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TREATMENT OF SYNTHETIC GREY WATER USING CORNCOB

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***Abstract*:** This project deals with the treatment of grey water using corncob, activated corncob and combination of corncob with activated corncob. Corncobs are most important agricultural waste in maize cultivation therefore it is one of the cost effective method for water treatment and hence can be reused for irrigation, washing, flushing etc. On comparison of the three methods, activated corncobs are considered more efficient in removal of influent characteristics. BOD and COD has major removal efficiency of 86.16% and 66.94% respectively.

Index Terms – Corncob, Synthetic Grey water

I. INTRODUCTION

1.1 General Background

Grey water or sullage is all wastewater generated in households or office buildings from streams without fecal contamination, i.e all streams except for the waste water from toilets. Sources of grey water includes sinks, showers, baths, clothes washing machines or dish washers.. As grey water contains fewer pathogens than domestic wastewater, it is generally safer to handle and easier to treat and reuse onsite for toilet flushing, landscape or crop irrigation, and other non-potable uses.

Grey water can be defined as any domestic wastewater produced, excluding sewage. The main difference between sewage (black water) and grey water is the organic loading. Sewage has a much larger organic loading than grey water. The various methods used must be safe from health point of view and not harmful to the environment. Here we use corncobs for treatment purpose. Quantities of pollutants ranging from detergents to gasoline to salts and heavy metals were all adsorbed by the corncob.

A corncob, also called cob of corn, is the central core of an ear of corn. It is the part of the ear on which the kernels grow. The ear is also considered a "cob" or "pole" but it is not fully a "pole" until the ear is shucked, or removed from the plant material around the ear. Young ears, also called baby corn, can be consumed raw, but as the plant matures the cob becomes tougher until only the kernels are edible. When harvesting corn, the corncob may be collected as part of the ear (necessary for corn on the cob), or instead may be left as part of the corn stover in the field. The innermost part of the cob is white and has a consistency similar to foam plastic.

Activated corncobs are the product of carbonization of corncob. These are carbon based materials produced by carbonization using heating process to increase carbon content of starting material. The carbonization can be done using both traditional and modern techniques.

1.2 Objectives

The objectives of this study are as follows:

- To treat the grey water using corn cob and activated corn cob and to check whether suitable for reuse applications.
- To solve the problem of water in water scarce areas.
- To reject use of chemicals.

1.3 Scope

- Cheap and cost effective methods to treat grey water.
- Reuse for other purposes like irrigation, washing etc.

II. LITERATURE REVIEW

Imran Ali (2016) et.al, conducted a study which designed and developed a simple and low-cost maize cobs tricking filter-based (MCTF) wastewater treatment (WWT) system The WW samples were analyzed for various parameters (including COD, BOD, TSS, TDS, turbidity, and colour) before and after WW treatment using the MCTF-WWT system. The MCTF was packed with maize cob shells obtained from an agricultural site. The maize cobs were used as support media for bio film growth in the MCTF-WWT system. The system was operated for six months in order to evaluate its performance for various WWT parameters. The study concludes that the maize cobs-based trickling filters could establish efficient and low-cost WWT systems for developing countries.

Karnapa Ajit (2016), conducted a study on increasing water demand due to the exponential growth in population has led to the idea of using waste water as a source of water. Immense technological advancements have been made in the field of waste water engineering which helps in separating various types of solids from waste water. Identification of the reuse potential of different types of waste water thus facilitates in treating them at source and using them for various beneficial purposes. The current paper looks at the reuse possibilities of grey water by studying the characteristics and available treatment options of grey water.

N. Samson Maria Louis, (2015), conducted a study on corncob which is converted into activated charcoal for treating dye waste water. Corn cob is roasted at high percentage with low cost chemical as catalyst to reduce time with temperature control to get 32% yield & certain low cost chemicals are added for obtaining activated carbon. In order to minimize the energetic cost of the process, the following optimal conditions i.e., 2 N phosphoric acid activating solution, impregnation time of 20 hr, activation temperature at 600O C for 60 min & pH5 are achieved for utilizing in dye wastewater treatment.

Ali S. M, (2014) et.al, conducted a study which aimed to use low cost adsorbents, which consist of corn cobs as plant wastes adsorbents in treatment of Industrial waste water by fixed bed column technique and study the effect of two variables (pH value and contact time). The sample of plant waste (Corn cobs) was tested to determine its activity which gives the best performance in heavy metals removal and other pollutants (TSS, TDS and COD). Adsorption tests showed the corn cobs adsorbents had significant heavy metal removal efficiency.

Muhammad B. Ibrahim (2013), conducted a study on the thermodynamics and sorption efficiencies for the remediation of Cr, Ni and Cd from their aqueous solutions using Maize Cob (MC) and Sawdust (SD) in a batch system are reported. Efficiencies were judged based on parameters such as sorbent weight, initial adsorbate loading concentration, pH and surface area. Shimadzu AA650 Double Beam Atomic Absorption/Flame spectrophotometer was employed to study concentration differences before and after the adsorption process.

III. MATERIALS AND METHODS

3.1 Preparation of corncob

Corncobs were collected, washed and sundried, further cut into different sections such as longitudinal sections, small pieces and powdered form for the treatment of grey water.

Fig 3.1: Corn cob

3.2 Preparation of activated corncob

Corncobs were collected, washed and sundried .The dried corncobs were cut into sections and converted into activated corncob for the treatment of grey water.

Fig 3.2: Activated corncob

3.3 Preparation of synthetic grey water

Table 3.1: Composition used for preparation of synthetic grey water

Compound	Concentration
Glucose (mg/l)	300
Sodium acetate trihydrate (mg/l)	400
Ammonium chloride (mg/l)	225
Disodium hydrogen phosphate (mg/l)	150
Potassium dihydrogen phosphate (mg/l)	75
Magnesium sulphate (mg/l)	50
Cow dung (ml/l)	0.2

Table 3.2: Influent characteristics of grey water used in the study

Parameter	Unit	Value
pH	-	8.22
TDS	mg/l	512
BOD	mg/l	367.9
COD	mg/l	472
Conductivity	Ms	1.02
Turbidity	NTU	8
Hardness	mg/l	72
Ammonia Nitrogen	mg/l	80

IV. RESULTS AND DISCUSSION

4.1 Treatment of synthetic grey water using corncob

The corncobs were collected, washed, sun dried and cut into different sections such as longitudinal pieces, small pieces and powdered form. These were arranged in layers such that the powdered corncob is the first layer followed by small pieces and finally the longitudinal pieces. Each layers were arranged with a height of 7cm. The grey water is poured through the set up. The filtrates were collected and its effluent characteristics were analysed and compared with influent characteristics.

Compressive strength is calculated by the equation,

Table 4.1: Effluent characteristics of synthetic grey water after treatment using corncob

Parameters	Unit	Before treatment	After treatment	Irrigation standards
pH	-	8.22	7.71	5.5-9
TDS	mg/l	512	600	500-2000
BOD	mg/l	367.9	65.9	100
COD	mg/l	472	228	250
Conductivity	ms	1.02	1.02	1.5-2.0
Turbidity	NTU	8	13	5
Hardness	mg/l	72	44	-
Ammonia Nitrogen	mg/l	80	62.4	-

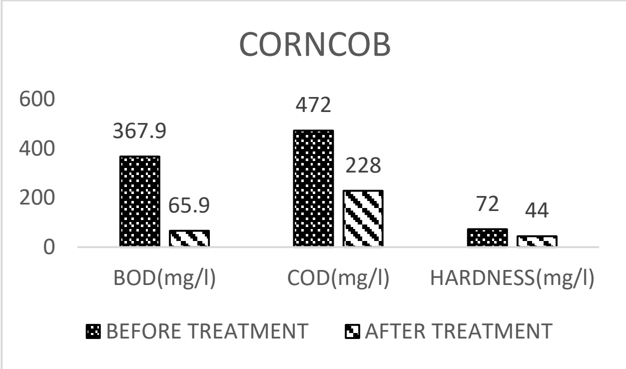

Fig 4.1: Variation of BOD, COD, hardness before and after treatment using corn cob

The above figure shows variation of graph of synthetic grey water using corncob. The values of BOD, COD and hardness were 367.9 mg/l, 472 mg/l and 72 mg/l respectively and after treatment the values reduced to 65.9 mg/l, 228 mg/l and 44 mg/l respectively.

4.2 Treatment of synthetic grey water using corncob and activated corncob

The corncobs were collected, washed and sundried. These were cut into longitudinal pieces, small pieces and powdered form. From these a small portion was converted to activated corncob. All these were arranged in layers with a height of 7cm. Initially powdered form of corncob and activated corncob were laid. Above that small pieces and longitudinal pieces of activated corncob were placed. Finally small and longitudinal sections of normal corncobs .Grey water is poured through the setup. Effluent and influent characteristics were compared.

Table 4.2: Effluent characteristics of synthetic grey water after treatment using corncob and activated corncob

Parameters	**Unit**	**Before treatment**	**After treatment**	**Irrigation standards**
pH	-	8.22	8.04	5.5-9
TDS	mg/l	512	600	500-2000
BOD	mg/l	367.9	60.9	100
COD	mg/l	472	184	250
Conductivity	ms	1.02	1.04	1.5-2.0
Turbidity	NTU	8	14	5
Hardness	mg/l	72	60	-
Ammonia Nitrogen	mg/l	80	74.8	-

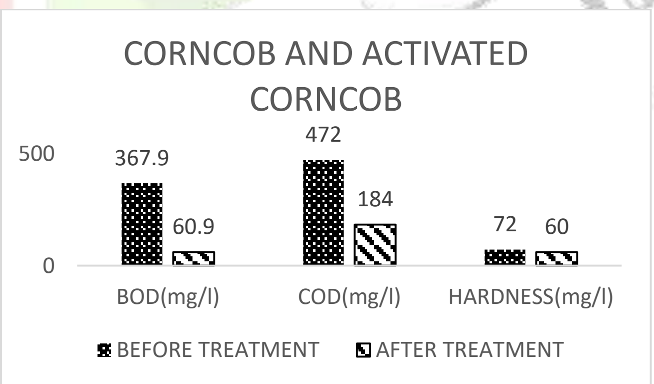

Fig 4.2: Variation of BOD, COD, hardness before and after treatment using corn cob and activated corncob

The above figure shows variation of graph of synthetic grey water using corncob and activated corncob. The values of BOD, COD and hardness were 367.9 mg/l, 472 mg/l and 72 mg/l respectively and after treatment the values reduced to 60.9 mg/l, 184 mg/l and 60 mg/l respectively.

4.3 Treatment of synthetic grey water using activated corncob

The corncobs were collected, washed, sundried and cut into different sections such as longitudinal pieces, small pieces and powdered form. These were converted into activated corncobs and are arranged in the set up with each layer of height 7cm. Grey water is poured through the set up. The effluent characteristics were noted and compared with the influent characteristics.

Table 4.3: Effluent characteristics of synthetic grey water after treatment using activated corncob

Parameters	Unit	Before treatment	After treatment	Irrigation standards
pH	-	8.22	8.47	5.5-9
TDS	mg/l	512	640	500-2000
BOD	mg/l	367.9	50.9	100
COD	mg/l	472	156	250
Conductivity	ms	1.02	1.09	1.5-2.0
Turbidity	NTU	8	13	5
Hardness	mg/l	72	75	-
Ammonia Nitrogen	mg/l	80	60	-

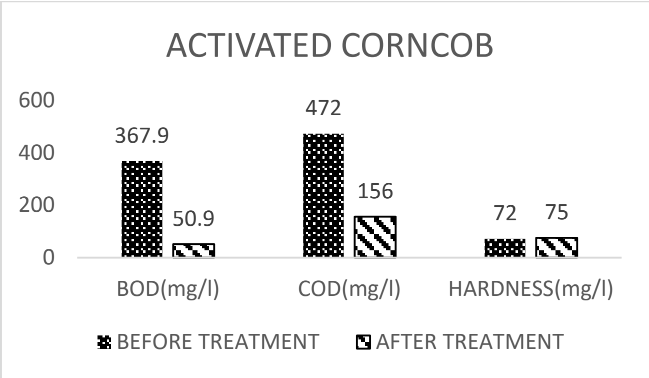

Figure 4.3: Variation of BOD, COD, and hardness before and after treatment using activated corncob

The above figure shows variation of graph of synthetic grey water using activated corncob. The values of BOD, COD and hardness were 367.9 mg/l, 472 mg/l and 72 mg/l respectively and after treatment the values reduced to 50.9 mg/l, 156 mg/l and 75 mg/l respectively.

Table 4.4: Percentage reduction

Parameters	Corncob alone	Corncob and activated corncob	Activated corncob
BOD	82.08	83.446	86.16
COD	51.69	61.016	66.94
Hardness	38.88	16.66	-

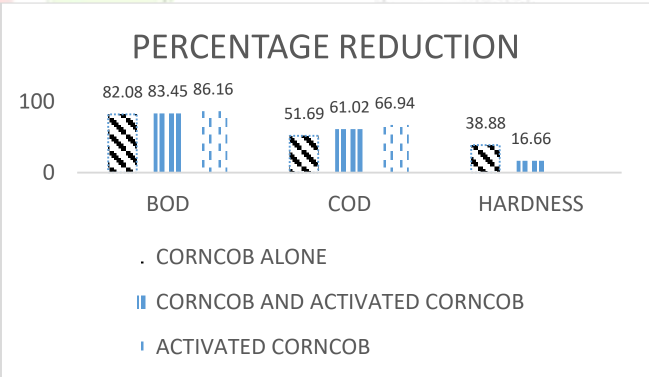

Fig 4.4: Graph showing percentage reduction

The above figure shows the percentage reduction of BOD, COD and hardness of synthetic grey water on treated using corncob, corncob and activated corncob and finally activated corncob respectively. From this comparison it is clear that the more percentage reduction for BOD and COD is achieved by treating the synthetic grey water using activated corncob, whereas the hardness value increased on treating with activated corncob.

V. CONCLUSIONS

Grey water is any wastewater which is produced from domestic applications like bathing, laundry, dish washing etc. Corncob is the most important agricultural waste in maize cultivation.

This project deals with the treatment of synthetic grey water using corncob, activated corncob and combination of both corncob and activated corncob. The main principle of using corncob for the treatment is its adsorption property. The suspended particles got adsorbed to the different sections of the corncob and immobilised with the help of corncob.

On comparing the different treatment methods, activated corncob enhances more percentage reduction of BOD (86.16%) and COD (64.94%)due to the presence of carbon content and effective property of adsorption. The content of ammonia nitrogen reduced on treatment using corncob, activated corncob and the combination of above. The hardness reduced on treatment with corncob and combination of corncob and activated corncob, but on treatment with activated corncob increased the hardness due the presence of trace elements such as sulphur and calcium.

It is clear from the above results that corncobs are well suited for treating grey water for reuses like irrigation, flushing etc as it is a simple and low cost method.

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