [4]. *Moringa oleifera* seeds contain proteins that have active coagulation properties and are being used for turbidity removal in many countries [5]. The study will evaluate the health hazards from the indiscriminate disposal of untreated wastewater into the environment, particularly effluent from paint industry and the efficiency of *Moringa oleifera* in treatment of the wastewater. This will make policy makers to promulgate laws that enhance proper disposal of wastewater. The information will be useful in determining the possibility of using *Moringa oleifera* seed in large scale paint industry for their and also validate their use as an alternative to chemical treatment of water.

### Materials and Methods

The *Moringa oleifera* seeds were collected from the department of Agronomy at Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State. The paint wastewater sample used for the

experiment was collected from B-Lux paint industry limited located at Okpara Square Umuahia, Abia State. Apparatus used include fermentation tube, Bunsen burner, microscope, distilled water, druhum tubes, pressure pot and petri dish. Macconkey Broth and EMB Algae media were also prepared.

### Media preparation of distilled water

16 g of Macconkey Broth was weighed and dissolved in 400 ml of distilled water, it was then sterilized by autoclaving at 100°C for 15mins, then the molten media was allowed to cool at room temperature because bacteria works at 32°C - 35°C.

### Coagulant preparation

*Moringa oleifera* seeds were obtained; the seeds were sun dried properly in the laboratory for 3days. Matured seeds which shows no sign of discoloration, softening or extreme desiccation were used [6]. The seed coating was first removed. The seed kernels were ground using mortar to fine powder and the powder was sieved through a 60 micrometer stainless steel sieve.

### pH and temperature measurement

The standardization of the pH meter was done using pH 4 and pH 9 tablet for alkaline and dissolved in distilled water, then filtered. The filtered water samples were analyzed for pH (using Hanny pH meter) and turbidity (using HACH DR/2000 spectrophotometer at wavelength of 450 nm and expressed as NTU). The conductivity was measured using Jenway 470 Conductivity meter. Total Dissolved Solids (TDS) was

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determined using Jenway TDS meter and temperature meter was used to check the temperature of the sample.

### Coliform identification

The fermentation tubes were arranged in three groups, and one group contains three tubes each. In the first three, 1 ml of macconkey broth was added, 10 ml of macconkey broth was added in the second group and in the last group, 0.1 ml of macconkey broth was added. Druhum tubes were inversely inserted into fermentation tube to attract gas, and then heated up to 15 mins so as to sterilize. It is allowed to cool as bacteria works at about 32°C - 35°C. The media was allowed to cool for 48 hrs. The druhum tube was checked after 48hrs and when shook, if bubbles emerge, then bacteria is present.

### Suspended solid (SS) measurement

Decantation method was used to filter the sample so as to reduce the pollutants at the bottom. The filter paper was cut in size to fit the funnel and dried at 100°C, then allowed to cool and weighed. It was then filtered through the funnel using a filter paper.

## Results and Discussion

### Temperature

This measures the effect of *Moringa oleifera* seed dosage on level of temperature of paint wastewater with time (Figure 1). The result shows *Moringa oleifera* seed has no significant effect on the paint wastewater temperature as time progresses. For sample A (0%), the sample maintained its temperature at 28°C for 3 hrs, then it increased to 30°C after 3 days and declined to 29°C on the 14<sup>th</sup> day. Samples B (0.2%) and C (0.4%) retained similar sample temperature value as sample A. It only maintained its temperature of 28°C for 3 hrs before increasing. In sample D and E, temperature was similar to sample A but at 14 days, it dropped to 28°C with respect to dosage of 0.6% and 0.8% of 2000l of paint wastewater used. Sample F (0.1%) had sinusoidal temperature readings, thus, reaching peak temperature reading at the same time interval of 3 days (Table 1). This shows that the temperature variations were controlled by the environmental temperature rather than the *Moringa oleifera* seed. Thus, the *Moringa oleifera* seed dosage has no effect on the paint wastewater treatment temperature.

### pH value

This measures the *Moringa oleifera* seed dosage effect level of acidity or alkalinity of substance with time. The result shows that with increase in the *Moringa oleifera* seed dosage, the pH value tend to change from alkalinity to acidity as the time interval increases. In sample A (0%), the pH value decreases with increase in time interval, but still above pH 7 after 337 hrs, while samples B (0.2%) and C (0.4%) reach pH 7 at time interval between 24 hrs – 48 hrs. In sample D and E, pH 7 was reached at time 24 hrs – 36 hrs in respect to dosage of 0.6% and 0.8% of 2l of paint wastewater used. Sample F (1.0%) reached pH 7 in less than 24 hrs. This shows that between 0 hr and 3 hrs, the samples were mainly alkaline ranging pH value of 8.6 – 7.3. At 24hrs, except sample F, it attains neutral point of 7-6.9. Thus, 7 days sampling indicates that most of the moringa seed treated paint wastewater. The result therefore proves that *Moringa oleifera* seed of 20 g can reduce the pH of paint wastewater from 8.6 to 7 within 18 hrs (Figure 2 and Table 2).

### Coliform MPN

Bacterial content of the sample was determined by conducting

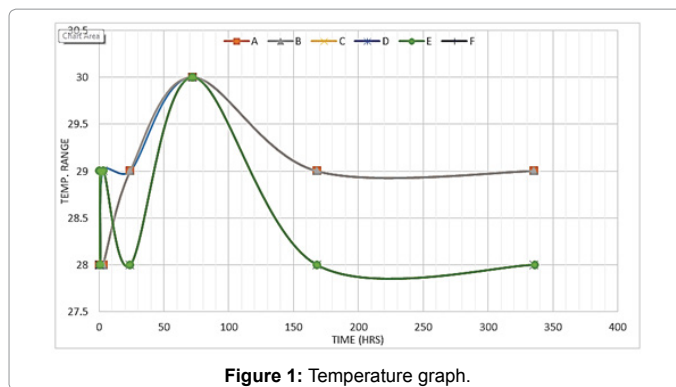


Figure 1: Temperature graph.

Sample Temperature (°C)	0	1	3	24	72	168	337
A	28	28	29	29	30	29	29
B	28	28	28	29	30	29	29
C	28	28	28	29	30	29	29
D	28	28	29	28	30	28	28
E	28	28	29	28	30	28	28
F	29	28	29	28	30	28	28

Table 1: Temperature table.

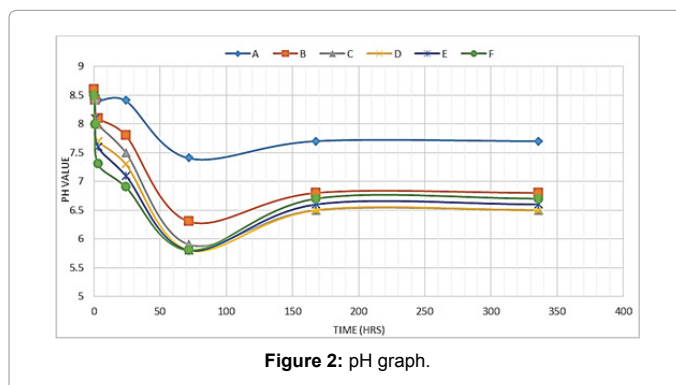


Figure 2: pH graph.

Sample	0	1	3	24	72	168	337
A	8.6	8.5	8.4	8.4	7.4	7.7	7.7
B	8.6	8.4	8.1	7.8	6.3	6.8	6.8
C	8.5	8.4	8	7.5	5.9	6.5	6.5
D	8.5	8	7.7	7.3	5.8	6.5	6.5
E	8.5	8.1	7.6	7.1	5.8	6.6	6.6
F	8.5	8	7.3	6.9	5.8	6.7	6.7

Table 2: pH value.

bacteriological analysis which involves coliform MPN value. This MPN value indicates the most probable number of the bacteria present per 100 ml of the sample. From this result, the coliform increased with increase in dosage and time. In sample A (0%), the bacteria development between 0 hr and 3 hr increased from  $3 \times 10^2$  after 24 hrs, to  $7.5 \times 10^3$  after 337 hrs. This implies that despite the increase in time, the rate of bacteria formation in paint wastewater were quite slow. Samples B (0.2%), C (0.4%) and D (0.6%) have similarities in their graphical representations as the *Moringa oleifera* seed consistently increased the bacteria generation in respect to time, from  $3 \times 10^2$  at 0 hr to  $2.4 \times 10^7$  after 337 hrs. Samples E and F having dosage of 0.8% and 1% of 2000 ml of paint wastewater respectively show the highest coliform result as seen in their graph which shows gentle and rapid

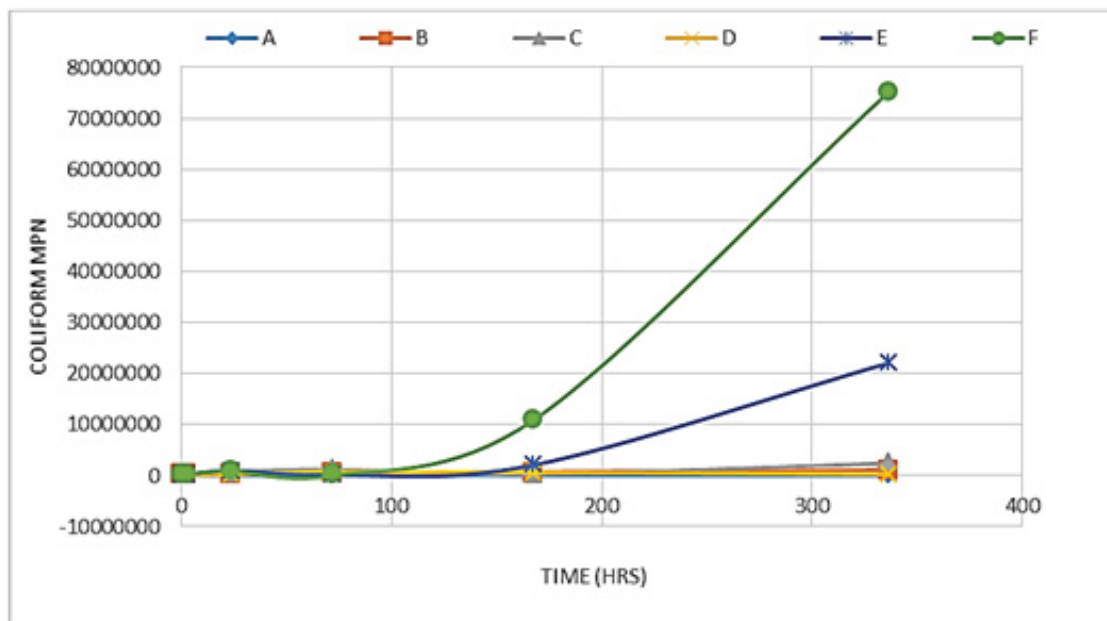


Figure 3: Coliform MPN value graph.

Sample	0	1	3	24	72	168	337
A	3	3	3	3.00E+02	7.00E+02	1.10E+03	7.50E+03
B	3.00E+02	1.50E+03	7.00E+04	2.80E+05	3.90E+05	7.30E+05	1.10E+06
C	7.00E+02	2.80E+03	1.40E+05	7.50E+05	1.20E+06	2.80E+05	2.40E+06
D	3.00E+02	1.40E+03	9.00E+04	2.30E+05	7.50E+05	6.40E+05	2.30E+05
E	3.00E+02	1.40E+04	2.30E+05	9.30E+05	1.40E+05	2.10E+06	2.10E+07
F	3.00E+02	2.30E+04	2.50E+05	8.70E+05	1.20E+04	1.10E+07	7.50E+07

Table 3: Coliform MPN (100 ml) value.

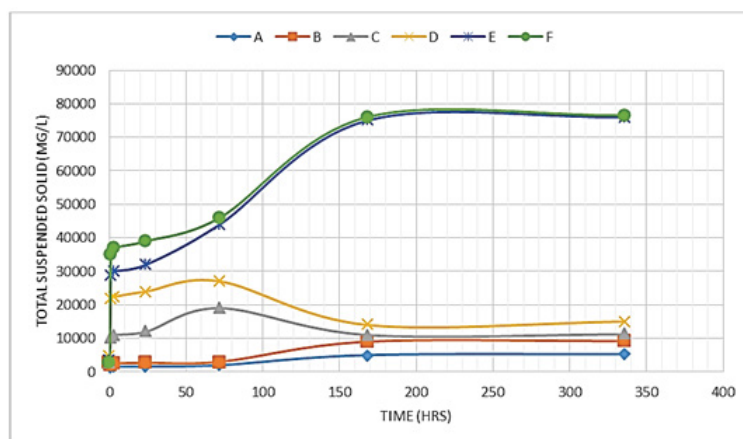


Figure 4: Total suspended solid graph.

Sample	0	1	3	24	72	168	337
A	2000	1000	1500	1600	2000	5000	5320
B	3000	2000	2450	2700	3000	9000	9200
C	3000	10000	11020	12000	19000	11000	11200
D	5000	22000	22400	24000	27000	14000	15000
E	3500	29000	30000	32000	44000	75000	76000
F	3000	35000	37000	39000	46000	76000	76500

Table 4: Total suspended solid.

bacteria growth respectively after 24 hrs. Thus, the higher the dosage, more coagulants are formed, which becomes very visible and can be removed easily, if need be (Figure 3 and Table 3).

### Total suspended solid

In this result, amount of suspended solid formed by the collision of the particles in the *Moringa oleifera* treated samples increased in respect to dosage increment (Figure 4). For sample A (0%), the amount of suspended solids formed were very low within of 0 – 14 days. Sample B (0.2%) follows the trend line of sample A, but increased its suspended solid after 4 days. Sample C (0.4%) and D (0.6%) had increase in solid suspension after 0.5 days, after which a decrease was observed. Sample E (0.8%) and F (1.0%) showed rapid development of suspended solid after 2.5 days. This implies that sample F with 20 g of *Moringa oleifera* seed possess a high tendency of removing suspended solid particles of 70000 mg/l from paint wastewater after 2.5 days (Table 4).

### Conclusion

Wastewater treatment using *Moringa oleifera* seeds revealed its efficiency in aiding maximum suspended materials removal, reduction of pH from alkalinity to acidity, etc. The seeds possess effective coagulation properties which were confirmed in laboratory studies. It

is also efficient in reducing the presence of microorganisms in water/wastewater. *Moringa oleifera* seed has been tested and confirmed to be an efficient and effective material for the bacteriological treatment of wastewater from paint industry. The seeds are neither harmful to humans nor animals. Thus, water treated using *Moringa oleifera* seeds are preferable, compared to alum or other chemicals, as it is more economical and environmentally significant.

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