*International Research Journal of Environmental Sciences*_____ ISSN 2319–1414
Vol. **9(3),** 64-66, July **(2020)** *Int. Res. J. Environmental Sci.*

Short Communication

Use of chemically modified sugarcane bagasse pith and pine sawdust for removal of colour from coolant effluent

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Available online at: www.isca.in, www.isca.me
Received 15th May 2019, revised 18th December 2019, accepted 20th March 2020

Abstract

The present study aimed at preparation of chemically treated adsorbents from natural waste materials such as, sugarcane bagasse pith and pine sawdust. The experiment conducted by changing operating conditions as pH, contact time, dose of adsorbent. The agitation speed was constant and kept about 200rpm. This study revealed that, as the adsorbent dose was increased, the percentage of removal of colour was also greater than before. It was observed that the maximum removal of colour found between contact times of 90-120 min. The adsorbent materials used in the present study are found abundantly in local area and economic as well as effective.

Keywords: Adsorption chemically modified adsorbent, sugarcane bagasse pith, pine sawdust, coolant effluent.

Introduction

The machine manufacturing industries produces a number of products from different types of machines, power tools and other technical equipment. Coolant is used for diminish overheating tools during metal cutting operations. The coolant is constantly circulated again and again through cutting tool until the coolant becomes feeble and extreme dirty. The illegal disposal of coolant wastewater in natural water bodies causes harmful impact on aquatic life and human.

Generally chemical precipitation, electrocoagulation, membrane filtration were used for pre-treatment of coolant wastewater. But after treatment, colour was observed in coolant effluent. The colour is highly water soluble and toxic, discharge of coloured compounds in natural water bodies damaging water life and disturbs the ideal condition of the environment[1].

There was number of methods for removal of colour like physical, chemical, biological, electro-coagulation, membrane filtration and photo degradation. Adsorption was physical method in which adsorbents were used to absorb colour molecules on surface of it[2]. Adsorption by natural waste materials like sugarcane bagasse[1], lignocelluloses material[3], wood apple shale[4], bananapith[5], tamarind fruit shell[6], wood shaving[7] and treated sawdust[8] were studied for removal of colour.

In this study chemically modified sugarcane bagasse pith and sawdust were used as adsorbents. Adsorbate coolant effluent collected from local machine shop industry. Batch adsorption process done by varying pH, contact time, adsorbent dose.

Materials and methods

Coolant Effluent: The coolant effluent used for experiment is collected from local machine manufacturing industry without additional filtration treatment. The following are characteristics of coolant effluent.

Table-1: Characteristics of raw wastewater.

pH	8-8.5
Colour	Yellow
COD	5000-9000 mg/L
BOD	4000-5500 mg/L
Turbidity	93 NTU

Chemically Modified Adsorbents: ***Adsorbent Treated with Sulphuric Acid:*** Waste sugarcane pith and sawdust were collected from local juice center and saw mill respectively. The materials were washed separately by using distilled water severally to remove dust and impurities and then left to dry in sunlight for 24 hours. After this sugarcane pith was crushed to powder. The materials were treated with concentrated sulphuric acid (ratio of 1:1 by weight/volume). Treated sample was kept in oven at 85^{o}C for 6 hours, and then materials were washed by using distilled water and wet through in sodium bicarbonate for 12 hours to remove remaining acid. Again oven drying the material at 100^{o}C for 4 hours, it was sieved through 1mm mesh size sieve.

Adsorption Experiment: To conduct batch adsorption experiment, 250ml Erlenmeyer flask was used at room temperature (25+1^{0}C). 1gm chemically activated sugarcane pith was added into100ml of coloured coolant effluent sample. The same procedure was done for pine sawdust. The mixture was stirred at 200 rpm agitation speed by mechanical stirrer.

Batch experiments were carried out at pH range 3-9, adsorbent dose range 0.1-1.0gm/100ml, contact period 30-120 min and agitation speed 200 rpm. The coolant effluent was scanning through UV- visible Spectrophotometer (Model 1800 Shimadzu, Japan). Colour concentration was determined by measuring absorbance value at maximum (λ_{max}= 420nm) before and after treatment.

Results and discussion

Effect of pH: To study the impact of initial pH of wastewater on effectiveness of the adsorbents in colour removal, varying range of pH 3-9 was considered. Initial pH of wastewater was adjusted by using diluted sulphuric acid and sodium hydroxide. No significant change in removal percentage of colour was found with adsorbent dose of 1gm/100ml for both adsorbents. The colour removal efficiency found were nearly equal.

Effect of Adsorbent Dose: For the range of selected adsorbent dose, the colour of wastewater was removed more efficiently with increasing dose of adsorbent. For sugarcane pith percentage of adsorption increased from 25.55% to 54.81%, as the adsorbent dose increases from 0.1 to 1.0gm/100ml. For sawdust percentage of adsorption increased from 11% to 41.85%, with same dose of adsorbent. This may be due to the increase in availability of surface active sites resulting from the increased dose and conglomeration of the adsorbent[8].

Effect of Contact Time: With increasing contact time, colour removal efficiency of adsorbents was observed to be increasing. However after 90 minutes no significant change was noted as shown in Figure-2. Therefore, the optimum contact time considered to be 90 minutes.

Table-2: Percentage Removal of Colour.

Material	Contact Time	% Removal of Colour
Sugarcane bagasse pith	30	23.5
Sugarcane bagasse pith	60	54.81
Sugarcane bagasse pith	90	60.08
Sugarcane bagasse pith	120	61.94
Pine sawdust	30	13.9
Pine sawdust	60	41.85
Pine sawdust	90	47.32
Pine sawdust	120	48.67

(Adsorbent dose=1gm/100ml, pH=8.2 and agitation speed=200 rpm).

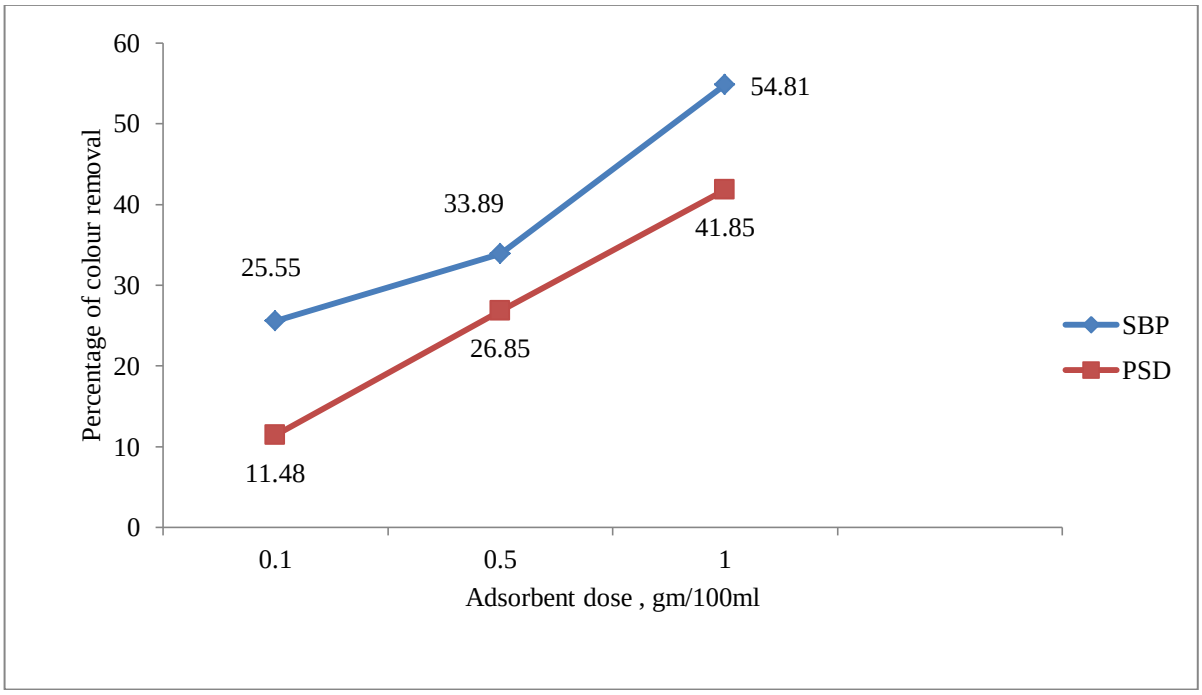

Figure-1: The percentage of colour removal with adsorbent dose (SBP- sugarcane bagasse pith and PSD- pine sawdust).

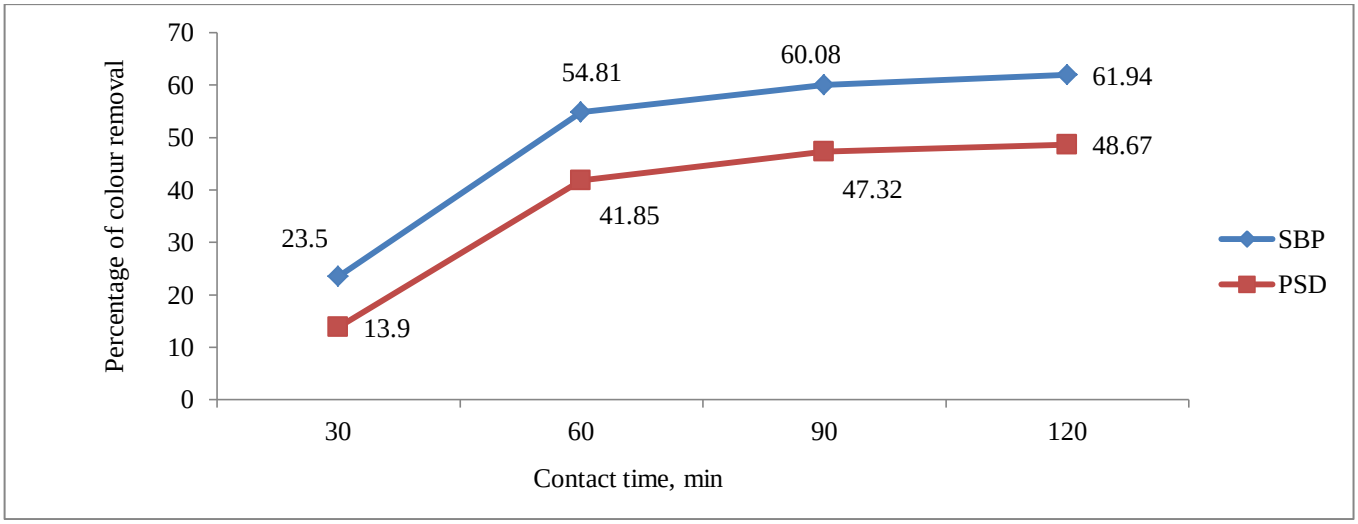

Figure-2: The percentage of colour removal with contact time (SBP- sugarcane bagasse pith and PSD- pine sawdust).

Conclusion

The study revealed that modified pine sawdust has lower colour removal efficiency than sugarcane bagasse pith. Initial pH of wastewater was kept as it is because no any significant effect found in varying pH from range 2-10. For sugarcane bagasse pith maximum percentage of colour removal was concluded at 1gm/100ml adsorbent dose in contact time of 120 minutes i.e. 61.94%. For pine sawdust maximum percentage of colour removal was concluded at 1gm/100ml adsorbent dose in contact time of 120 minutes i.e. 48.67%. Agitation speed was 200 rpm for all adsorption process. Adsorption is highly dependent on dose and contact time. The sugarcane bagasse pith and pine sawdust is easily available and economical.

References

1. Abdullah, A. L., Salleh, M. M., Mazlina, M. S., Noor, M. J. M. M., Osman, M. R., Wagiran, R., & Sobri, S. (2005). Azo dye removal by adsorption using waste biomass: sugarcane bagasse. *International Journal of Engineering and Technology*, 2(1), 8-13.
2. Katheresan, V., Kansedo, J., & Lau, S. Y. (2018). Efficiency of various recent wastewater dye removal methods: a review. *Journal of environmental chemical engineering*, 6(4), 4676-4697.
3. Antonija Kazerle, Katarina Kolak, Tihana Marcek, Damir Haseny, Darke Velic & Natalija Velic (2016). Adsorptive Removal of Malachite Green from Aqueous Solution Using Lignocellulosic Waste Material. *2nd International and 6th Croatian Scientific and Professional Conference Water for all.*
4. Sartape, A. S., Mandhare, A. M., Jadhav, V. V., Raut, P. D., Anuse, M. A., & Kolekar, S. S. (2017). Removal of malachite green dye from aqueous solution with adsorption technique using Limonia acidissima (wood apple) shell as low cost adsorbent. *Arabian Journal of Chemistry*, 10, S3229-S3238.
5. Namasivayam, C., & Kanchana, N. (1992). Waste banana pith as adsorbent for color removal from wastewaters. *Chemosphere*, 25(11), 1691-1705.
6. Saha, P., Chowdhury, S., Gupta, S., Kumar, I., & Kumar, R. (2010). Assessment on the removal of malachite green using tamarind fruit shell as biosorbent. *CLEAN–Soil, Air, Water*, 38(5-6), 437-445.
7. Janoš, P., Coskun, S., Pilařová, V., & Rejnek, J. (2009). Removal of basic (Methylene Blue) and acid (Egacid Orange) dyes from waters by sorption on chemically treated wood shavings. *Bioresource Technology*, 100(3), 1450-1453.
8. Garg, V. K., Gupta, R., Yadav, A. B., & Kumar, R. (2003). Dye removal from aqueous solution by adsorption on treated sawdust. *Bioresource Technology*, 89(2), 121-124.