

Step towards Better Future: Treating the Waste Water Generated from Dairy Industries using Fruit Peels

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Abstract: Now-a-days water scarcity is the major problem faced by world; hence it is important to treat waste water generated from various sources before it is discharge. Among various techniques, adsorption is a fast, inexpensive and universal method. The method followed for removing the useful organic substance include Dehydration and carbonization, investigating effect of pH, time, adsorbent dosage and particle size. The review of study on removal of organic substance from dairy waste using de-hydration, carbonization and batch extraction method is discussed in this paper. As noted, most researchers deal with the batch extraction, as this process shows good result for removal of different organic and inorganic contaminants from dairy waste. In batch extraction it was observed that the combination of banana and orange peel provides the better results. The carbonization method is found to be more efficient than the de-hydration method. The carbonization method is efficient because carbon is strong oxidant and has a unique pores structure with absorbs the organic substance on its surface easily. For the removal of turbidity, total suspended solids [TSS], biochemical oxygen demand [BOD] and chemical oxygen demand [COD] orange peel was found to be more efficient than banana peel in all the methods this is due to the characteristics of orange peel, the orange peel contain fibre which has more hydroxyl radical, hence more adsorption capacity. But the combination of orange and banana peel in 1:1 proportion act as a best adsorption, even better than orange peel alone.

Keywords: Fruit Peels, BOD, COD, TSS, Turbidity, etc.

I. INTRODUCTION

India is known to be house of dairy industries it contributes 23% of the total milk production in the world the dairy industries owner does not have any use of the waste water generated from the dairy, hence after giving the primary treatment they discard them in the nearby water bodies, without even thinking about the cons society will face after. This review research paper has been designed to give something back to the society and the generations to come. The water is very precious gift for the mankind, life without water cannot be imagined the carelessness of the industrialist is not just polluting a water body but also aquatic species and mankind. [1]

Pranav D. Pathak et.al. perform a study on fruit peel waste as a novel low-cost bio-adsorbent where banana and orange peel and combination of both and removed different organic and inorganic contamination form aqueous effluent [2]. Rizki Ibtida Prasetyaningty et.al. conducted a study on fruit peels as natural adsorbents to remove chromium (Cr⁶⁺) from synthetic textile wastewater [3]. Pongthipun Phuengphai et.al., conducted a study on removal of copper (II) from aqueous solution using chemically modified fruit peel as adsorbent [4]. Naba Kumar Mondal made study on fruit peel as an adsorbent for removal of fluoride from aqueous solution by doing batch study [5].

Mohapatra, et al., discusses about the usefulness and characteristics of banana peel, and it was concluded that banana peels are strong antioxidant and color absorber [6]. Jatto, et al. studied treatment of wastewater from food industry using snail shell. It concluded that snail shell act as a good adsorbent in treatment of wastewater

[7]. Velmurugan P, et al conducted a study on dye removal [methyl blue] from aqueous solution using low-cost adsorbent. It used adsorbent of combination of orange, banana and neem leaves. It was concluded that orange peel act as a novel adsorbent [8].

All the food that we eat in a day compromise at least one element of dairy. Demand of dairy products is increasing in different countries, which result in the development of the dairy industry and increases in the generation of waste. The major waste generated from dairy is waste water. The waste water generated has high nutrient concentration, biological oxygen demand [BOD], chemical oxygen demand [COD], various organic and inorganic content. There are many methods for water purification, the easier and cost-efficient method is adsorption [9]. This review paper focus on adsorption technique to remove all the impurities present in the water hence making it suitable to reuse. The research paper has been designed by keeping in mind to purify wastewater generated by dairy industries and making it suitable for daily use by suggesting optimize technique with a simple and affordable.

II. EXPERIMENTAL

A. Materials

Material will be use in this work is dairy waste sample, banana and orange peels.

B. Experimental Procedure

Method which are used in this review paper are listed below: De-hydrated method, Batch extraction method and Carbonization Method

1. De-hydrated Method



The collected banana and orange peels were cut into small 0pieces, washed with distilled water to remove dirt and suspended impurities and then dried for 48hrs in an oven at 100°C in order to remove the moisture content of the peel. After the drying process, the peels are kept in desiccator for 30 minutes the desiccator cools the peels, after that the peels are ground to fine powder and sieve through 600µm, 425µm, 300µm for different particle size. These dehydrated peels were directly used as biosorbent in experimental investigation.

2. Batch Extraction

In this process 250ml Erlenmeyer flask is used to carry out batch Experiments. Take 100 ml of the dairy wastewater of COD, BOD and pH determined, to that we have to add a dose of adsorbent. Different doses i.e., 5g, 10g, 1.5g, 20g of adsorbents are taken for analysis. Using a digital pH meter, pH has been measured.



At a desired temperature, in water bath agitate it at a constant speed of 150rpm in flask. The temperature usually maintained between 25-30 °C for 1-3 hours. Centrifuge or filter the mixture and determine the concentration of pollutant in the aqueous phase. Calculate the amount of pollutant adsorbed from the aqueous solution by determining the equilibrium concentration in solution.

3. Carbonization Method

The collected banana and orange peels were cut into small pieces, washed with distilled water to remove dirt and suspended impurities and then dried for 48 hours in an oven at 100°C in order to remove the moisture content from the peels. After the drying process, the peels are kept in the desiccators for 30 minutes and then the dried peels kept in the furnace for 3 hours at 200°C to convert it into carbon. After that the peels were removed, cooled and ground to fine powder and sieve through 600µm, 425µm, 300µm for different particle size.

III. RESULTS AND DISCUSSION

A. Removal of Turbidity

The impurity or dirt observed in water is due to turbidity. Turbid meter equipment is used to analyze it. By using various dosage of banana and orange peel as an adsorbent turbidity is removed. The percentage of removing turbidity at 1g for banana adsorbent is 86%, for orange adsorbent is 9% and the highest 95% was achieved when both orange peel and banana peel was taken in equal proportion.

B. Removal of Total Suspended Solids

Total suspended solids are those constitute of water which are not filterable. The percentage of removing TSS at 1g for banana adsorbent is 88%, for orange adsorbent is 89% and highest 93% was achieved when both orange peel and banana peel was taken in equal proportion

C. Biochemical Oxygen Demand [BOD]

BOD is the amount of oxygen required to microorganism to decompose the organic matter. The percentage of removing BOD at 1g dosage for dairy wastewater is maximum in case of orange adsorbent i.e. 90%, for banana adsorbent the removal of BOD is 89% and highest 95% was achieved when both orange peel and banana peel was taken in equal proportion.

D. Chemical Oxygen Demand [COD]

COD is the amount of oxygen consumed by organic matter in a solution. The percentage of removing COD from banana peel was taken in equal proportion.

IV. CONCLUSION

The study was made to review on removal of organic substance from dairy waste using de-hydration, carbonization and batch extraction method. As noted, most researchers deal with the batch extraction, as this process shows good result for removal of different organic and inorganic contaminants from dairy waste. In batch extraction it was observed that the combination of banana and orange peel provides the better results. The carbonization method is found to be more efficient than the de-hydration method. The carbonization method is efficient because carbon is strong oxidant and has a unique pores structure with absorbs the organic substance on its surface easily.

For the removal of turbidity, total suspended particle [TSS], biochemical oxygen demand [BOD] and chemical oxygen demand [COD] orange peel was found to be more efficient than banana peel in all the methods this is due to the characteristics of orange peel, the orange peel contain fibre which has more hydroxyl radical, hence more adsorption capacity. But the combination of orange and banana peel in 1:1 proportion act as a best adsorption, even better than orange peel alone.

REFERENCES

- [1] Ms.P. Sasirekha, V. Mutheeswari, S. Sivapackiam, S. Soundharya, J. Ragheljebamariyal, Treatment of Industrial Waste Water by Using Orange Peels & Fish Scales. IJSRD - International Journal for Scientific Research & Development| Vol. 5, Issue 01, 2017.
- [2] Pranav D. Pathak, Sachin A. Mandavgane and Bhaskar D. Kulkarni [2015], Fruit peel waste as a novel low-cost bio adsorbent, published in journal Rev Chem Eng 2015; 31(4): 361-381.
- [3] RizkiIbtidaPrasetyaningtyas, Saskia Anindya Putri, FaeghehMoazeni& Shirley Clark, Fruit peels as natural adsorbents to remove chromium (Cr^{6+}) from synthetic textile wastewater. In G. F. Scott, & W. Hamilton (Eds.), World Environmental and Water Resources Congress 2019 (pp. 190-200). American Society of Civil Engineers (ASCE).
- [4] PongthipunPhuengphai, ThapaneeSingjanusong, NapapornKheangkhum, AmnuayWattanakornsiri. 2021: Removal of copper(II) from aqueous solution using chemically modified fruit peels as efficient low-cost biosorbents. Water Science and Engineering, 14(4): 286-294. doi: 10.1016/j.wse.2021.08.
- [5] Mondal, N.K. Natural Banana (*Musa acuminata*) Peel: An Unconventional Adsorbent for Removal of Fluoride from Aqueous Solution through Batch Study. Water Conserv Sci Eng 1, 223–232 (2017).
- [6] Mohapatra Debadbandya, Sabyasachi Mishraand NamrataSutar, Banana and its by-product utilisation: an overview, Journal of Scientific & Industrial Research, Vol.69,May2010,pp.323-329.
- [7] Jatto, E.O., Asia, I.O., Egbon, E.E., Otutu, J.O., Chukwuedo, M.E. and Ewansiha, C.J. Acaedmia Arena., 2010,2(1):32–36.
- [8] Velmurugan, P., Rathina Kumar, V. &Dhinakaran, G., International journal of environmental sciences.,2011, 7(1):1492-1496.
- [9] Dr. K.M. Gopala Krishnan, Mr. M. Dhivakar Karthick, treatment of dairy waste water using natural adsorbent like fruit peel, International Journal of Science Technology and Management, Volume No.10, Issue No.03, March 2021.
- [10] Kanawade, S.M. &Gaikwad, R.W., International Journal of Chemical Engineering and Applications.,2011, 2(3):202-206.
- [11] AbdurRahman, F., Akter, M. and Abedin, M.Z., International Journal of Scientific & Technology Research.,2013,2(9), 47-50.
- [12] Bazarafshan, E., Moein, H., Mostafapour, F.K. and Nakhaie, S., Journal of Chemistry, 2013.
- [13] Wikipedia, Freundlich equation, http://en.wikipedia.org/wiki/Freundlich_equation, 2014.
- [14] Wikipedia,Water. [Online], Available form: <http://en.wikipedia.org/wiki/Water>, 2014.
- [15] World Health Organization, Environmental management., http://www.who.int/denguecontrol/control_strategies/environmental_management/en/, 2014.

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