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OPTIMIZATION OF PARAMETERS FOR CATIONIC SURFACTANT REMOVAL FROM DOMESTIC WASTE WATER BY ACTIVATED CORN COB POWDER

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ABSTRACT

Direct and indirect releases of large quantities of surfactants to the environment may result in serious health and environmental problems. Therefore, surfactants should be removed from water before water is released to the environment. Using powdered activated Corn cobs as adsorbent may be an effective technique to remove surfactants. In this study, the removal of surfactants by adsorbent was investigated and the influences of the operating parameters on the effectiveness on adsorption rate were studied. Cetyl trimethyl ammonium bromide (CTAB) has been widely used in synthesis of gold nanoparticles (e.g., spheres, rods, bipyramids), mesoporous silica nanoparticles (e.g., MCM-41), and hair conditioning products.

The present research work is to investigate the optimized conditions for removal of cationic surfactant from domestic waste water using activated Corn cob powder .The initial concentration of cationic surfactant in domestic waste water is 426ppm. The optimum conditions for removal of cationic surfactants were Time of 90min, Adsorbent dosage of 1%(W/V) , pH-7 and at 30℃ temperature obtained. From the obtained optimal conditions the removal efficiency was 90.6 % .

KEYWORDS: Surfactants, Pollutants, Activated Corn cobs, Optimization, Domestic waste water

INTRODUCTION

Surfactants are the major active ingredients of laundry detergents. Therefore, special attention should be focused on the treatment and disposal of laundry wastewater. Pollution discharges containing surfactants cause severe changes to biota because the activities of many aquatic organisms depend fundamentally on water surface tension. Surfactant usage is increased widely but not only in house hold purpose also used by industries also. So it is very important to treat waste from surfactants.

Surfactants are routinely deposited in numerous ways on land and into water systems, whether as part of an intended process or as industrial and house hold waste some of them are known to be toxic to animals, ecosystem, humans and can increase the diffusion of other environmental contaminants. In recent days these detergents, hand wash products which contain these surfactants are enormously increased and huge amount of domestic waste water which come from households , hotels and restaurants are being released into water bodies. Due to release of large amount of waste which containing these harmful surfactants into the water bodies the aquatic life gets damaged the permissible limit of surfactants to be released into to the water bodies is 0.3mg/l.[1]

Adsorption is the simplest method to use separation of cationic surfactant from waste water. Most industries like drinking water, waste water treating are already using this adsorption technology to treat waste water from different sources.[2]

India ranks 6th position among the world in the production of maize with 23,290,000 tonnes per year. Corn Cobs are one of the main by product from this harvest. So by using of this by product we can treat the waste water which is more polluted by cationic surfactant. It is the great idea to treat waste from waste.[3]

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The main objective of this work is to find the optimum parameters to separate the cationic surfactant removal from waste water by using activated corn cob powder. The parameters like dosage, time, pH and temperature plays an important role.

MATERIALS AND METHODS

Preparation of Activated Corn Cobs Powder:

The activated corn cobs powder was prepared by simple technique. after the collecting of corn cobs we will dry the corn cobs by exposing to direct sun light. The primary step is to convert the raw dried corn cobs into char, then char was soaked in concentrated NaOH solution. After soaking, it is dried in oven and then finally it is activated.

After that heat the powder in muffle furnace from 28 ℃ to 450℃ Maintain the nitrogen atmosphere in the oven and finally we get porous material this material is crushed. These porous powder was mixed with water and KOH. Here we can take three times more KOH than porous powder. After completion of washing this powder have to dry in oven at 130℃ for 12 hrs. These dried powder was taken out from oven and placed in muffle furnace at 850℃ for 1 hr. The activated corn cob powder was removed from furnace and washed with deionised water. After that poured in 0.1 mol Hydro choric acid and stir for 60 min. Finally wash these powder up to neutral pH then again dried in oven. After drying process it is sieved to 0.1 to .42 m m Mesh and label as activated corn cob powder and raw corn cob powder was also labeled separately. In this work the activated corn cob powder was selected for further work because The BET surface area is very high as compared to raw corn cobs powder. The finer particles had a much higher capacity at breakthrough point and almost twice the efficiency compared to the coarse aggregates[04].

Determination of Cationic Surfactants

Materials

All absorption spectra and spectrophotometric measurements were made on a UV–Visible spectrophotometer from Varian (Palo Alto, CA, USA), model Cary 50 Conc, using quartz cells of path length 10 mm. pH measurements were made with a Tacussel (Lyon, France) pH-meter equipped with a calomel electrode.

Chemicals

The anionic dye Patent Blue V (C54H62CaN4O12S4) was analytical reagent grade and obtained from Fluka (Buchs, Switzerland). It was used without further purification. 0.579 g of the dye were diluted in distilled water to give a solution of 10-3 M. A standard CS, cetyltri methyl ammonium bromide (CTAB) was used as the reference (98%purity, Fluka). A stock solution was prepared by dissolving 1 g of CTAB in distilled water to give 5.48 x 10-3 M, and this was stored in a fridge. Standard solutions were prepared by accurate dilution. A buffer solution was prepared with an acetate buffer (CH3COOH/ CH3COONa); the pH was adjusted to 4–4.5 with a pH meter. To accelerate phase separation, 0.5 M of sodium sulfate solution was added to the extraction system. Chloroform was used as the solvent without further purification (Fluka).

Analytical Procedure

One-hundred millilitres of a sample containing CS was transferred to a conical flask, and then 5 ml of sodium sulfate solution was added, along with 5 ml of acetate buffer and 2.5 ml of Patent Blue V solution. The flask was covered and then shaken vigorously with a magnetic stirrer for 15 min with 15 ml of chloroform. The two phases were allowed to separate in a separating funnel. The organic extract was then washed with 100 ml of distilled water by vigorous shaking. The organic layer was recovered and its absorbance was measured at the wavelength of maximum absorption (627 nm) against chloroform, which was used as reference[05].

RESULTS AND DISCUSSIONS

Experiments of adsorption was carried out in batch process. Activated corn cob powder was collected for further process. In this present work optimization parameters like effect of contact time, adsorbent dosage, pH, Temperature were studied.

Effect of Contact Time:

The time required for reducing cationic surfactant concentration in wastewater is estimated by taking 100 ml of sample in a conical flask and add 0.5gm using activated corn cob powder derived from corn cobs to the sample and stir at 300rpm. The removal of cationic surfactant from waste water was studied as function of contact time

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in the range of 20-150 min, 8pH at 25°C. The cationic surfactant concentration is estimated for every 10 min. The concentration is estimated for every 10 min. The cationic surfactant concentration is estimated time interval of 10 min to till it comes stable. The concentration of cationic surfactants is decreased and stable at 120min. Continuously the cationic surfactant concentration decreased from 2 hrs and then it becomes stable even though the process continues further there is no change in the concentration, which means that increase in the time of treatment with using activated corn cob powder derived from corn cobs does not have effect on the cationic surfactants .The mechanism of solute transfer to the solid includes diffusion through the fluid film around the adsorbent particle and diffusion through the pores to the internal adsorption sites. In the initial stages of adsorption of cationic surfactant, the concentration gradient between the film and the available pore sites is large, and So the rate of adsorption is faster. The rate of adsorption decreases in the later stages of the adsorption probably due to the slow pore diffusion of the solute ion into the bulk of the adsorbent. In this process the removal of cationic surfactant or percentage removal with respect to time is shown in the bellow Table-1 and Fig. 1. Hence the optimum time required for the removal of cationic surfactant in this process is found as **120** min.[8]

Table 1: Effect of time on % Removal of cationic surfactant

S.no.	**Time (min)**	**% Removal of cationic surfactant**
1	0	0
2	20	2.8
3	30	3.3
4	40	5.4
5	60	7.74
6	90	15.2
7	120	17.1
8	130	17.1
9	150	17.1

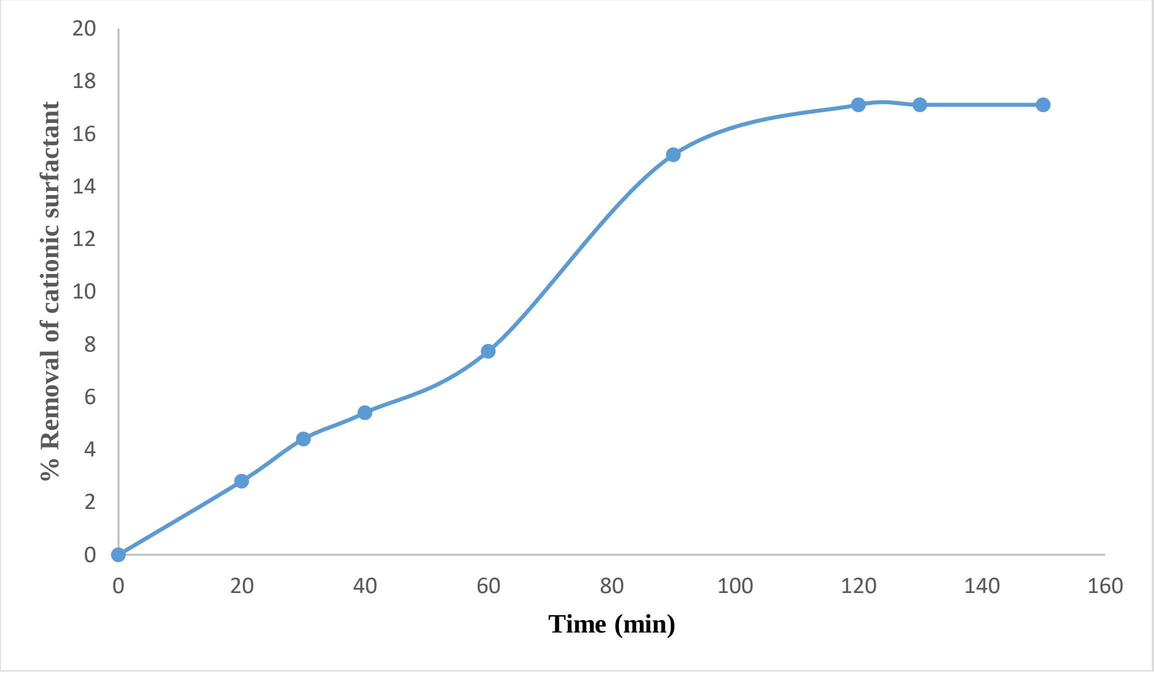

Fig. 1 : Effect of time on % Removal of cationic surfactant

Effect of adsorbent dosage:

The adsorbent mass effect on amount of mass surfactant absorbed was under taken and contact time(2 hrs.) by varying the adsorbent(activated corn cob powder) mass. This study reveals that amount of surfactant adsorbed exponentially decreases with increase in activated corn Cobb powder mass and reached to constant removal value

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after a particular carbon concentration beyond which there is no significant decrease in surfactant uptake. This behavior may be due to as the dosage of adsorbent increased, the adsorption sites remain unsaturated during the adsorption reaction leads to drop in adsorption capacity or due to aggregation/agglomeration of sorbent particles at higher concentrations, which would lead to a decrease in the surface area and an increase in the diffusional path length. The particle interaction at higher adsorbent concentration may also help to desorbs some of the loosely bound anions from the sorbent surface [9]. In this process the removal of cationic surfactant or percentage removal with respect to adsorbent dosage is shown in the bellow Table-2 and Fig. 2.

Table 2: Effect of dosage of adsorbent on % Removal of cationic surfactant

S. No	Dosage (gm)	% Removal of cationic surfactant
1	0.25	7.74
2	0.5	17.1
3	0.75	27.5
4	1	34.2
5	1.25	34.26
6	1.5	34.26
7	1.75	34.26

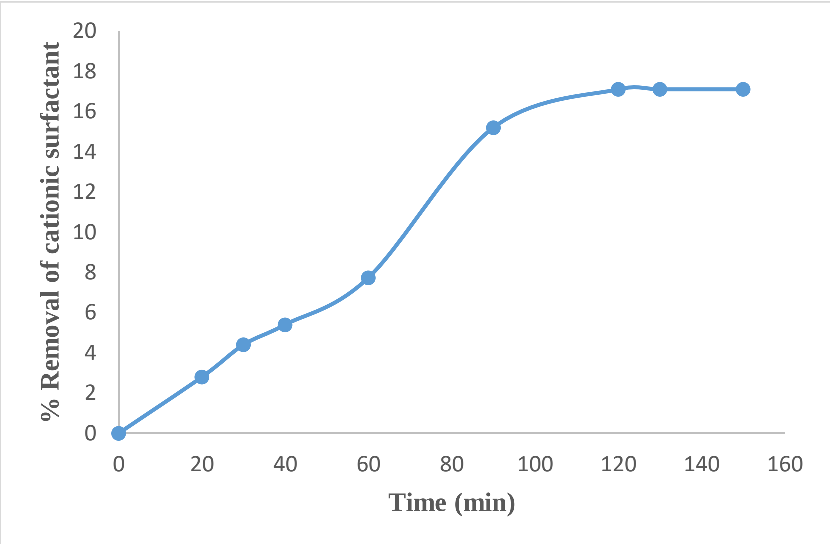

Fig. 2: Effect of dosage of adsorbent on % Removal of cationic surfactant

Effect of pH:

the optimized ph to reduce the cationic surfactant from waste water using activated corn cobs powder is found by taking the 100 ml of sample in conical flask and add 1 gram of activated corn cob powder to that sample and stirring for 2 hours .the cationic surfactant concentration is estimated from the pH 2 to the end of ph where we received minimum concentration of cationic surfactant. From the pH 2-4 we get the low % removal of cationic surfactants. At pH of 5-6 we will get maximum % removal of cationic surfactants. The final maximum removal % of cationic surfactants is at pH 7.at this ph we get 88.26% of maximum removal of cationic surfactants.[10]

Table 3: Effect of pH on % Removal of cationic surfactant

S. No	pH	% Removal of cationic surfactant
1	2	48.63
2	3	53.78
3	4	58.12
4	5	72.90
5	6	84.50
6	7	88.26
7	8	84.30

8	9	81.15

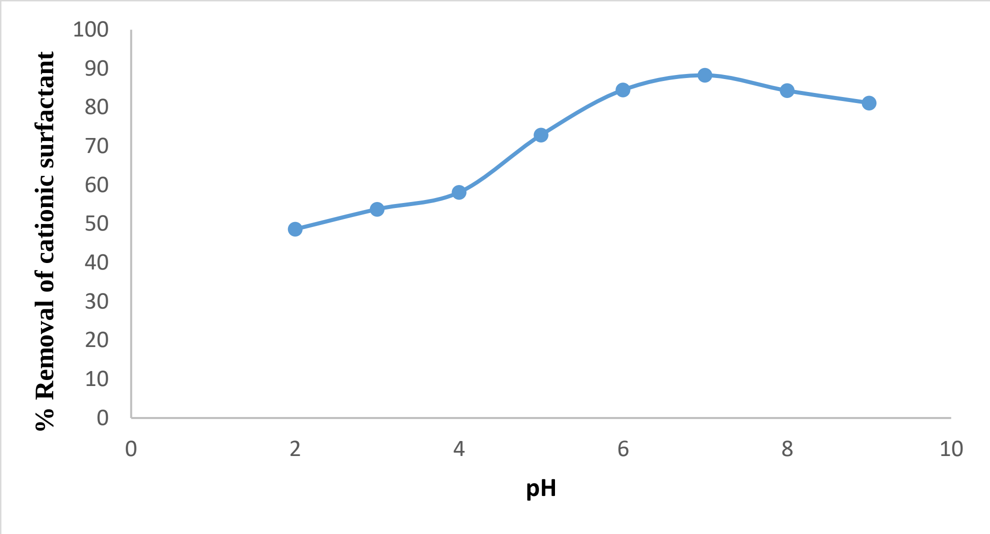

Fig. 3: Effect of pH on % Removal of cationic surfactant

Effect of temperature:
The effect of temperature for the cationic surfactant removal using activated corn cob powder derived from corn cobs was studied. It is found that the % removal of cationic surfactants remains almost constant for the temperature range of 25℃ to 40℃. This may be due to the endothermic adsorption of divalent cations.[11]

Table 4: Effect of temperature on% Removal of cationic surfactant

S.No.	Temperature℃	% Removal of cationic surfactant
1	25	89.26
2	30	90.6
3	35	90.5
4	40	90.3

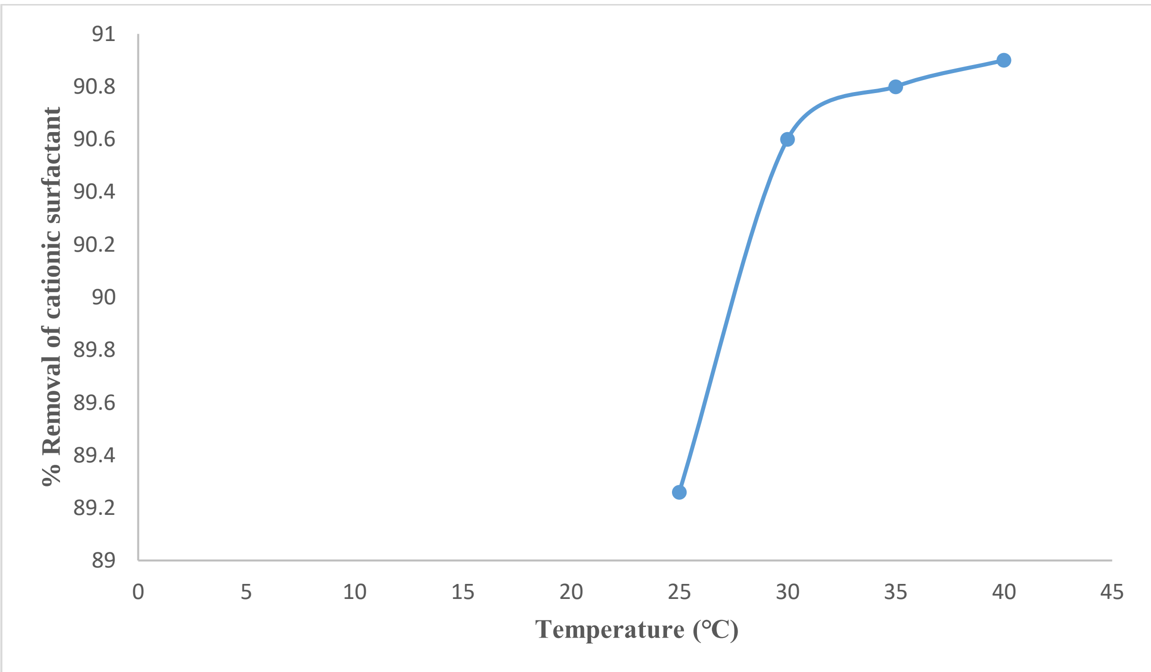

Fig.4: Effect of temperature on% Removal of cationic surfactant

CONCLUSION

The current work was focused to find the optimized condition of the sorption of cationic surfactant on the activated corn cobs powder. The results present in this paper is to show how the activated corn cob powder will effect on different parameters.

Based on the results we concluded that the Optimum time, Dosage, pH, Temperature for the separating of cationic surfactant from waste water using activated corn cob powder. Continuously the cationic surfactant concentration decreased from 2 hr and then it becomes stable even though the process continues further there is no change in the concentration. The quantity of the dosage of activated corn Cob powder is 1 gm. Final maximum removal % of cationic surfactants is at pH 7. At this pH 88.26% of maximum removal of cationic surfactants were obtained. It is found that the % removal of cationic surfactants remains almost constant for the temperature range of 25℃ to 40℃. So the temperature has no effect in this process.

By using these optimum parameters we can effectively remove the cationic surfactant from waste water with removal percentage of 90.6**%.**

REFERENCES

[1] Mehmath yalcin. (2004) The Adsorption Kinetics Of CTAB into Powdered Active Carbon , kluwer Academic Publishers,vol10,pp339-348.
[2] Matthew J. Scott, Malcolm N. Jones . (2000) Review The biodegradation of surfactants in the environment ,elsevier,1508,pp 235-251.
[3] Prathyusha C and Hemalatha S .(2013) Yield and economics of speciality corn at various levels of nitrogen application under pongamia + maize agri- silvi system, International Journal of Advanced Research ,vol1,pp476-48..
[4] Yakout S. M and Nayl A. A. (2009) Removal of cationic surfactant (CTAB) from aqueous solution on to activated carbon obtained from corncob , in Applied Science Innovations Pvt. Ltd.,India,vol2, pp107-116.
[5] Zhaohui Li . (2007) Removal of cationic surfactants from water using clinoptilolite zeolite, Zeolites to Porous MOF Materials ,the 40th Anniversary of International Zeolite Conference,kenosha..
[6] Idouhar M and Tazerouti A. (2008) Spectrophotometric Determination of Cationic Surfactants Using Patent Blue V: Application to the Wastewater Industry in Algiers in J Surfact Deterg ,vol11,pp263-267.
[7] Ahmad Said , Supwatul Hakim M, and Yuli Rohyami. (2014) The effect of contact time and pH on Methylene Blue Removal By Volcanic Ash ,international conference on Chemical,Biological and Environmental Sciences, kanpur, pp12-13.
[8] Zhaohui Li and Robert S. Bowman. (1997) Counterion Effects on the Sorption of Cationic Surfactant and Chromate on Natural Clinoptilolit, ,Environ. Sci. Technol,vol 31,2407-2412.
[9] TesfayeTeka and Semegn Enyew. (2014) Study on effect of different parameters on adsorption efficiency of low cost activated orange peels for the removal of methylene blue dye, International Journal of Innovation and Scientific Research,vol8,pp 106-111.
[10] Azinoor Azida and Abu Bakar . (2014) The Effectiveness of Corn Cob Activated Carbon in Rainwater Harvesting Filtration System ,2nd International Conference on Technology, Informatics, Management, Engineering & Environment ,Indonesia, August 19-21.
[11] Olier anthony and Raul zana. (1994) Effect of Temperatures on the interaction between neutral polymers and a cationic and a nonionic surfactant in aqueous solution ACS journal,vol10,4048-4052.

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