International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

A COMPARATIVE STUDY ON MUSA PARADISIACA, ORYZA SATIVA AND ARACHIS HYPOGAEA IN TREATMENT OF TEXTILE WASTEWATER

R.Abiramy[1], L.Mekala[2]

[1]PG Scholar, Erode Sengunthar Engineering College, Perundurai, Tamilnadu, India
[2]Assistant Professor, Department of Civil Engineering, Erode Sengunthar Engineering College, Perundurai,

---

Abstract- *Textile industry is one of the most important and rapidly developing industrial sectors. The present study involves the applicability of Musa paradisiaca and Oryza sativa as an adsorbent for the removal of pH and TDS from textile wastewater. In this study a naturally available materials such as Musa paradisiaca andOryza sativa were collected and prepared to the required grade in laboratory. Batch adsorption experiments were carried out to optimize the influencing parameters such as contact time, adsorbent dosage, pH. The removal efficiency for pH by using Musa paradisiaca in Collection Tank was found to be 8 with a dosage of 5 g/l for a contact time of 180 minutes. Similarly at optimum conditions TDS removal was 86.5% respectively.*
The removal efficiency for pH by using Oryza sativa in Collection Tank was found to be 8 with a dosage of 5g/l for a contact time of 150 minutes. Similarly at optimum conditions TDS removal was 82.3% respectively. The pH removal performances in Collection Tank were compared and the adsorption capacities followed the order: Oryza sativa >Musa paradisiaca. The TDS removal performances in Collection Tank were compared and the adsorption capacities followed the order: Musa paradisiaca > Oryza sativa.

Keywords: Textile Effluent, Musa paradisiaca, Oryza sativa, pH, Colour, TDS.

Introduction

Textile industry in India

Indian Textile Industry has earned a unique place in our country. It is among one of the industries which were earliest to come into existance in india. It accounted for 14% of the total industrial production, contributes to nearly 30% of the total exports and is the second largest employment generator after agriculture. This industry provides one of the most basic needs of people and holds importance; maintaining sustained growth for improving quality of life. It has an image of self-reliant industry, from the production of raw materials to the delivery of finished products,with substantial value-addition at each stage of processing which forms a major contribution to the country's economy. Indian textile industry is one of the leading in the world. The Indian government has come up with a number of export promotion policies for the textiles sector. It has also allowed 100 per cent FDI in the Indian textiles sector under the automatic route. The future for the Indian textile industry looks promising, buoyed by both strong domestic consumption as well as export demand. With consumerism and disposable income on the rise,the retail sector has experienced a rapid growth in the past decade with the entry of several international players like Marks & Spencer, Guess and Next into the Indian market. The apparel market in India is estimated to grow at a Compound Annual Growth Rate (CAGR) of 11.8 per cent to reach US$ 180 billion by 2025.

Principles of adsorption

Adsorption may be defined as the process of accumulation of any substance giving higher concentration of molecular species on the surface of another substance as compared to that in the bulk. When a solid surface is exposed to a gas or a liquid, molecules from the gas or the solution phase accumulate or concentrate at the surface. The phenomenon of concentration of molecules of a gas or liquid at a solid surface is called adsorption. It is a well established and powerful technique for treating domestic and industrial effluents.

Adsorbate: The substance that concentrates at the surface is called adsorbate.

Adsorbent: The material upon whose surface the adsorption takes place is called an adsorbent.

2. MATERIALS AND METHODOLOGY

Collection of sample wastewater

The raw textile effulent wastewater has been collected.The effulent was collected from collection tank and secondary tank. After that the collected samples were brought to the laboratory and the samples are stored in deep freezer at 4°C°° until analysis.

Adsorbent collection & preparation Musa Paradisiaca Adsorbent

The Banana Peel (Musa paradisiaca) also called banana skin is the outer covering of the banana fruit. The peel were collected and dried using hot air oven at 105° C for 4 hours and activated in muffle furnace at 650° C for 20 mins.

Then, the sample is sieved by a series sieves, the powder used for the experiments having a granulations of 600 micron.

Fig 1: Dried Banana peel Activated Banana peel Oryza Sativa Adsorbent

Rice straw (Oryza sativa) is the vegetative part of the rice plant, cut at grain harvest or after. It may be burned and left on the field before the next ploughing. The straw were collected and dried using hot air oven at 105° C for 4 hours and activated in muffle furnace at 650° C for 20 mins. Then, the sample is sieved by a series sieves, the powder used for the experiments having a granulations of 600 micron.

Fig 2: Dried Rice straw Activated Rice straw Arachis Hypogaea Adsorbent

The peanut (Arachis hypogaea) are the newly thought adsorbent because of their extended surface area, micro porous structure, high adsorption capacity and high degree of reactivity. The husk were collected and dried using hot air oven at 105° C for 4 hours and activated in muffle furnace at 650° C for 20 mins. Then, the sample is sieved by a series sieves, the powder used for the experiments having granulations of 600 micron.

Fig 3: Dried Peanut husk Activated Peanut husk

3. RESULTS AND DISCUSSION

General

The experimental work on the textile wastewater was planned to determine the optimum adsorbent required for the removal of TDS. The sample was collected. Then the same waste water sample was analyzed to determine the physico-chemical parameters present in it.The physico-chemical parameter determined are pH, colour, TDS, COD, BOD are compared with the raw effluent.

Physicochemical parameters

Table 3.1 Characterization of textile wastewater

S.No.	COLLECTION TANK	SECONDARY TANK
Odour	Unpleasant	Unpleasant
Colour (Hazen unit)	Dark Brown	Yellow
pH	10	12
TDS (mg/l)	9900	2420
BOD (mg/l)	820	540
COD (mg/l)	1900	750

Effect of contact time on pH

Effect of Contact Time with Adsorbents in Collection Tank

Initial pH of collection tank was 10 and it is seen that the dosage of 5 g/l had a effect on final pH of the water (pH value are 7.5, 7.5, 8). This result implements that the pH value has been gradually decreased due to the effect of adsorbents in the collection tank. The adsorbent materials (Musa Paradisiaca, Oryza Sativa, Peanut husk) are added and varying the contact time from 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 390 minutes and at 180, 150, 210 minutes, the pH value comes to standard.

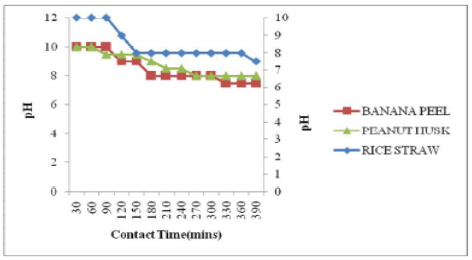

Fig 4: pH effect on Collection Tank with adsorbents

In figure 3.1, the result showed that using adsorbent materials (Musa Paradisiaca, Oryza Sativa, Peanut husk), the pH value decreases when the contact time increases for a dosage of 0.1 g/20ml. The optimum contact time for reducing the pH value is 180, 150, 210 minutes.

Effect of contact time on TDS

Effect of Contact Time with Adsorbents in Collection Tank

Initial TDS of collection tank was 9900 mg/l and it is seen that the dosage of 5 g/l. The mixing was filtered through centrifugal force. The result shows that the higher TDS removal efficiency (90 % with Musa Paradisiaca, Oryza Sativa and 47.8% with Peanut husk). This result implements that the TDS removal efficiency has been gradually increased due to the effect of adsorbents in the collection tank. The adsorbent materials (Musa Paradisiaca,Oryza Sativa, Peanut husk) are added to collection tank wastewater and varying the contact time from 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 390 minutes. The maximum removal efficiency was attained at 60, 60, 150 minutes.

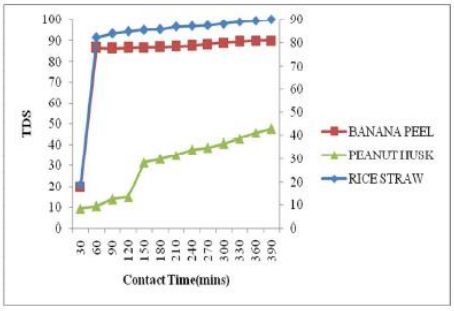

Fig 5: TDS effect on Collection Tank with adsorbents

In figure 3.2, the result showed that using adsorbent materials. The TDS removal efficiency increases with increase in contact time for a dosage of 0.1 g/20ml. The maximum TDS removal efficiency was 86.5% at 60 minutes with Musa Paradisiaca as an adsorbent, 82.3% at 60 minutes with Oryza Sativa as an adsorbent and 31.5% at 150 minutes with Peanut husk as an adsorbent.

Effect of contact time on pH

Effect of Contact Time with Adsorbents in Secondary Tank

Initial pH of collection tank was 12 and it is seen that the dosage of 5 g/l had a effect on final pH of the water (pH value are 8, 8, 8.5). This result implements that the pH value has been gradually decreased due to the effect of adsorbents in the collection tank. The adsorbent materials (Musa Paradisiaca, Oryza Sativa, Peanut husk) are added and varying the contact time from 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 390 minutes and at 330, 330, 270 minutes, the pH value comes to standard.

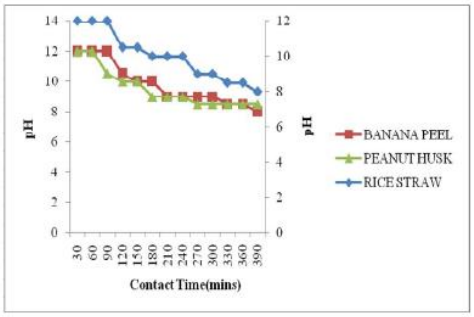

Fig 6: pH effect on Secondary Tank with adsorbents

In figure 3.3, the result showed that using adsorbent materials (Musa Paradisiaca, Oryza Sativa, Peanut husk), the pH value decreases when the contact time increases for a dosage of 0.1 g/20ml. The optimum contact time for reducing the pH value is 330, 330, 270 minutes.

Effect of contact time on TDS

Effect of Contact Time with Adsorbents in Secondary Tank

Initial TDS of collection tank was 2420 mg/l and it is seen that the dosage of 5 g/l. The mixing was filtered through centrifugal force. The result shows that the higher TDS removal efficiency (59.8 % with Musa Paradisiaca, 60.7% with Oryza Sativa and 38.6% with Peanut husk). This result implements that the TDS removal efficiency has been gradually increased due to the effect of adsorbents in the collection tank. The adsorbent materials (Musa Paradisiaca, Oryza Sativa, Peanut husk) are added to secondary tank wastewater and varying the contact time from 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 390 minutes. The maximum removal efficiency was attained at 390 minutes with adsorbents.

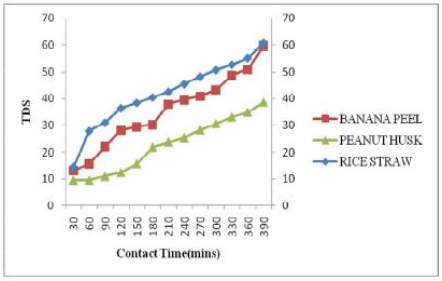

Fig 6: TDS effect on Secondary Tank with adsorbents

In figure 3.4, the result showed that using adsorbent materials. The TDS removal efficiency increases with increase in contact time for a dosage of 0.1 g/20ml. The maximum TDS removal efficiency was 59.8% at 390 minutes with Musa Paradisiaca as an adsorbent, 60.7% at 390 minutes with Oryza Sativa as an adsorbent and 38.6% at 390 minutes with Peanut husk as an adsorbent.

4. CONCLUSION

General

In this work an attempt is made to study the uses of the natural adsorbents Musa Paradisiaca, Oryza Sativa and Peanut Husk on the reduction of the excess physico-chemical parameters present in the waste water.

- The physico-chemical parameters are treated with the help of the natural adsorbents, were the parameters like pH, colour, Total Dissolved Solids (TDS).
- The adsorption test was conducted to test the level of pH and TDS present in the waste water. Here 20 ml of waste water samples are taken in 78 beakers and the adsorbents are added at a rate of 0.1g/20 ml in each beaker respectively.
- The samples with added adsorbents are stirred for the formation of floc. Then, the samples are kept undisturbed for varing contact time such as 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360, 390 minutes for better removal of pH and TDS from waste water. Here, it is concluded that the optimum contact time for removal of pH and TDS from collection tank with the adsorbent Musa Paradisiaca are 180 mins and 60 mins. The removal efficiency of TDS at 60 mins is 86.5%. The optimum contact time for removal of pH and TDS from collection tank with the adsorbent Oryza Sativa are 150 mins and 60 mins. The removal efficiency of TDS at 60 mins is 82.3%.
- The optimum contact time for removal of pH and TDS from collection tank with the adsorbent Peanut Husk are 210 mins and 150 mins. The removal efficiency of TDS at 150 mins is 31.5%.
- The optimum contact time for removal of pH and TDS from secondary tank with the adsorbent Musa Paradisiaca are 330 mins and 390 mins. The removal efficiency of TDS at 390 mins is 59.8%. The optimum contact time for removal of pH and TDS from secondary tank with the adsorbent Oryza Sativa are 330 mins and 390 mins. The removal efficiency of TDS at 390 mins is 60.7%.
- The optimum contact time for removal of pH and TDS from secondary tank with the adsorbent Peanut Husk are 270 mins and 390 mins. The removal efficiency of TDS at 390 mins is 38.6%.
- The results shows that the adsorbents shows better adsorption capacity in collection tank than the secondary tank.

REFERENCES

[1] Aakanksha Darge and Mane S. J. (2013), 'Treatment of Industrial Wastewater by using Banana Peels', International Journal of Science and Research, Vol. 4, Issue 7, pp.2319-7064.

[2] Annadurai G., Juang R. and Lee D. (2003), 'Use of cellulose based wastes for adsorption of dyes from aqueous solutions', Journal of Hazardous Materials, Vol. B92, pp 263-274.

[3] Ashraf (2011), 'Banana peels get a second life as water purifier, Banana Peel Applied to the Solid Phase Extraction of Copper and Lead from River Water: Preconcentration of Metal Ions with a Fruit Waste', Industrial & Engineering Chemistry Research, Vol. 2, pp.1231-1236.

[4] Ashraful Islam and Arun Kanti Guha (2013), 'Removal of pH, TDS and Color from Textile Effluent by Using Coagulants and Aquatic/Non Aquatic Plants as Adsorbents', Journal of Resources and Environment, Vol.3, Issue.5, pp.101-114.

[5] Brahmaiah T., Spurthi L., Chandrika K., Ramanaiah S. and Sai Prasad K. S. (2015), 'Kinetics of Heavy Metal (Cr & Ni) Removal from the Wastewater by using Low Cost Adsorbent', Sri Jayachamarajendra College of Engineering, Mysore, pp. 210-235.

[6] Emad S. Elmolla, W. Hamdy, A. Kassemand A. Abdel Hady (2015), 'Comparison of different rice straw based adsorbents for chromium removal from aqueous solutions', International Journal of Science and Research, Vol. 20, pp.6991-6999.

[7] Eric R. Mortensen, Tzahi Y. Cath, Jonathan A. Brant, Keith E. Dennett and Amy E. Childress (2007), 'Evaluation of adsorbents for Reducing Total Dissolved Solids Discharged to the Truckee River', Vol. 10, pp.12 1-136.

[8] 8. Feroz S., Thuraiya Mahir Al Khusaibi, Joefel Jessica Dumaran, Geetha Devi M. and Nageswara Rao L. (2015), 'Treatment of Dairy Wastewater using Banana Peels', Journal of Chemical and Pharmaceutical Research, Vol. 7, No.4, pp.1385-1391.

[9] Hossain and Marco A. (2012), 'Removal of copper from water by adsorption onto banana peel as bioadsorbent', Int. J. Adv. Res., Vol. 4, pp.520-525.

[10] Kevin Baik and Jun Noh (2009), 'Extraction of Bio-Ethanol from Wasted Bio-Wastes through the Process of Fermentation and Distillation', California State Science Fair Project Summary, pp.1-5.

[11] Mebrahtom Gebresemati and Alula Gebregergs (2014), 'Optimized ethanol production from banana peels', Journal of Scientific and Industrial Research, Vol. 9, pp.102-115.

[12] Mirghani M. E. S., Kabbashi N. A. , Qudsieh I. Y. and Elfaki F. A. (2008), 'A new method for the determination of toxic dye using FTIR spectroscopy', IIUM Eng Journal, Vol. 9, No.2, pp.1-94.

[13] Mohapatra D., Mishra S. and Sutar N. (2010), 'Banana and its byproduct utilization: an overview', Journal of Scientific and Industrial Research, Vol. 69, pp.323-329.

[14] Morris Schnitzer, Carlos M. Monreal and Erin E. Powell (2013),'Rice straw biomass: A resource for high-value chemicals', International Journal of Research, Vol. 3, pp.51-67.

[15] Nandita Sarker Dr. and Fakhruddin A. N. M. (2015), 'Removal of phenol from aqueous solution using rice straw as adsorbent', Appl water sci, Vol. 10, pp.320-324.

[16] Nidhi Jain Dr. (2015), 'Removal of Heavy Metal by using different Fruit Peels, Vegetable Peels and Organic Waste – A Review', International Journal of Advanced Research, Vol. 3, Issue.11, pp.916 - 920.

[17] Ogidi O. I., Okereke J. N. and Dr. Obasi K. O. (2016), 'Biosorption of Cd and Pb in Textile Effluent Using Banana Peels', The International Journal of Science & Technology, Vol. 4, pp.102-121.

[18] Okereke J. N. , Ogidi O. I. and Obasi K. O. (2016), ' Research Article Removal of Inorganic Anions in Textile Effluent using Banana Peels', Int. J. Adv. Res. Biol. Sci.,Vol. 3, Issue.6, pp.2348-8069.

[19] Roshanak Khandanlou, Mansor B. Ahmad, Hamid Reza Fard Masoumi, Kamyar Shameli, Mahiran Basri and Katayoon Kalantari (2015), 'Rapid Adsorption of Copper(II) and Lead(II) by Rice Straw/Fe3O4 Nanocomposite: Optimization, Equilibrium Isotherms, and Adsorption 8 Kinetics Study', International Journal of Science, Vol. 24, pp.1230-1245.

[20] Shalini Gautam And Saima H. Khan (2016), 'Removal of Methylene Blue from Waste Water using Banana Peel as Adsorbent', International Journal of Science, Environment and Technology, Vol. 5, No.5, pp.3230-3236.

[21] Shivani B Chavda and Pandya M. J. (2014),'Evaluation of Removal of TDS, COD and Heavy metals from Wastewater using Biochar', International Journal of Innovative Research in Technology, Vol. 1, Issue.9.

[22] Supitcha Rungrodnimitchai (2010), 'Modification of Rice Straw for Heavy Metal Ion Adsorbents by Microwave Heating', International Journal of Science, Vol. 10, pp.10-16.