

COMPARATIVE STUDIES ON EBT DYE ADSORPTION USING COCONUT POONAC AND MAIZE FODDER

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Abstract

Water is considered to be one of the most notable resources of living things. Water pollution is provoked by urban civilization by the excessive use of pesticides. During past decades dyes have substantially ravaged aquatic environments of human health. Dye stuff estimated to reach 2,68598 kilo metric tons in 2019 and forecasted to reach 278247 kilo metric tons by 2023. Nearly 200000 tons of dyes are lost because of dyeing process. EBT dye is widely applied in various industrial purposes, which is highly toxic and carcinogenic. The almost importance is to remove the toxic pollutants from industrial effluents before they discharge into aquatic environments. The present paper reveals that the coconut poonac and maize fodder helps to adsorb the EBT dye.

Key words: Dye adsorption, ecology, fodders, water pollution EBT DYE.

1. Introduction

The stress on our water environment as a result of increase industrialization which aids urbanization is becoming very high thus reducing the availability of fresh water. Polluted water is great concern to the aquatic organisms, plants, humans and climate and indeed alter the ecosystem. The dye effluent which is eliminated from the industries is not properly recycled hence they get accumulated in the environment which is finally exposed in the soil and water which is harmful to the humans and affects the flora and fauna (1).

The water waste that the industry releases contain percentage of these dye molecules. Many dyes specifically EBT dye mainly from industry and laboratories (2). EBT dye means Ferrochrome black T dye can be carcinogenic and mutagenic. EBT dye is a complex metric indicator that is used in complex metric titrations. E.g. in the water hardness determination process. It is a dye. In its prorogated form Ferrochrome Black T is blue. It turns red when it forms a complex with calcium, magnesium or other metal ions used as the indicator in a EDTA titration. Effective method to remove this dye is adsorbing process (3).

Adsorption is the adhesion of atoms, ions, or molecules from a gas, liquid or dissolved solid to a surface. In recent years many adsorbents prepared on the basis of agricultural wastes and by products such as sugarcane, luffacylindrica, fibers, pineapple leaf and applied for the removal of ionic and non ionic dye molecules from water. Here we concentrate on fodders (4).

Fodders refers particularly to the food given to the animals. The worldwide animal feed industry produced 873 million tones of feed in 2011, fast approaching 1 billion tones according to international feed industry federation, with an annual growth rate about 2%. Coconut poonac maize fodder is used as fodder for horses and cattle. It has high oil and proteins level in animal feed are fattening for stock. Coconut oil can be extracted from coconut and expelled the coconut poonac. Maize is quickly growing, yields high biomass and is highly palatable. It could be regarded as a potential low cost bio adsorbent (5). The application of bioadsorbents in the uptake of anionic (EBT dye). The purpose of this study was to evaluate the likelihood of using fodders as bioadsorbents of hazardous dye (6).

2. MATERIALS AND METHODS:

The present study pertaining to, —COMPARATIVE STUDIES ON DYE ADSORPTION USING COCONUT POONAC AND MAIZE FODDER

2.1 PREPARATION OF BIO-ADSORBENTS:

COCONUT POONAC:

A 100g of dried coconut poonac was converted into powdered form and sieved to form a fine powder. This fine powder of coconut poonac was used as adsorbent for the removal of EBT dye.

MAIZE FODDER:

A 100g of dried maize fodder was converted into powdered form and sieved to form a fine powder. This fine powder of maize fodder was used as adsorbent for the removal of EBT dye.

samples do not need this process.

3. If you have many samples look alike, inscribe marks on the sample stub or samples. It is very hard to recognize similar samples in the SEM.

4. Then, completely dry the sample in the drying oven at 60°C for at least 3 hours depending on the sample conditions. The rule of thumb is that it is better leave them overnight in the drying oven (11).

2.8 FTIR (Fourier transformation infrared spectroscopy) ANALYSIS:

Fourier transform infrared spectroscopy (FTIR) is a technique which is used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. IR radiation is passed through a sample. The infrared light passes and it's absorbed by the sample and some of it is passed through (transmitted). The lights absorbed compounds and gives their exact frequencies each peaks indicates particular functional groups or class. Sample molecular vibrations were analyzed for functional groups identifications in unknown plants (12).

3. RESULT AND DISCUSSION:

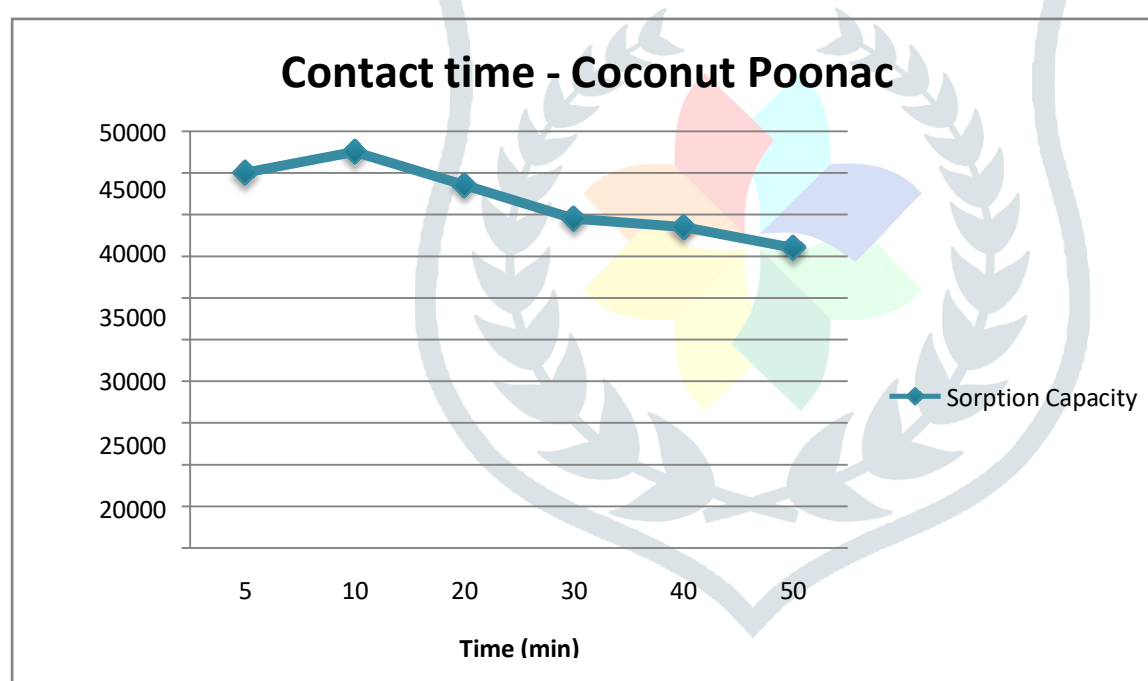
This work involves comparative studies on the removal of EBT dye adsorption on coconut poonac and maize fodder. The adsorbents are low cost and non-conventional materials which could be used as alternative bio adsorbents. The experimental parameters which affect the extent of adsorption of dye were reported by varying the contact time, dosage of adsorbent and pH of solution. The effect of these parameters with above mentioned procedure the results has be evaluated. The sorption capacities of two adsorbents are tabulated and discussed. The comparison between these two adsorbents are analysed with graphical representation by means of percentage.

REMOVAL OF ERICHROME BLACK T (EBT) DYE BY COCONUT POONAC:

2.4 EFFECT OF CONTACT TIME:

The Sorption Capacity (SC) of coconut poonac was determined by varying contact time in the period of 5-60 minutes.

GRAPHICAL REPRESENTATION:

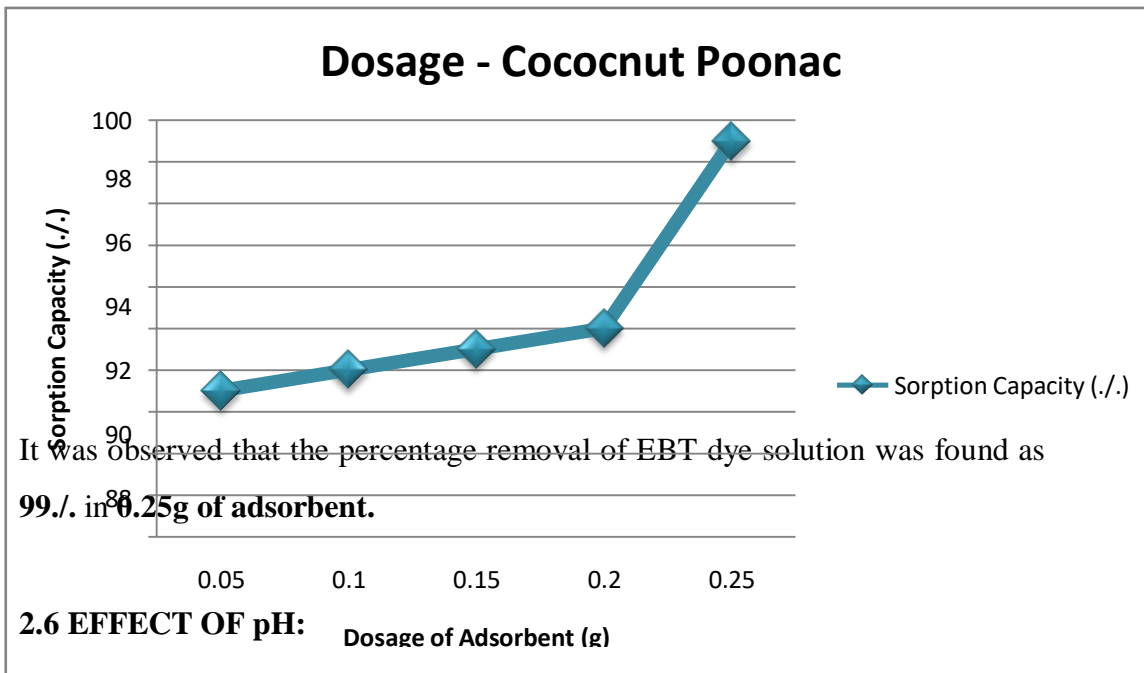


The sorption capacity of adsorbent reached saturation at 10 minutes. Hence SC at the period of **10 min** of coconut poonac was found as **47000mg/g**.

2.5 EFFECT OF DOSAGE:

The Sorption Capacity (SC) of coconut poonac was determined by varying dosage level in the range of 0.05g to 0.25g. The percentage removal of EBT dye by coconut poonac as an adsorbent was found to increase with increase in dosage. This is mainly due to the increase in availability of active adsorption sites on the surface of adsorbent.

GRAPHICAL REPRESENTATION:

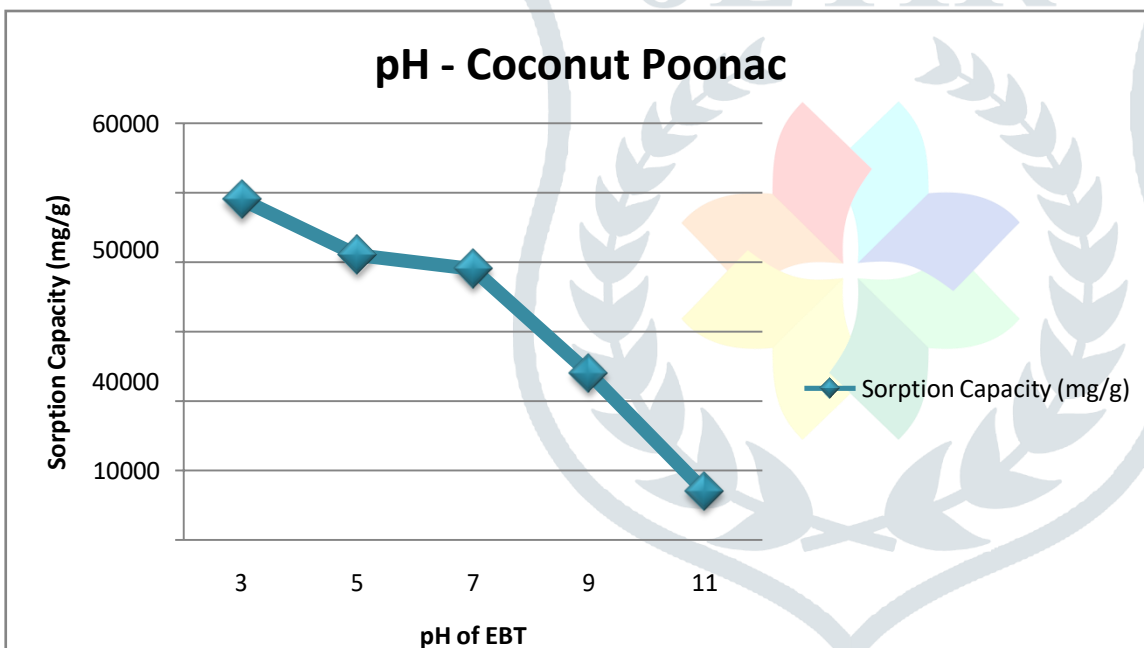


It was observed that the percentage removal of EBT dye solution was found as 99.5% in 0.25g of adsorbent.

2.6 EFFECT OF pH:

The sorption capacity of the coconut poonac was determined at five different pH level between 3-11. The pH of the working solution was controlled by adding HCl or NaOH.

GRAPHICAL REPRESENTATION:



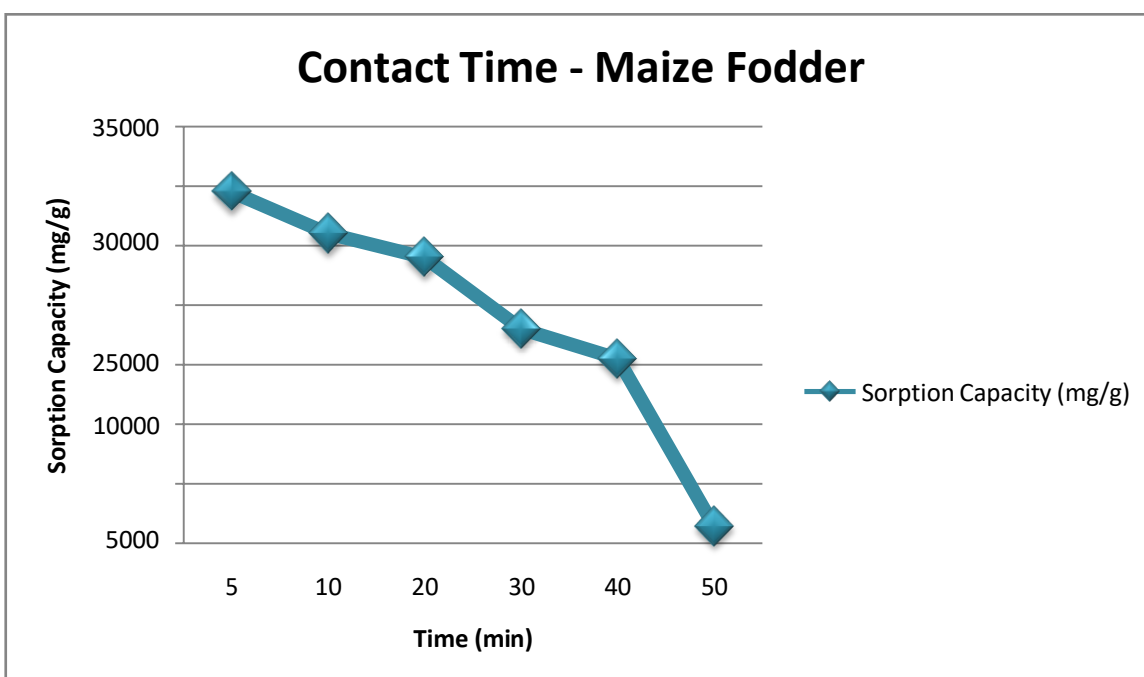
The maximum adsorption was observed at pH 3 with sorption capacity as 54000mg/g.

EFFECT OF ERICHROME BLACK T (EBT) BY MAIZE FODDER:

2.4 EFFECT OF CONTACT TIME:

The Sorption Capacity (SC) of maize fodder was determined by varying contact time in the period of 5-60 minutes.

GRAPHICAL REPRESENTATION:

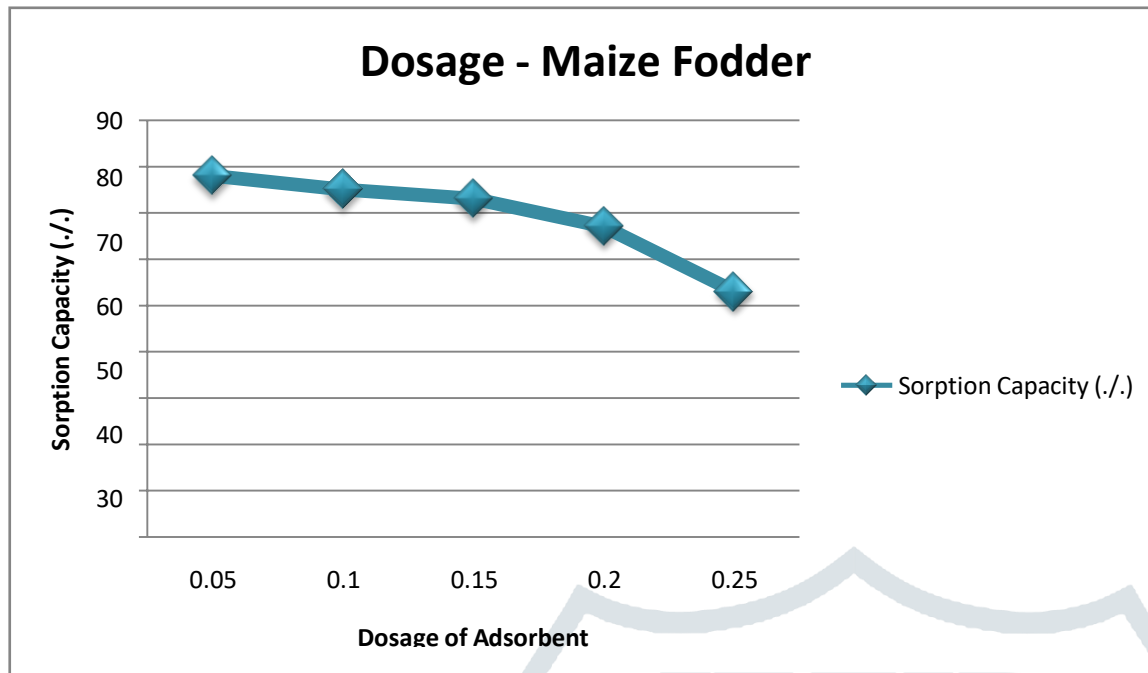


The sorption capacity of adsorbent reached saturation at 5 minutes. Hence SC at the period of **5 min** of maize fodder was found as **29500mg/g**.

2.5 EFFECT OF DOSAGE:

The Sorption Capacity (SC) of coconut poonac was determined by varying dosage level in the range of 0.05g to 0.25g. The percentage removal of EBT dye by maize fodder as an adsorbent was found to increase with decrease in dosage. This is mainly due to the reverse of adsorption by desorption.

GRAPHICAL REPRESENTATION:

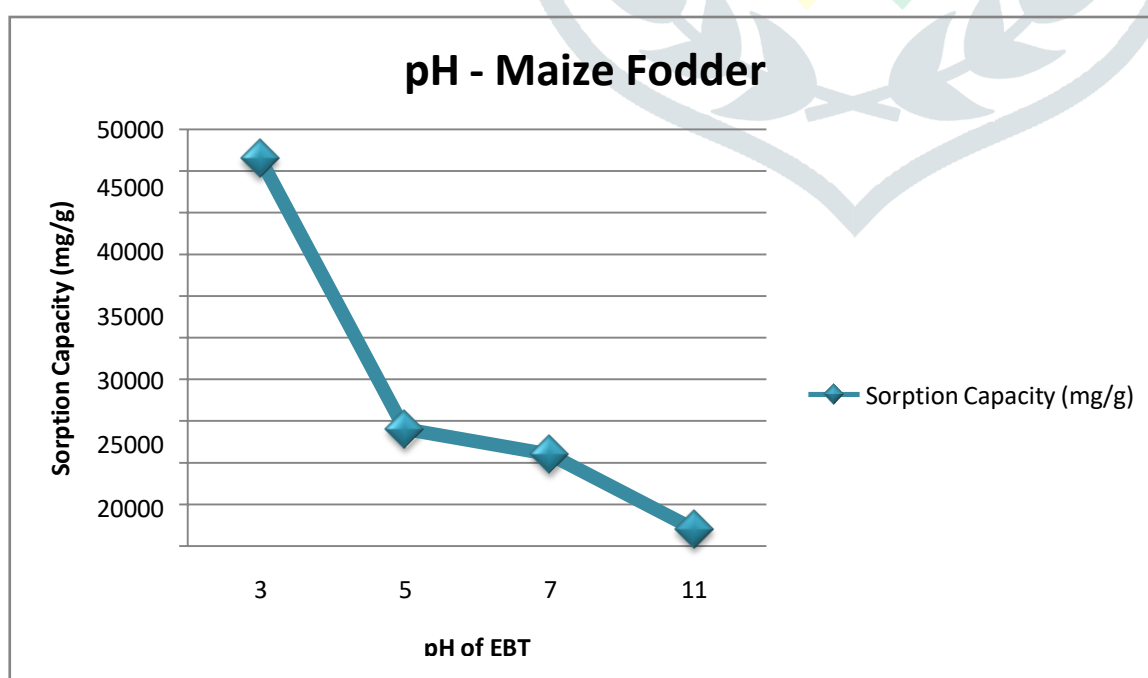


The sorption capacity is found to be maximum on **0.05 g of maize fodder** with **78%** of sorption capacity.

2.6 EFFECT OF pH:

The sorption capacity of the maize fodder was determined at five different pH level between 3-11. The pH of the working solution was controlled by adding HCl or NaOH.

GRAPHICAL REPRESENTATION:

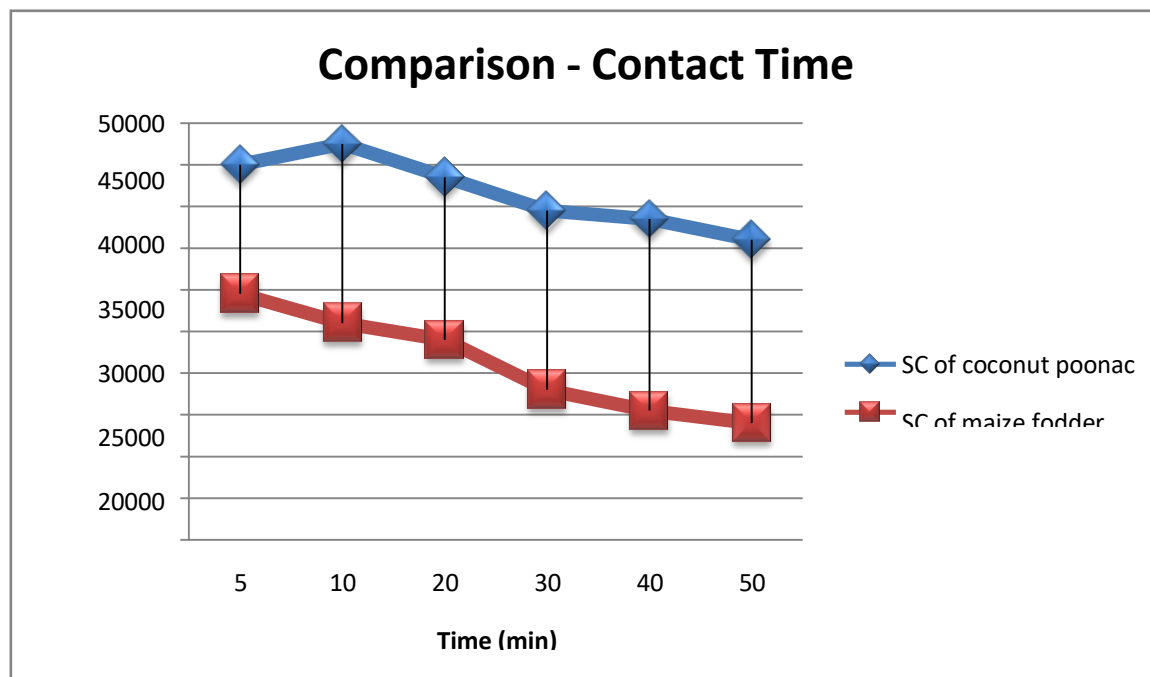


COMPARISON BETWEEN COCONUT POONAC AND MAIZE FODDER ON THE REMOVAL OF EBT DYE:

2.4 EFFECT OF CONTACT TIME:

The removal of EBT dye increases with decrease of contact time and reaches maximum value for **coconut poonac** at **10 minutes** and **maize fodder** at **5 minutes**. Among these two adsorbents, the removal of EBT dye by adsorption on **coconut poonac** was found to be **maximum** and **rapid**, whereas **maize fodder** showed a **minimum adsorption**.

GRAPHICAL REPRESENTATION:

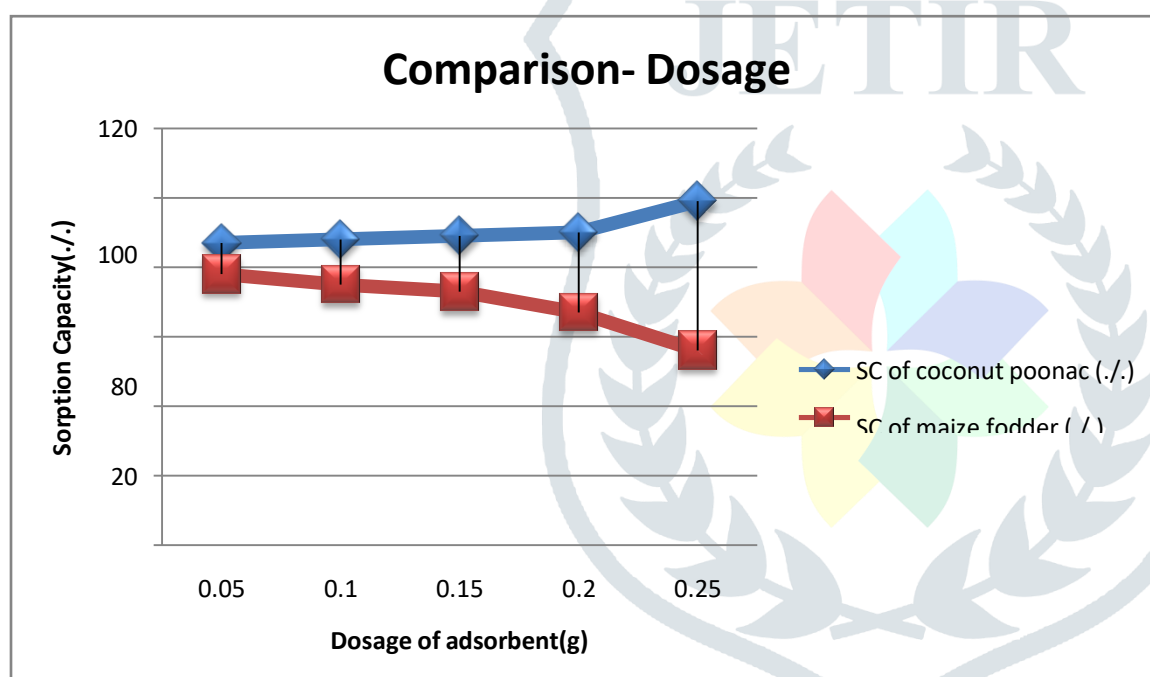


On comparing the SC of those various adsorbents at optimum conditions, **coconut poonac** acts as a **good adsorbent** at **10 minutes**, rather than **maize fodder**.

2.5 EFFECT OF DOSAGE:

The percentage removal of EBT dye by these two adsorbents is found to be decrease with increase in coconut poonac and then increase with decrease in maize fodder dosage of adsorbents.

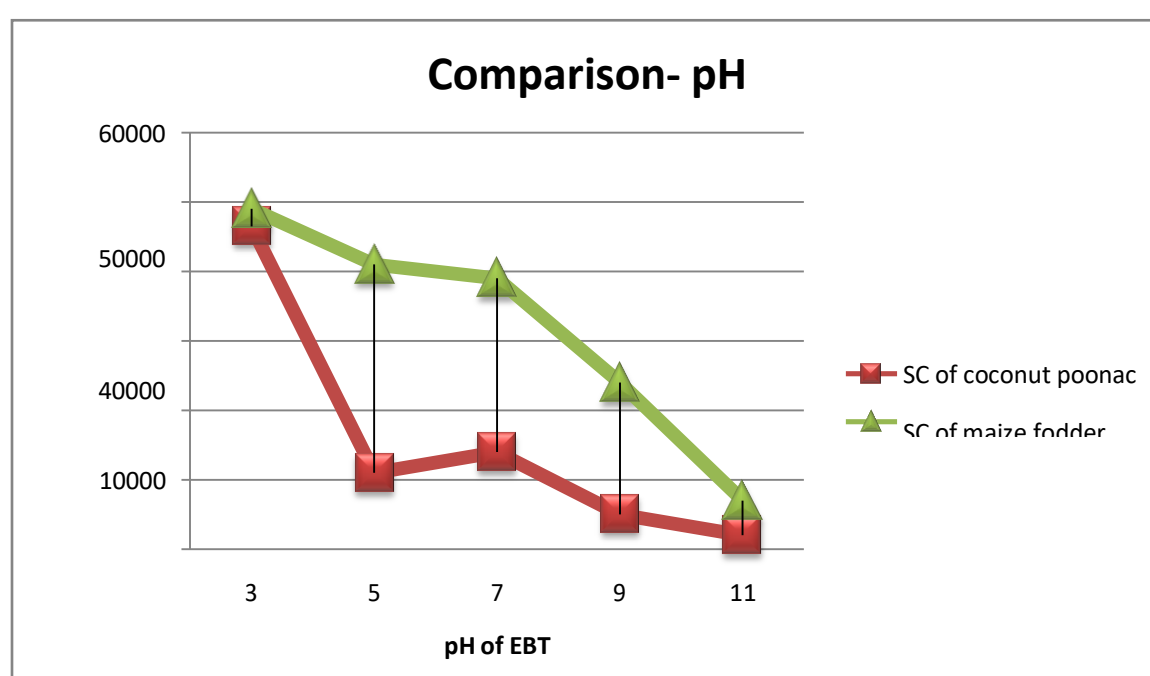
GRAPHICAL REPRESENTATION:



On comparing the percentage of removal of EBT dye, **coconut poonac** showed the **maximum adsorption** as **99%** than maize fodder **78%**.

2.6 EFFECT OF pH:

The removal of EBT dye by **coconut poonac** and **maize fodder** showed the **maximum removal** at **pH 3** as **49000** and **46500 mg/g** respectively.



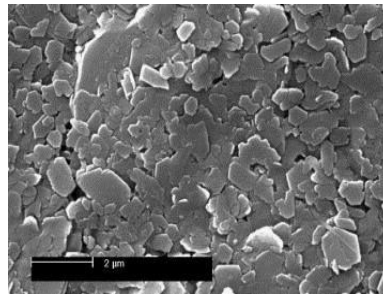
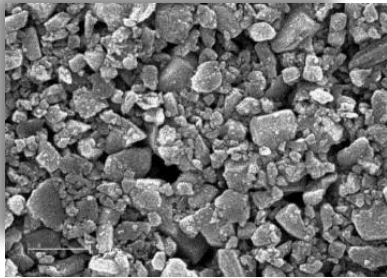
According to comparison study on adsorption between the two adsorbents, it concludes that **coconut poonac is more cost effective, economically fit and acts as an alternate to commercial adsorbents as an organic (bio) adsorbent** than maize fodder.

2.7 SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS:

SEM images of EBT adsorbed, coconut poonac and maize fodder are attached. This indicates the **structural changes on the surface of the bioadsorbents by adsorbing EBT on their surface.**

COCONUT POONAC (LOADED):

MAIZE FODDER (LOADED):

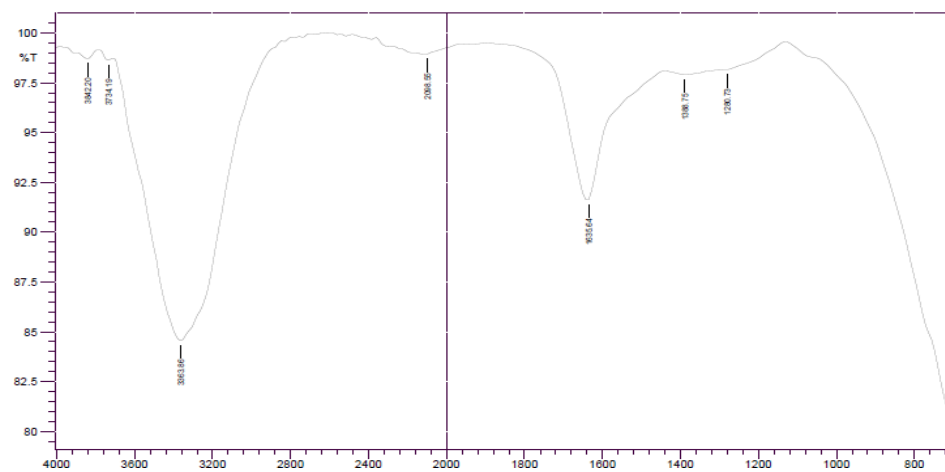


The mechanism of EBT adsorption removal by coconut poonac and maize fodder was observed. In this mechanism a **high increase in the SC was observed in coconut poonac than in maize fodder** due to the availability of **active adsorption sites in coconut poonac.**

2.8 FTIR ANALYSIS:

FTIR spectroscopy of coconut poonac and maize fodder before and after adsorption of EBT dye were recorded in the frequency ranging between 4000 – 500cm⁻¹ on FTIR shimadzu IR affinity. The sample were prepared in KBr disc. The intensities of transmittance of the were relatively more in the case of bioadsorbents than commercial adsorbents. This is due to the interaction between the fundamental functional groups in the adsorbents. The unloaded and loaded results of FTIR analysis of coconut poonac and maize fodder with peak values and functional groups are tabulated with results.

COCONUT POONAC – LOADED:

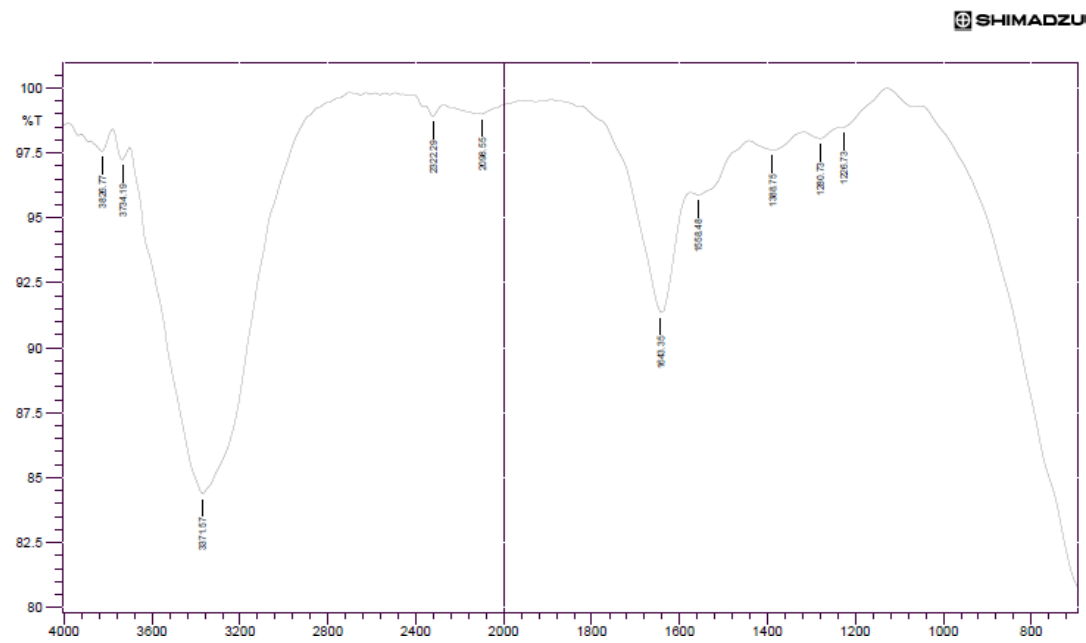


PEAK VALUES WITH FUNCTIONAL GROUPS:

COCONUT POONAC:

PEAK VALUES	FUNCTIONAL GROUPS
3642	C=O
3734	C-H
3863	-OH(bend)
2018	C=O
1636	C=C
1308	C-C(stretch)
1280	-OH
1444	C=C
2915	C=O(stretch)
1382	-OH

MAIZE FODDER – LOADED



MAIZE FODDER:

PEAK VALUES	FUNCTIONAL GROUPS
3820	C=O
3734	C=O
3371	C-H
2322	C-H(bend)
2096	-OH
1643	C=O
1553	C-H(stretch)
1306	C-H(bend)
1260	C=C
1226	-OH

The peak values of FTIR analysis of coconut poonac and maize fodder shows that the functional groups present in bioadsorbent may be responsible for the adsorbent of EBT dye from the polluted water.

CONCLUSION

In the present global world the aggregation of dye leads to water pollution. EBT dye is toxic which is used in textile industry. The application of coconut poonac and maize fodder to remove dye from polluted water. This solutions are affordable and reachable let us act for the change.

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