



Full Length Research Article

BIO-COAGULATION OF CHICKEN ABATTOIR WASTEWATER USING MORINGA OLEIFERA LEAVES

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ABSTRACT

In this study an attempt was made to use a bio coagulant for treating chicken abattoir waste water. Moringa Oleifera Leaves were used in two different forms- one in the form of Moringa Oleifera Leaves Powder (MOLP) and the other in the form of Activated Carbon prepared from Moringa Oleifera Leaves (MOLAC). Before and after treatment of chicken abattoir wastewater with Moringa Oleifera Leaves Powder and Activated Carbon prepared from Moringa Oleifera Leaves, samples were analyzed for different parameters like turbidity, Total Solids, Total Suspended Solids, BOD, COD, Oil and grease, Total Nitrogen, Electrical Conductivity etc. All parameters were reduced with treatment using Activated Carbon prepared from Moringa Oleifera Leaves. Moringa Oleifera Leaves Powder was also found to be effective in reduction of parameters like turbidity, Oil and grease, Total Nitrogen and Electrical Conductivity. But some parameters like BOD and COD of treated abattoir wastewater was found to be more than the initial values.

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INTRODUCTION

In the present scenario, due to the swelling population, a high demand for water resources and water reuse has surfaced in both urban and rural areas. The inflated industrial activities augmented the water requirement multifold as well as the quantity of waste water discharged. This up heaved the importance of treating the industrial wastewater in a higher degree and reusing it for all uses except drinking and other domestic needs. In this work, an attempt has been made to treat chicken abattoir wastewater using a bio coagulant-Moringa Oleifera Leaves. Moringa Oleifera seeds are famous for its properties as a natural coagulant, adsorbent and antimicrobial agent. Leaves of Moringa Oleifera are also found to be possessing most of these properties.

Objectives of the Study

- To analyze the feasibility of Moringa Oleifera Leaf powder as a coagulant for treating slaughter house effluent.

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- Prepare activated Moringa Oleifera leaf powder and use it for treatment of Chicken slaughter house wastewater.
- Compare the results of MOLAC and MOLP.

MATERIALS AND METHODS

- Collection of Sample: - Samples were collected from the equalization tank of a chicken slaughter house before any treatment was given. Therefore the wastewater is termed as Raw Chicken abattoir wastewater.
- Preserving the Sample: - Till the analysis was conducted, samples were preserved at 4^o C.
- Analysis:-The important characteristics of the waste water were analyzed. Parameter selected for the study were Turbidity, Conductivity, 3-day BOD
- at 27^oC, COD, Total Suspended Solids, Oil and Grease and Total Nitrogen. Standard methods prescribed by APHA were followed for the analysis.
- Preparation of Moringa Oleifera Leaf powder (MOLP):- Moringa Oleifera leaves were hand plucked from a house garden in Bangalore. Small twigs and yellow colored leaves were removed. It was sundried for 15 days. The

dried leaves were crushed to a medium fine powder in grinder. MOLP retained in 150 μ sieve and passed through 300 μ sieve were used. The fine powder was used as coagulant for analysis.

- Preparation of activated carbon from Moringa Oleifera leaves (MOLAC): 5g of dried leaves were cut into small pieces, taken in the crucible and heated in oven at 400 $^{\circ}$ C for 15 minutes. The carbon thus produced was thoroughly washed. It was then hot air oven dried at a temperature of 105 $^{\circ}$ C. The activated Moringa Oleifera leaves were slightly crushed and used as a coagulant.
- Jar Test: Analysis of optimum dosage of coagulant was done using jar test apparatus. Jar test was conducted with varying quantities of Moringa Oleifera leaf powder (MOLP) and with Activated Carbon prepared from Moringa Oleifera Leaves (MOLAC) under uniform pH and temperature.
- Analysis of Treated Effluent:-After jar test, the samples were again analyzed to find turbidity, Total Solids, Total Suspended Solids, BOD, COD, Oil and grease, Total Nitrogen, Electrical Conductivity etc to find the change in parameter.

RESULTS AND DISCUSSION

The wastewater from chicken abattoir was analyzed to understand the basic characteristics of wastewater in terms of parameters like pH, colour, turbidity, Total Solids, Total Suspended Solids, BOD, COD, Oil and grease, Total Nitrogen, Electrical Conductivity, Iron and Copper.

The results of the analysis are tabulated in Table 1.

Table 1. Initial analysis of Raw chicken abattoir wastewater

Sl No.	Parameters	Units	State Pollution Control Board Standards	Raw Chicken Abattoir Wastewater
1	pH	--	5.5 – 9.0	7.12
2	Colour	--	Agreeable	Light Pink
3	Turbidity	NTU	2.0 Max	41.40
4	Conductivity	μ mhos/cm	2250 Max	7650.0
5	Iron as Fe	mg/l	3.0 Max	1.8
6	BOD ₅ at 27 $^{\circ}$ C	mg/l	10 Max	1300.0
7	COD	mg/l	250 Max	2000.0
8	Total Suspended Solids	mg/l	30 Max	87.6
9	Oil and Grease	mg/l	10 Max	1023.0
10	Total Nitrogen	mg/l	100 Max	321.0
11	Copper as Cu	mg/l	3.0 Max	0.9

Source: Karnataka State Pollution Control Board Standards (KSPCB)

From the table it is clear that parameters like colour, turbidity, Conductivity, BOD, COD, Total Suspended Solids, Oil and Grease content and Total Nitrogen of the chicken abattoir wastewater are more than KSPCB Standards. Whereas pH, Iron as Fe and Copper as Cu are well within the permissible limits prescribed by KSPCB.

- Tests carried out with MOLP (Moringa Oleifera Leaf Powder)

Jar tests were performed to obtain the optimum dosage of MOLP. Tests had shown that the best dosage of MOLP is in the range of 0.75g/l to 1.5g/l of chicken abattoir wastewater. The initial turbidity of waste water had been reduced in the range of 8% to 36% after using MOLP as a coagulant.

Figure 1 shows the variation in the reduction of turbidity with respect to various MOLP dosages. The various parameters of raw abattoir waste water were found to vary with the treatment of MOLP. The following test results gives an insight into the change in parameters occurred after the treatment of chicken slaughter house waste water with MOLP.

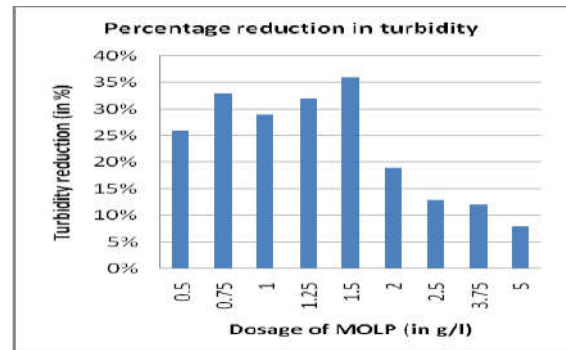


Fig. 1. Percentage reduction in turbidity with varying MOLP dosages

Some parameters like BOD, COD and Total Suspended Solids were found to be more after the treatment. On the other hand, some parameters which cannot be easily removed, like turbidity, oil and grease, total nitrogen and Electrical Conductivity had greatly reduced after treatment with MOLP. Oil and grease content was reduced to 777mg/l from 1023 mg/l(24%). Turbidity was reduced from 35 to 7 NTU (79%). EC reduction was from 7.65mmhos/cm to 6.2mmhos/cm (18%) and Total Nitrogen content reduced from 321 mg/l to 16.8 mg/l (95%).

The BOD content of treated wastewater increased from 1300 to 1430 mg/l. COD content increased to 2200mg/l from 2000mg/l and total solids also increased from 85 to 415 mg/l.

- Tests carried out with MOLAC (Activated Carbon prepared from Moringa Oleifera Leaves)

Next round of tests were carried out with Activated Carbon prepared from MO Leaves (MOLAC). Optimum dosage of MOLAC was found to be between 1g/l -2g/l. Turbidity of the chicken abattoir wastewater was found to be reduced in the range of 80 to 85%. The test revealed that MOLAC is an excellent bio-coagulant which reduces turbidity, BOD, COD, EC, oil and grease content, TSS and total nitrogen.

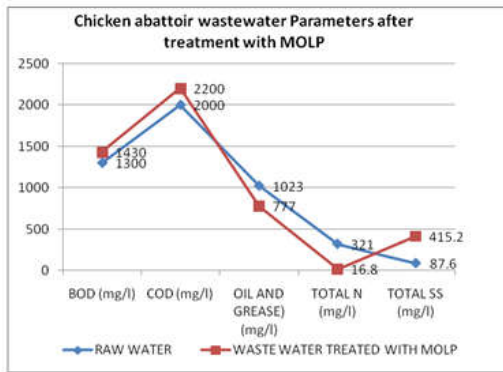


Fig. 2. Test result after treatment with MOLP

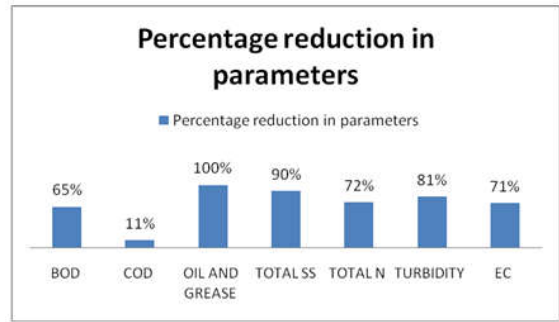


Fig. 6. Reduction in parameters after treatment with MOLAC

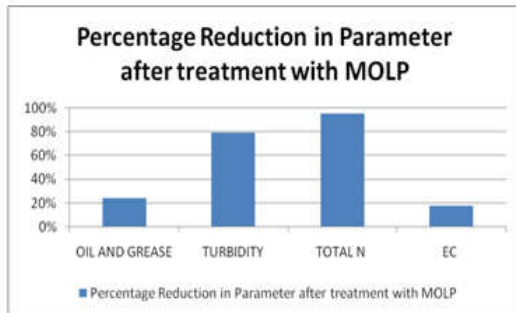


Fig. 3. Reduction in parameters after treatment with MOLP

- Comparison of MOLP with MOLAC:

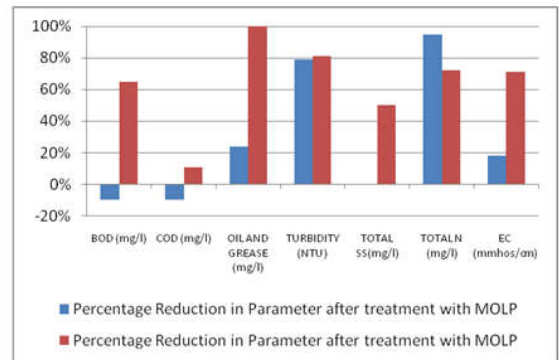


Fig. 7. Comparison between MOLP and MOLAC-Percentage reduction in parameters

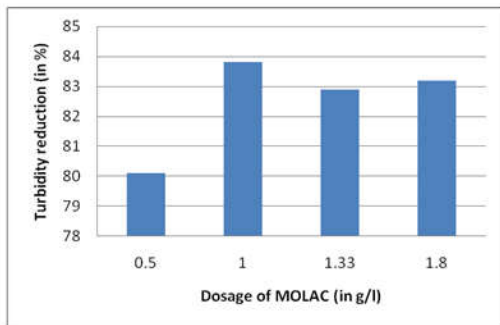


Fig. 4. Turbidity reduction with MOLAC

The initial electrical conductivity of wastewater was decreased from 7650 micromhos/cm to 2254 micromhos/cm (71%). While BOD had decreased from 1300 mg/l to 450 mg/l (65%), COD had decreased from 2000 mg/l to 1788.8 mg/l (11%). This had also decreased oil and grease content to a great extent from 1023 mg/l to 2.4 mg/l (almost 100%). While turbidity had decreased from 35.15 NTU to 6.8 NTU (81%) and TSS had decreased from 87.6 mg/l to 8.6 mg/l (90%), Total Nitrogen had decreased from 321 mg/l to 88.4 mg/l (72%).

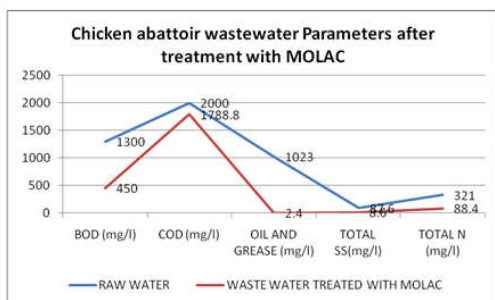


Fig. 5. Test result after treatment with MOLAC

The trials with MOLP had decreased the following parameters; Electrical conductivity decreased by around 18%. Oil and grease content of waste water was decreased by 24%. Total nitrogen content was also reduced by 94.8%. But some parameters like BOD, COD and TSS was found to have increased after the treatment. This slight increase in certain parameters could have happened owing to the organic nature of MO. The analysis of various parameters after tests conducted with MOLAC had shown a dramatic change in most of the parameters. Electrical conductivity had reduced by 70.54%, BOD had reduced by 65.38%, COD reduction was by 10.56%, oil and grease content by 99.76%, TSS reduction was by 90% and total nitrogen content was reduced by 72.46%. This result shows that MOLAC is an excellent solution for treating chicken abattoir waste water.

Conclusion

Moringa Oleifera Leaves are an environmentally-affable natural coagulant suitable for the treatment of waste water containing undesirable parameters like BOD, COD, EC, Total Nitrogen etc. Founded on the experimental test results; the following conclusion can be drawn.

- The best dosage of MOLP in treatment of chicken slaughter house waste water is in the range of 0.75g/l to 1.5g/l.
- The initial turbidity of waste water had been reduced in the range of 8% to 36% after using MOLP as a coagulant.

- Some parameters like BOD, COD and Total Suspended Solids were found to be more after the treatment with MOLP. This may be due to the organic nature of MOLP. On the other hand, some parameters which cannot be easily removed, like turbidity, oil and grease, total nitrogen and Electrical Conductivity had greatly reduced after treatment with MOLP.
 - The trials with MOLP had decreased the following parameters; Electrical conductivity decreased by around 18%. Oil and grease content of waste water was decreased by 24%. Total nitrogen content was also reduced by 94.8%.
 - MOLAC is found to be an excellent bio-coagulant which reduces turbidity, BOD, COD, EC, oil and grease content, TSS and total nitrogen.
 - Optimum dosage of MOLAC was found to be between 1g/l -2g/l. Turbidity of the chicken abattoir wastewater was found to be reduced in the range of 80 to 85%.
 - After treatment with MOLAC, Electrical conductivity had reduced by 70.54%, BOD had reduced by 65.38%, COD reduction was by 10.56%, oil and grease content by 99.76%, TSS reduction was by 90% and total nitrogen content was reduced by 72.46%.
 - Future studies should be conducted to see how to bring the parameters to the limits prescribed by KSPCB
- REFERENCES**
- Ameen Sarairah; Characterization and Assessment of Treatability of Wastewater Generated in Amman Slaughterhouse (Dirasat, Engineering Sciences, Volume 35, No. 2, 2008).
- Facundo Dagoberto Morales Avelino, R. Mendez Novelo, M. Tamayo., Treatment of slaughterhouse wastewater using *Moringa Oleifera* lam seeds as coagulant, *Tropical and Subtropical Agroecosystems*, vol 10, pg 523-529, 2009.
- Harush D P, Hampannavar V. S Mallikarjun. Treatment of chicken slaughter house waste water using aerobic biodegradable coagulants, *IJESR*, VOL 1, 2011, page 23-26.
- Malusare C.N, Prof. Milind R. Gidde; Study of *Moringa oleifera* Extracts in Water Treatment, National Seminar Vision 2025-Technological Developments in Biological Sciences, Pg 17-19, January 2011.
- Mangale Sapana M., Chonde Sonal G and Raut P D., Use of *Moringa Oleifera* (Drumstick) seed as Natural Absorbent and an Antimicrobial agent for ground water treatment., *Research Journal of Recent Sciences*, Vol 1(3), pg 31-40, March 2012.
- Nikolaeva, S. Sánchez, E. and Borja, R. Chicken slaughter house Wastewater Treatment by Anaerobic Fixed bed Reactors from Laboratory to pilot-scale plant: A case study in Costa Rica Operating at Ambient Temperature.
- Prashant A. Kadu1, Rajshree B. Landge and Y. R. M. Rao Treatment of chicken slaughter house wastewater using rotating biological contactors
- R Rajkumar, T Meenamahal, J Rajeshbanu; 2010 Treatment of Poultry Slaughterhouse Wastewater in upflow anaerobic filter under low upflow velocity. Engine Division, Hindustan Aeronautics Ltd., Bnagalore- 560093, Karnataka.
- Shannyn Snyder M.A., Interdisciplinary Studies (Concentrations: Anthropology and Global Health), George Mason University, B.A., Political Science, George Mason University. Article- Water in crisis – India (2010).
- T.Sumathi and G. Alagumuthu; Adsorption Studies for Arsenic Removal Using Activated *Moringa Oleifera*, PG & Research Centre, Department of Chemistry, Sri Paramakalyani College, Alwarkurichi 627 412, India;
