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Treatment of polluted water from Kharar Drain, near SAS Nagar using activated carbons

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Abstract
Kharar, sub-division near SAS nagar, has a drainage that collects waste water from various domestic and industrial sources. The water is highly polluted as evident from initial characterization (TS- 12000 ppm, Hardness- 1600 ppm, Alkalinity- 1450 ppm, BOD- 1500 ppm and COD- 3000 ppm). Water samples also had heavy metal content like Zn (1.5 ppm), Ni (0.75 ppm), Cr (3 ppm). Such highly polluted water can't be reused for any domestic, agricultural and industrial purpose. Two different Activated Carbons (AC), Bottle palm activated carbon (BPAC) and Eucalyptus Bark Activated Carbon (EBAC) were analyzed for their ability to treat waste water from Kharar drainage. Activation of raw carbon was done by using combination of sulfuric acid and high temperature of 150 ^{0}C in stepwise procedure. Various treatment parameters were optimized separately for two types of activated carbons like Adsorbent dosage, contact time, pH and agitation speed. Using optimized parameters batch of 100 ml sample was treated with BPAC and EBAC. BPAC treated effluent to 88% at dose of 4g/25 ml, at pH 8 and 100 rpm shaking speed for time period of 60 minutes whereas, EBAC treated water to 83% at dosage of 5g/25 ml at pH 6, 100 rpm shaking speed for time period of 90 minutes. Final Characterization of treated water was done to analyze extent of removal of individual pollutant. With BPAC, Hardness and TS content were removed to more than 90%. BOD was reduced to 70%, however COD was removed to 66.6%. Heavy metal removal also occurred. EBAC showed little lesser treatment as compared to BPAC but, still both adsorbents were efficient in waste water treatment and could be potential natural part of waste water cleansing technology.

Keywords: Polluted water, domestic and industrial sources, SAS Nagar

Introduction
Wastewater is usually contaminated with organic pollutant, inorganic pollutant, heavy metals, etc. It is necessary that water should be treated before domestic, agricultural or industrial use to bring the pollutants to environmental acceptable limits [1]. Problem pose now-a-days to water treatment is increasing level of organic pollutants, which can't be decomposed easily by biological agents [2]. Heavy metals also pose lot of biological problems in living organisms, the highest trophic level of food chain being the most effected one. So, numerous attempts have been made to remove heavy metals from waste water by employing low cost activated carbons, biosurfactants, etc., [3, 4]. Thus, conventional biological methods of waste water treatment are not satisfactory and must be supplemented with additional stages of treatment. Adsorption is an important physico-chemical process that can remove dissolved, difficult to remove organic pollutants as well as heavy metals from polluted water [5-7]. Process of adsorption can be achieved by employing Activated carbons produced from waste materials. Efficiency of the process can be increased by optimizing the process parameters like pH, dosage, contact time, shaking speed, etc., [8]. Hence, this study examines the adsorption and treatment of waste water from Kharar drainage, near SAS Nagar by using activated carbon produced from Eucalyptus bark and Bottle palm.

Materials and Methods
Sample collection: Sample was collected from Kharar drainage, a Sub-division near SAS-Nagar. Sample collection was done in a clean, dry capped plastic bottles. Physical parameters like pH and temperature were checked at the point of collection. Sample was stored in the laboratory for experiment purpose at 4^0 C and was used within 72 hours.

Initial characterization of effluent: Various parameters like colour, odour, TS, TDS. TSS, alkalinity, Hardness, BOD, COD and heavy metals like chromium, nickel and zinc were determined by standard methods [9].

Preparation of Activated Carbon: Raw material was procured from felled down trees of bottle palm and eucalyptus from local area. The material was grounded to fine powder separately and sieved to obtain uniform material.

Washed, dried powdered carbon was activated by adding sulphuric acid in 4g: 1.5 ml ratio. Resultant was placed in hot air oven at 150^0C for 12 hours. Char obtained was washed, soaked in 1% sodium carbonate to remove residual acid, again washed with distilled water and dried.

Optimization of process parameters: optimization of process parameters for batch mode was done on the basis of percent decolorization of effluent. For this purpose, λ_{max} for effluent was calculated. Following parameters were optimized:

1. Effect of adsorbent dose: Adsorbent dose was varied in effluent starting with 1g adsorbent per 25 ml effluent. Set-up was kept on shaker at 100 rpm after adjusting the pH to 7. Decolorization assay was done after 30 mins.
2. Effect of contact time: It was optimized by varying the contact time between effluent and adsorbent. Minimum contact time investigated was 15 min. Successive investigations were done by increasing the contact time by factor of 15 mins.
3. Effect of pH: Effect of pH was investigated in range 1 to 14 by varying the pH in each set by value of 2.
4. Agitation speed: Different sets were investigated at following shaking speeds (rpms): 50, 75, 100, 125, 150, 175 and 200.

Batch treatment with optimized conditions and final characterization: A batch of effluent was treated with each type of adsorbent (Bottle palm activated carbon and EBAC) with optimized conditions and final characterization of treated sample was done for following parameters: TS, BOD, COD Hardness, Alkalinity, heavy metals (Chromium, nickel and zinc).

The efficiency of two adsorbents Bottle palm activated carbon and EBAC was compared and rating was done on the basis of color removal from effluent [10].

Result and Discussion

Initial characterization: It is evident from Table 1 that the effluent is highly polluted and cannot be used for any domestic or industrial purpose without treatment.

Table 1: Physical and chemical properties of sample.

Parameter	Unit	Value
Color	CU	Dark green
Smell	-	Offensive
pH	pH	9
Hardness	Ppm	1600
Alkalinity	Ppm	1450
TS	Ppm	12000
TSS	Ppm	3500
TDS	Ppm	8500
BOD	Ppm	1500
COD	Ppm	3000
Zn	Ppm	1.5
Ni	ppm	0.75
Cr	ppm	3

Effect of operation parameters on decolorization of waste water: Adsorption operation exploits the ability of certain solids to preferentially concentrate specific substances from solution onto their surface. Adsorption is highly effective and one of the most promising low-cost waste water treatment method which reduce water parameters well within disposable standards. The adsorption process depends upon nature, geometry of adsorbent material, type and quality of wastewater as well as physic chemical conditions such as pH, Temperature, contact time, dosage and shaking speed.

Effect of Adsorbent dose: It is observed from Table 2 that percent decolorization of sample increases with increase in activated carbon dosage. Similar results were observed in literature [11] during treatment of industrial waste water with commercial activated carbon.

Table 2: Optimization of adsorbent dose.

Dosage	BPAC (%)	EBAC (%)
1g	21	18.4
2g	30	29
3g	48	37
4g	63	46.7
5g	63.5	52.5
DOSAGE	BPAC (%)	EBAC (%)
1g	21	18.4

Effect of contact time: It is observed from Figure 1 that percentage decolorization of sample increase with increase in contact time initially and after some time it remains almost constant due to equilibrium established, the desorption of already adsorbed pollutant occurs vacating the adsorption site for adsorption of another free pollutant. Similar results have been reported in literature for removal of organic acid [12].

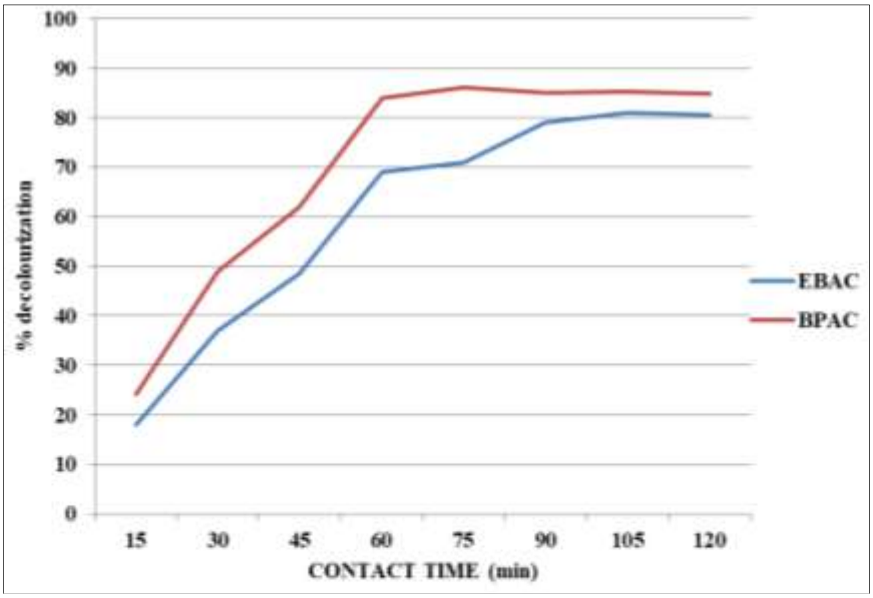

Fig 1: Effect of contact time on wastewater treatment

Effect of pH: In any adsorbate-adsorbent system, pH effects the nature of surface of adsorbent, extend of ionization and rate of adsorption as evident from Figure 2. Optimum working pH BPAC is observed to beslightly basic (pH 8) and for EBAC is 6, slightly acidic.

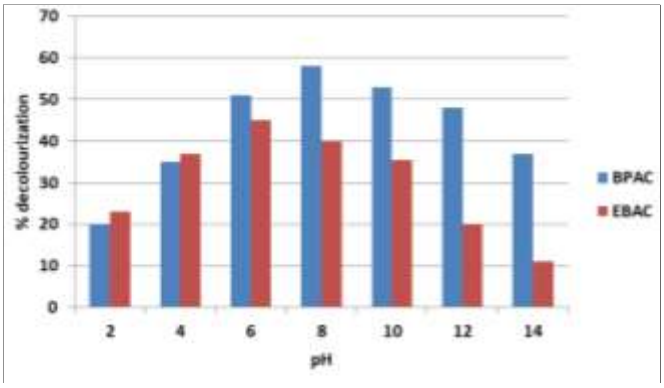

Fig 2: Effect of pH on wastewater decolorization.

Effect of agitation: It is observed that there is increase in % decolorization with increase in agitation speed till equilibrium is attained; this is due to removal of resistance posed to mass transfer onto surface of adsorbent. After equilibrium is achieved there occur desorption due to high shaking speed and saturation of adsorption sites (Figure 3).

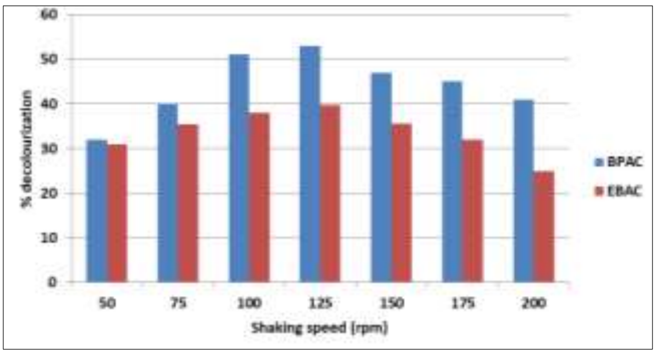

Fig 3: Effect of shaking speed wastewater decolorization.

Batch treatment of effluent with optimized conditions and final characterization: Treatment of effluent was done with optimized conditions with BPAC and EBAC separately (Table 3) and comparison of treatment efficiency was done on basis of percent decolorization of polluted water (Figure 4).

Table 3: Comparison of treatment of wastewater with two activated carbons at optimized conditions.

Conditions	EBAC	BPAC
Dose	5g/25ml	4g/25ml
pH	6	8
Shaking speed	100 rpm	100rpm
Time	90 min	60 min
Treatment	83%	88%

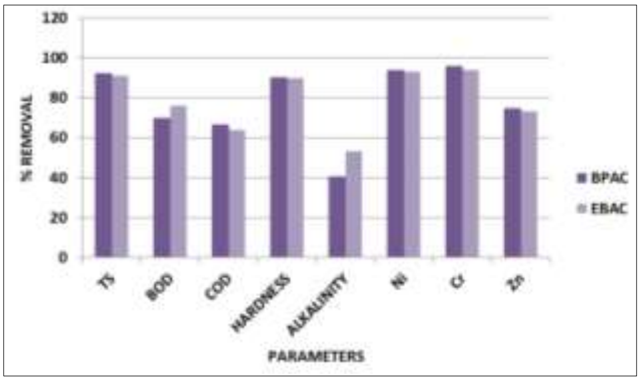

Fig 4: Final Characterization of water treated with the BPAC and EBAC.

Conclusion

This research work revealed the usefulness and effectiveness of activated carbon produced from waste material. From experimental information gathered, it has been shown in this study that activated carbon produced from waste BPAC and EBAC can effectively remove pollutants from waste water. However, it is observed that BPAC is more effective than EBAC as it shows more percent decolorization of 88% whereas EBAC shows 83% decolorization of sample. Color of sample is directly related to presence of organic and inorganic pollutants. Both activated carbons were found to be effective in reducing BOD and COD to considerable extend. The most important finding is related to removal of heavy metal content. Ni and Cr content were removed to more than 90% by both EBAC and BPAC whereas Zn removal was little lesser but satisfactory to be more than 70%. Therefore, the effectiveness of activated carbon produced from Bottle palm and Eucalyptus bark in removal of pollutants from waste water has been established. Work continues on the effect of particle size and adsorption isotherms.

References

1. Aydin A. The Microbiological and Physico-chemical quality of ground water in west in west threce, Turkey. Polish Journal of Environmental Sciences 2007;3:377-383.
2. Chandra R, Bharagava RN, Rai V. Melanoidins as major colourant in sugarcane molasses-based distillery effluent and its degradation. Bioresource Technology 2008;99(11):4648-4660.
3. Mulligan CN, Yong RN, Gibbs BF. Heavy metal removal from sediments by bio-surfactants. Journal of Hazardous Material 2001; 85:111-125.
4. Okafor JO, Aneke NAG. Characterization of adsorbent for the purification of Coca-Cola effluent. Proceedings of the Nigerian Society of Chemical Engineers, 31st annual conference 2006, 22-24.
5. Amuda S, Ibrahim AO. Industrial wastewater treatment using natural material as adsorbent. African Journal of Biotechnology 2006;5(16):1483-1487.
6. Kannan N, Srinivasan T. Studies on adsorption of copper by low-cost carbonaceous adsorbents. Indian Journal of Environmental Protection 1998;18(3):194.
7. Mohammed A, Nesaratnam S, Mohammed H. Preparation of phosphoric acid- activated carbon using palm date pits: Physico-chemical and adsorptive properties. Journal of Chemical Technology, 2005.
8. Ibaraj S, Sulochana N. Effect of agitation time and adsorbrnt dosage on adsorption of dyes. Indian Journal of Chemical Technology, 2002;9:201-208.
9. Peavy HS, Rowe DR, Techobanoglous G. Water quality: Defination, characterization and perspectives. Environmental Engineering 1985;11:43.
10. Sanghi R, Bhattacharya B. Comparative evaluation of activated carbons with natural adsorbents for decolourization of dye solution. Journal of Scientific and Industrial Research 2002;61:432-436.
11. Olafadehan OA, Aribike DS. Treatment of industrial wastewater effluent. Journal of Nigerian Society of Chemical Engineers 2000;19:50-53.
12. Kannan N, Xavier A. New composite mixed adsorbents for the removal of acetic acid by adsorption from aqueous solution-A comparative study. Environmental toxicology and chemistry 2001;79:95-107.