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Comparative Studies on the Use of Ordinary And De-Oiled Moringa Oleifera In The Treatment Of Abattoir Waste Water

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ABSTRACT

The menace of indiscriminate wastewater disposal has been an age long concern of every environmentalist. Moringa oleifera was used as a coagulant to treat wastewater and have been found to be effective. In this paper, a comparison has been made using Moringa oleifera extracts in its ordinary state and after extracting the oil content, in the treatment of Abattoir wastewater. Parameters investigated include both the chemical, physical and biological parameters before and after the treatment process. Jar test was conducted to obtain the optimum dosages in both cases.The optimum dosage obtained when 10% concentration of both ordinary and de-oiled moringa, hitherto identified by MPS (moringa powder solution) and MCS (moringa cake solution) respectively was 1.1mls.This was at the flocculation speed of 90 revolution per minute and in 1hour contact time. Soxhlet extraction was done to extract the Moringa oleifera oil using Hexane as solvent in the extraction process. Significant turbidity removal from 218.4NTU to 42NTU which translated to 80.77% was observed when de-oiled moringa was used, as compared with that of ordinary moringa which reduced from 218.4NTU to 68NTU being 68.86%. At 2hrs. contact time, pH reduced from 2.74% with the use of MPS to1.98% after using MCS. The BOD of 73.68% reduced to 68.42% at 90rpm when MCS and MPS were used in the treatment process respectively. Similar trend was observed in the other parameters considered. This research revealed that de-oiled moringa oleifera performed better in abattoir wastewater treatment as compared to ordinary moringa.The result was compared with the W.H.O standard and found to be within the acceptance limit.

KEYWORDS: *Waste Water, Moringa Oleifera, Abattoir,Ordinary, De-oiled,*

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I. INTRODUCTION

Wastewater discharge from slaughter houses constitute health hazard and pollution of the water bodies leading to the extinction of aquatic animals (Agravel et al; 1994, Kannan et al; 2008).This waste essentially composes of blood, urine, meat, soluble protein excretes, fats, feacal matter and assorted particles. These composition forms a good medium and substrates for the growth of pathogenic micro organisms which has been identified to endanger the health of man. (Kannan et al; 2008). The need to treat this wastewater for possible recycling is of paramount importance in providing healthy environment and eliminating the odor posed by this waste, in addition to its unaesthetic presentation. Most industries are unable to treat their waste products adequately due to the high cost of chemicals conventionally used in treating the wastewater being generated, this is in addition to the high exchange rates, beside these chemicals are eventually hazardous to health Jahn (1981,1986,1988). This has led to the exploring of alternative substances that are biodegradable, nontoxic, environmentally friendly and locally available. One of such is the moringa oleifera (Jahn, 1981; Kawamura, 1991; Grabow et al; 1985).Researchers have established that Moringa oleifera seed has high antimicrobial activity and strong coagulating properties for sedimentation of suspended particles in developing countries (. Studies have shown that the active ingredient responsible to making this substance an effective coagulant is the diametric cation peptides isoelectric point ranging between 10 and 11. (Gassen et al; 1990; Anwar et al, 2007; Jahn, 1981, 1986; Olsen, 1987). Gassenchmidt et al; 1991). This is a deciduous tree of the moringaceae family popularly referred to as the wonder tree, owing to its variety of applications which includes its medicinal value, as a cosmetics, due to amino acid content, minerals and vitamins (Fuglie, 2001; Laurence,1965). The leaves, fruits and flower of this tree forms one of the traditional diets in many countries. (Siddhuraju and Becker2003; Anhwange et al; 2004). The seed extract of this substance has been severally used to treat turbid water with high degree of success (Muyibi et al, 1995; Ndabigengersere et al, 1995).Furthermore, Muyibi et al (2002) had studied the effect of oil extraction from Moringa oleifera coagulant on raw water and have attained 97% turbidity removal.

Ademiluyi (1990),extracted the moringa oiled and used the cake to improve its sludge conditioning potential, after comparing its efficiency with the ordinary moringa, He concluded that the oil-free moringa has higher conditioning potential than the ordinary moringa. Suleyman et al; (2003).carried out a selective oil extraction and used the cake to treat raw water samples with an appreciable success. Whereas the researcher used petroleum ether as the solvent in the extraction process, in this work, hexane was preferred and used for the same purpose. The speed of flocculation was also varied to ascertain the speed that favors best flocs formation. In light of the success attained in treating wastewater and raw water samples, this work is set out to compare the treatment performance between the ordinary and de oiled moringa oleifera in abattoir wastewater treatment, with the view to identify the best form this substance should be used. When this is achieved, it will eliminate the odour, pollution and unaesthetic characteristics associated with slaughter houses and help the economy and hygiene of developing countries.

II. MATERIAL AND METHODS

2.1 Material Samplings.

Matured and dry moringa pods (30-60cm length) were collected, the seeds were removed and pounded manually using pestle and mortar, it was then sieved with 0.06mm BS sieve to obtain a fine powder, sealed in polythene bags. 120gms of the powdered moringa was weighed and shared into two equal portions. 60gms was subjected to oil extraction using electro thermal soxhlet extractor where hexane served as the solvent and the process executed. The cake after extraction was dried and crushed to form de-oiled moringa seed powder.

10grams of the ordinary moringa powder and of the de-oiled were made up to 100ml with distill water, mixed and filtered to obtain stock solutions respectively.

15litres of abattoir wastewater sample was collected from slaughter house drain path at Markurdi (by river Benue Bridge) by composite sampling method, into a cleaned rubber jerry can and brought to the Benue state water works laboratory for analysis. the initial waste water quality was determined in line with the standard method of waste water measurements (APHA, 1995).

2.2 Analysis

Jar test was performed to obtain optimum dosages using jar test apparatus JLT4 velp scientific. 500ml of abattoir wastewater were poured into 6 no. beakers of 600mls capacities, this set up was placed in a flocculator, the six paddles were lowered into it. Varying dosages by serial dilution method were applied and the machine was operated with speeds in revolution/min.

2.3 Preliminary investigations.

The initial wastewater quality was determined in line with the standard method of wastewater measurement APHA (1995).To determine the effect of the ordinary moringa seed powder and de-oiled moringa oleifera, samples of abattoir wastewater were measured in the 6 beakers of 500mls capacities and placed under flocculator. The paddles were lowered and the flocculator speed varied from 30 to 270 revolution/min. 10% moringa powder stock solutions (MPS) and moringa cake solutions (MCS) were prepared respectively. After filtering out this solution, varying doses ranging from 0.8-1.2 each were dropped into 5 of the six wastewater bakers respectively, and the flocculator was operated from 30min to 2hrs. The paddles were then lifted out of the samples to allow the flocks formed to settle.

2.3.1 Physical Qualities

The abattoir wastewater physical qualities were determined with particular reference to its temperature, turbidity, suspended solids, colour and odour. While the spectrophotometer HACH 1991 was used in determining the turbidity, suspended solids the total solids and colour. In which cases the abattoir wastewater was measured in a 25ml capacity bottles and placed in the sample cell, when the respective programmed numbers were entered, the reading was displayed in NTU and recorded

2.3.2 Chemical Qualities

Similarly, chloride and iron were determined by the use of spectrophotometer, pH meter HACK 1991 was used to determine the pH of the samples, and potassium permanganate was used in determining the chemical Oxygen Demand (COD) as recommended by (Hammer,1977).

2.3.3 Biological Qualities

Dissolve oxygen DO_2 (i) was determined using the oxygen meter model 71 by HACK. The probe was immersed into distilled water to adjust the reading. Subsequently the probe was immersed in the Abattoir wastewater and the reading recorded. The DO_2 (s) was also determined in similar manner. Subsequently the BOD was obtained by calculation.

2.3.4 Microbial Qualities

The Coliform counts were determined through the use MacConkey broth as a reagent with wastewater samples in bottles were incubated in an autoclave condition. The number of positive bottles were identified and recorded accordingly.

III. RESULTS AND DISCUSSION

Preliminary observations

Results revealed that the samples physical characteristics had initial turbidity of 218.4NTU, total dissolved solids, of 108.4mg/l, suspended solids had a value of 188mg/l and the total solids was 296.4mg/l. The sample temperature obtained was 32^{o}C while colour was 450pt$_0$ On assessing the chemical quality, result indicated that the sample had the pH of 6.58, hardness 240mg/l, Fe 2.42mg/l, chloride was 42.7mg/l and chemical oxygen demand (COD) 372mg/l. While in the case of the bacteriological, the DO_2 (i) was 4.4mg/l with the DO_2(ii) of 1.9mg/l and the calculated BOD was 152mg/l. The total coliform per 100ml of water was 1,800.
The results of the experimental analysis are as shown in figures 1-18. The assessed parameters indicating the performance of the treatment using moringa powder solution (MPS) and moringa cake solution (MCS) are presented and discussed.

Physical parameters

The increase in speed of flocculation which was varied from 30 to 270 revolutions per minute using 10% concentration of the solution had no significant effect on the temperature of the sample, seeing that the initial temperature 32^{o}C only resulted to a marginal change ranging between 30.9-31^{o}C. However, the result revealed optimal performance at 90rpm when either(MPS), or (MCS) was used as shown In fig.1-6. at this speed, the initial turbidity of 218.4NTU was significantly affected and reduced to as low as 38NTU when MCS was used which translates to 85.75% turbidity removal, as compared to the use of MPS, where the initial turbidity reduced to 42NTU being 80.77%. in the case of moringa powder solution (MPS). This optimum performance attained, could be attributed to the moderate agitation that enhances flocs formation commonly associated with this coagulant which agrees with the findings of Aho et al, (2012). Further increase in speed resulted into the loosening of the particles bonds The MCS being oil free provided easy flocs formation, this goes to show that the presence of oil in moringa oleifera interferes with the treatment efficiency, as the oil forms a coating round the substance and inhibit contact with the suspended particles in the treatment process. This speed further favors the agglomeration and subsequent settlement. The relatively low temperature of 30^{o}C at 1hr contact time recorded in the case of MCS must have enhanced the fast settlement of the flocs formed which agrees with former works that confirmed that at low temperature, particles have greater tendencies of settling.Contact time was also varied from 10mins to 2hrs after introduction of MPS and MCS respectively, An excellent performance was observed after 1hr contact time on using MCS, where the initial turbidity was reduced to as low as 10NTU which amount 95.4% and to 20NTU being 90.4% turbidity removal when MPS was used. The initial total solid also reduced to 40.2mg/l and 35.4mg/l being 81,71% and 85% in 1hr contact time when MPS and MCS were used respectively.

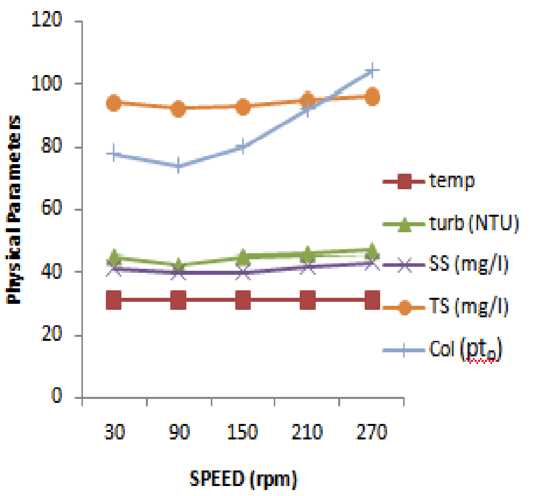

Fig 1: 10%mps, speed vs physical parameters

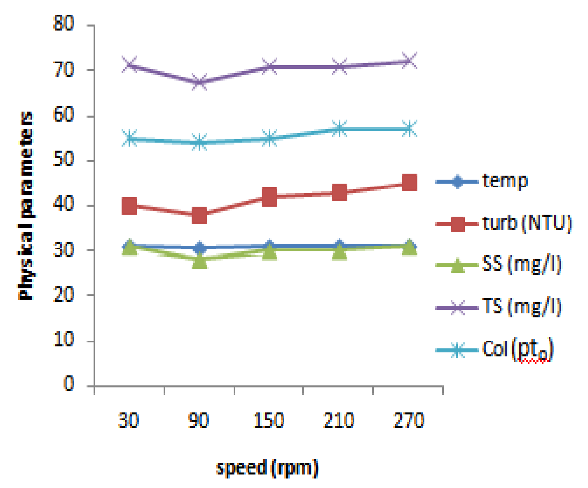

Fig. 4: 10%mcs. speed vs physical parameters.

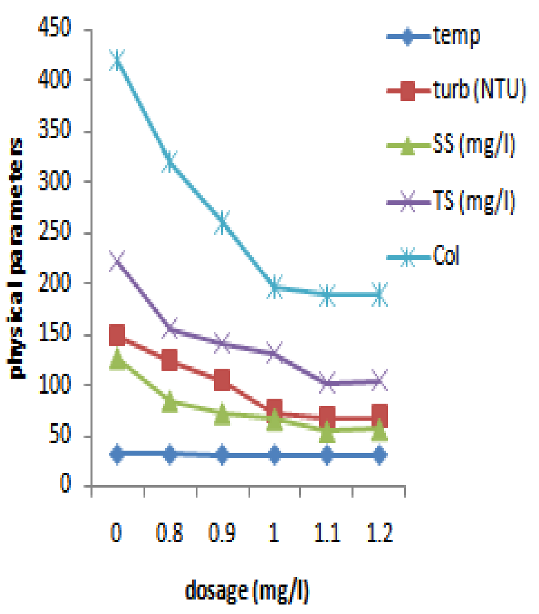

Fig. 7: 10%mps. dosage vs physical parameters.

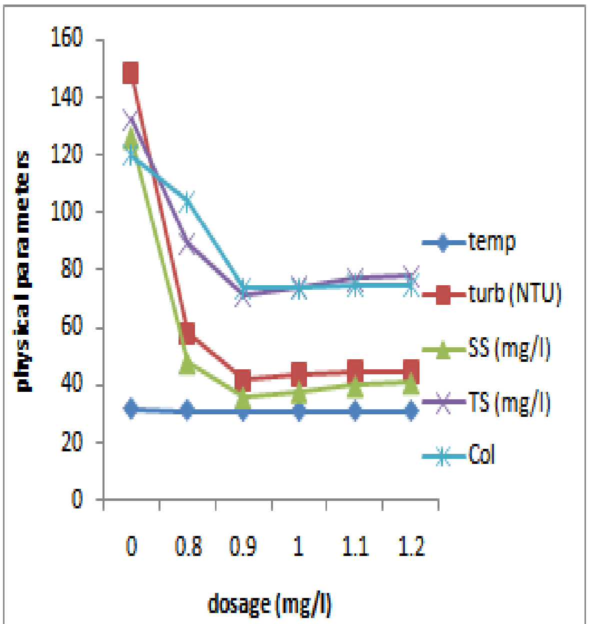

Fig. 10: 10%mcs. dosage vs physical parameters.

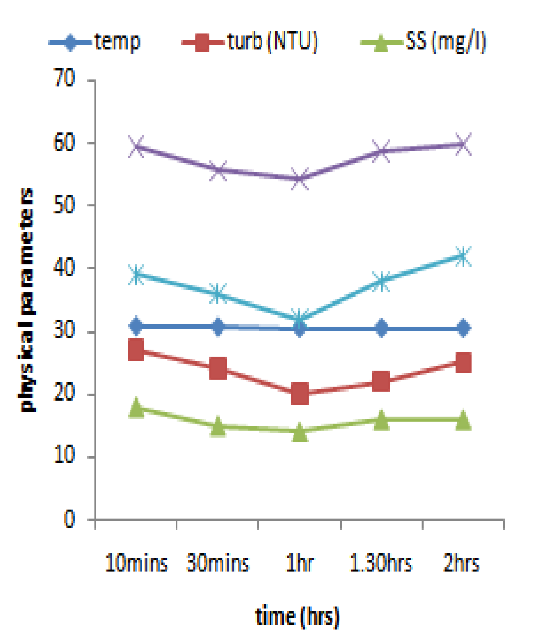

Fig.13: 10%mps. time vs physical parameters.

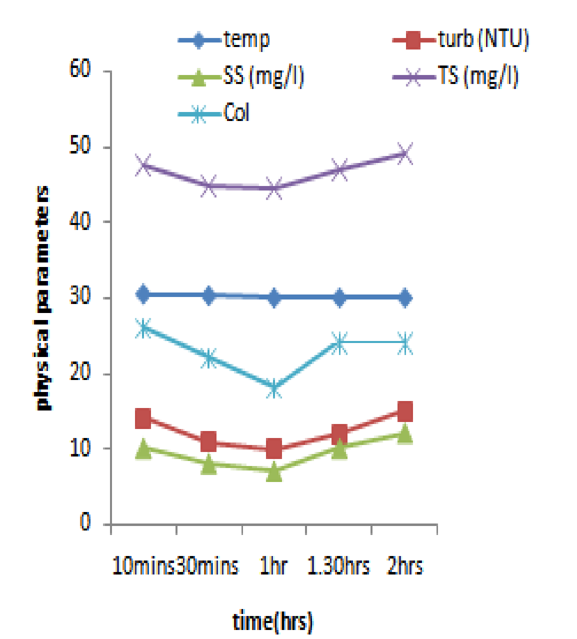

fig.16: 10%mcs. time vs physical parameters

3.3 Chemical Parameters

The chemical qualities assessed are the pH, iron, chloride and chemical oxygen demand using 10% concentration of MPS and MCS in fig. 7 to 12. The most significant of the abattoir waste water quality was at 1hr contact time when the initial COD dropped to 68NTU which translate 81.72% when MCS was used as compared with 80% reduction in the case of MPS. this optimum contact time resulted to a significant reduction in the organic matter present in the abattoir waste. the pH value reduced to 6.40 at 2hrs when MPS was used, as against the 6.45 recorded for MCS, this is a better improvement in the waste water quality treated with MCS whereas, with MPS the waste water tend to be more acidic indicating the presence of uric acid. the iron content which was initially low, further reduced to 0.28 and 0.32mg/l with the introduction of MCS and MPS respectively.

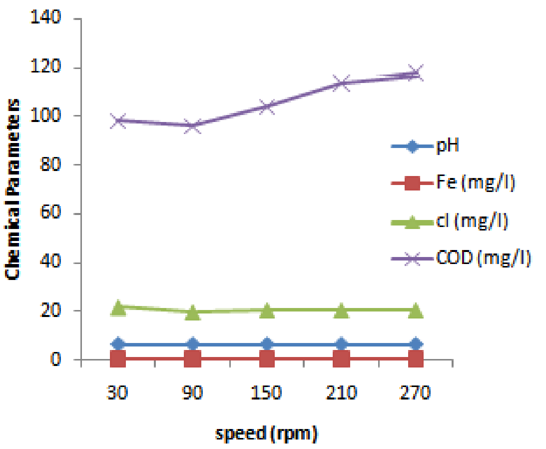

Fig 2: 10%mps. speed vs chemical parameters.

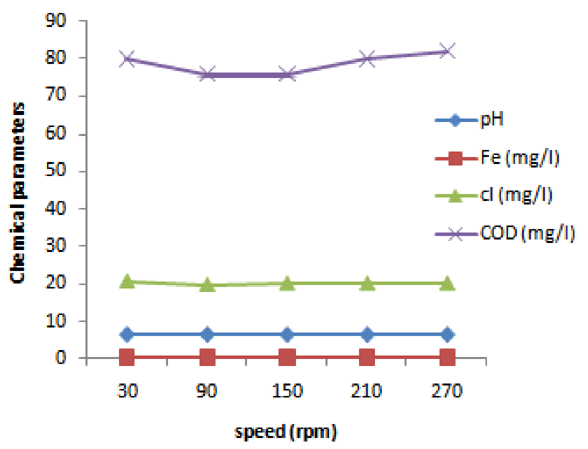

Fig. 5: 10% mcs. speed vs chemical parameters

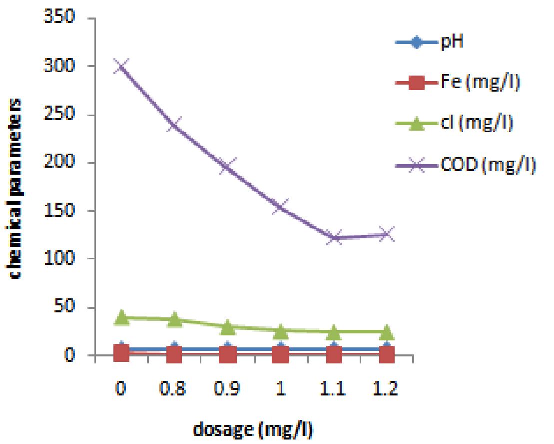

Fig. 8: 10%mps. dosage vs chemical parameters.

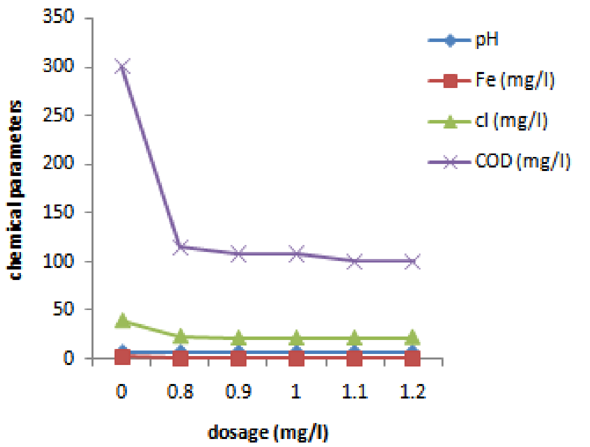

Fig.11: 10%mcs. dosage vs chemical parameters.

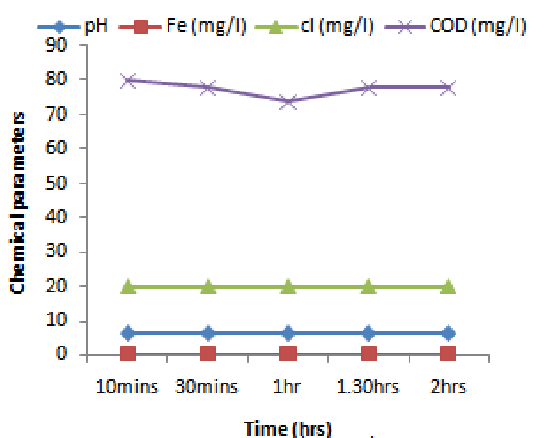

Fig. 14: 10%mps. time vs chemical parameters.

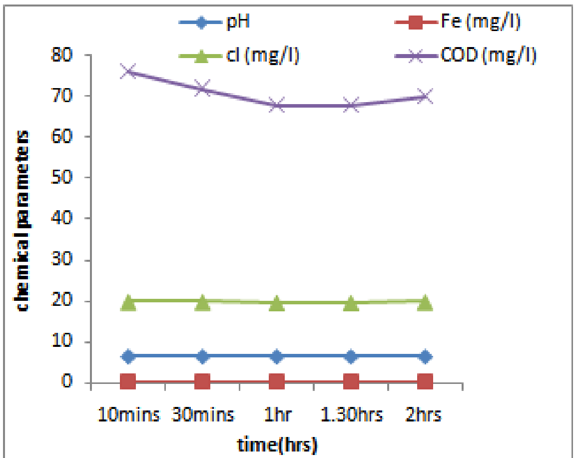

fig.17: 10%mcs. time vs chemical parameters.

3.4 Bacteriological parameters

The biological qualities investigated and treated are the coliform and BOD. the dose that resulted in the significant reduction of coliform bacteria was 1.1mg/l where the initial coliform of 1800cfu reduced to 170cfu being 90.56% when MPS was used whereas for MCS, it was reduced to 130cfu being 92.78%. However, the most significant coliform removal was attained at 1hr contact time after flocculating at 90rpm.In when case, with the introduction of MPS 97.94% reduction was attained and as high 99% bacteria removal was made possible using MCS. The efficiency demonstrated by these substance, is revolutionary as it is pointing at potential of its being used as a disinfectant in waste water treatment. Similarly the performance of this coagulant in reduction was highest in the case of MCS at the same speed of 90rpm within 1hr contact time were the initial BOD came down to 37mg/l and 34mg/l representing 75.65% and 77.68% using MPS and MCS respectively. This indicates that bacteria response to treatment requires more time.The contact time after flocculation at 90rpm was varied from 10min to 2 hours in this experiment and 1hr turned out to be adequate enough to clarify the abattoir waste water when either the MPS or MCS was used.

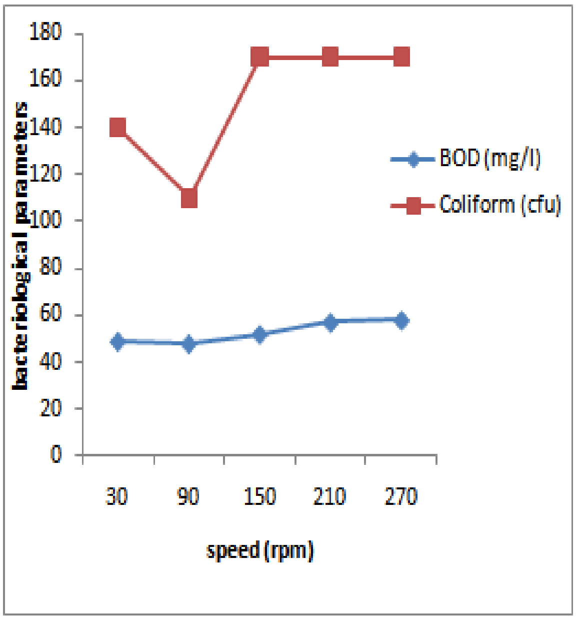

Fig.3 : 10%mps. speed vs bacteriological parameters.

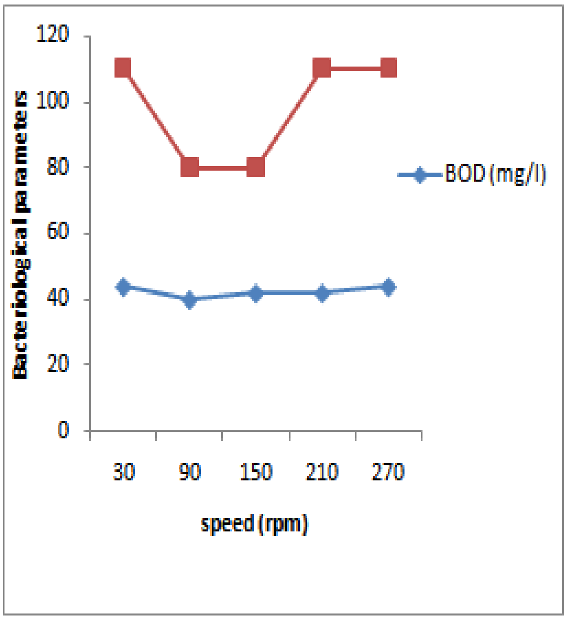

Fig. 6: 10%mcs. speed vs bacteriological parameters.

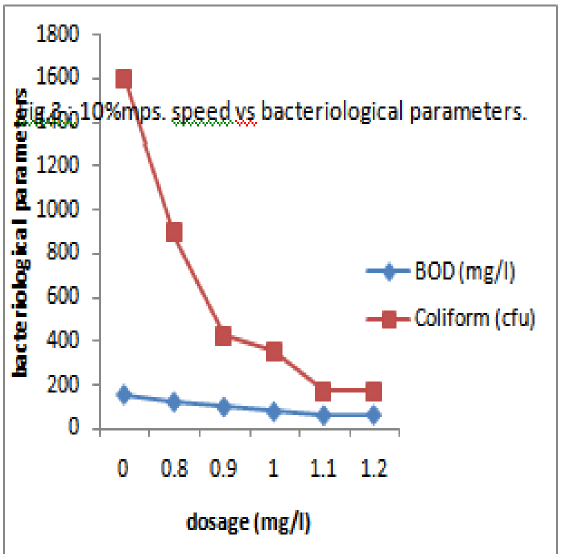

Fig. 9: 10%mps. dosage vs bacteriological parameters.

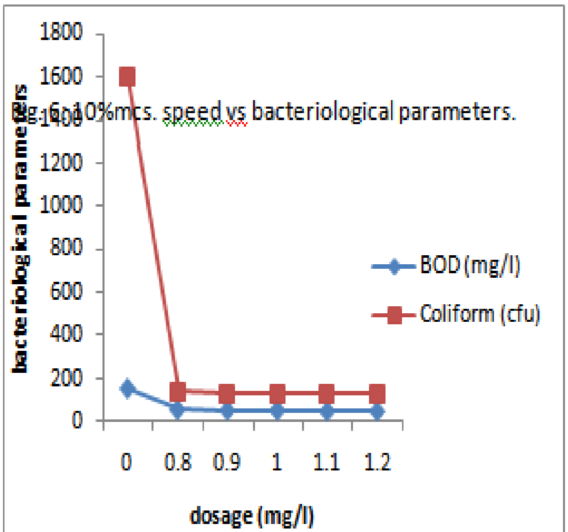

Fig.12: 10%mcs. dosage vs bacteriological parameters.

IV. CONCLUSION

The initial abattoir wastewater treated revealed high values of contaminant in all the parameter studied, capable of endangering the environment and hazardous to human and animal health.The results of the use of the de-oiled moringa oleifera in abattoir wastewater treatment revealed higher performance compared to the use of the ordinary moringa as can be seen from the figures presented. The use of either the ordinary or de-oiled moringa had very little effect on the pH of the abattoir wastewater. The Fe content in abattoir wastewater is generally low. The highest turbidity removal from 218.4NTU to as low as 68NTU which is attained with the use of MCS. This clearly shows that the oil content in moringa inhibits its treatment performances. The entire work revealed optimum dosage of 1.1mg/l, speed 90rpm and 1hr contact time to be optimum when 10% concentration of ordinary and de-oiled moringa oleifera was applied in the treatment process.It is however recommended that the concentration of the stock solution of ordinary and de-oiled moringa used in the abattoir wastewater treatment be increased to 20% in subsequent research to observe any possible improvement or not of the wastewater quality. The results obtained from this work compares favorably well with WHO standard.

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