WASTEWATER TREATEMENT FROM ADSORBENT MADE FROM VETIVER GRASS

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***Abstract*: Adsorption of wastewater onto vetiver grass based adsorbents from aqueous solutions was studied to enable comparison with alternative commonly available absorbents. Batch experiments were conducted to determine the effect of method of treatment of vetiver grass on adsorption. Vetiver grass, which is a relatively abundant and inexpensive material, is currently being investigated as an adsorbent for the removal of various pollutants from wastewaters. Various pollutants, such as dyes, phenols, organic compounds, pesticides, inorganic anions, and heavy metals can be removed very effectively with vetiver grass as an adsorbent. This thesis presents a brief review on the role of vetiver grass and vetiver grass ash in the removal of various pollutants from wastewater. Studies on the adsorption of various pollutants by vetiver grass materials are reviewed and the adsorption mechanism, influencing factors, favourable conditions, etc., discussed in this article. It is evident from the review that vetiver grass and its ash can be potentially utilized for the removal of various pollutants from water and wastewaters.**

The purpose of this study was to identify the effectiveness of activated carbon for the reduction of pollutants from municipal wastewater. Wastewater samples were collected from drainage systems near leather complex, Kolkata, West Bengal. Analysis showed that the activated carbons used were significantly different in their efficacy for wastewater treatment. It was observed that by increasing the concentration of activated adsorbent, the removal efficiency of both activated adsorbents increased The vetiver grass based activated carbon was found more efficient After the treatment of municipal wastewater, its quality was found to be appropriate for direct discharge into streams, lakes, rivers. The water could be used for irrigation purpose.

***Keywords*: Biochar, Adsorbent, Wastewater, Heavy metals, Water treatment,**

I. Introduction: - Adsorption of wastewater onto vetiver grass based adsorbents from aqueous solutions was studied to enable comparison with alternative commonly available absorbents. Batch experiments were conducted to determine the effect of method of treatment of vetiver grass on adsorption. Vetiver grass, which is a relatively abundant and inexpensive material, is currently being investigated as an adsorbent for the removal of various pollutants from wastewaters. Various pollutants, such as dyes, phenols, organic compounds, pesticides, inorganic anions, and heavy metals can be removed very effectively with vetiver grass as an adsorbent. This thesis presents a brief review on the role of vetiver grass and vetiver grass ash in the removal of various pollutants from wastewater. Studies on the adsorption of various pollutants by vetiver grass materials are reviewed and the adsorption mechanism, influencing factors, favourable conditions, etc., discussed in this article. It is evident from the review that vetiver grass and its ash can be potentially utilized for the removal of various pollutants from water and wastewaters.

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II. Materials & Methods

Material: -

The prime material required for the present research work is Roots of Vetiver Grass. This grass is highly carbonaceous which is good for making biochar.

Methodology:-

Methodology that was used in this paper for conducting present research work is enlisted below

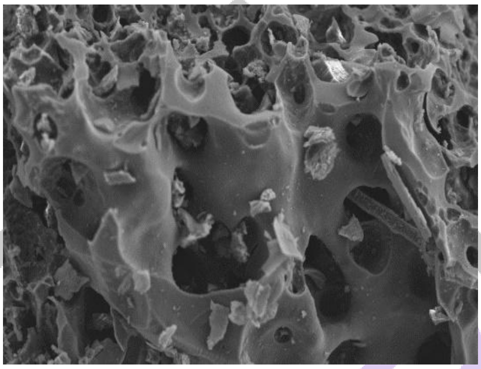
- **Pyrolysis of vetiver grass:** Pyrolysis is the thermo-chemical decomposition of organic material in the absence of oxygen at high temperature. Vetiver grass was collected from the farmyard and thoroughly washed with distilled water to remove the dirt and unwanted materials.
- **Estimation of volatile organic carbon:** Volatile organic compound are emitted into the atmosphere from anthropogenic and biogenic source and also found in situ in the atmosphere as product of the atmospheric transformations of other VOC_S. Vetiver grass was burnt at 520^0C for 2 hours in muffle furnace.
- **Estimation of Ash content:** The residue after completely burnt vetiver grass and the ash remain during combustion which consists metal oxides. Ash is one of the components in the proximate analysis of biological materials consisting mainly of salty inorganic constituents. It includes metal salt which are important for processes requiring ions such as Na (sodium),

K (potassium) and Ca (calcium). The pre-weighted amount of dried vetiver grass was pyrolysis at 800^0C for 2 hours in a porce line boat kept in tube furnace.

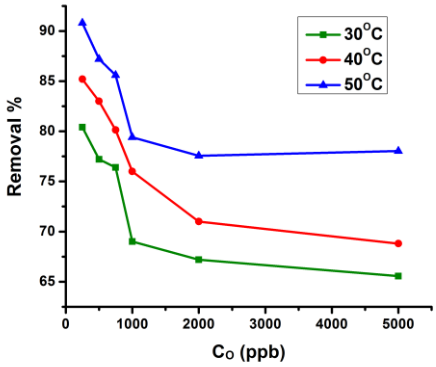
- **Surface modification of biochar (charcoal) by acid treatment:** The accurately weighed (2 gm) prepared biochar was mixed with 100 ml of molar of H2SO4 solution and stirred in an orbital shaker for 5 hrs. And the mixture was placed in a stainless steel Teflon autoclave vessel and kept in a hot air oven for 2 hrs. at 140^0C. After cooling of the solution, it was washed until neutral pH was obtained then the modified biochar was dried in a hot air oven at 140^0C.
- **Estimation of acidic group present on the biochar:** The prepared biochar and as acid treated biochar was added individually NaOH solution $NaHCO_3$ solution. The solution were made by dissolving required amount of NaOH and $NaHCO_3$ distill water. Boiling was done to eliminate the CO_2 present in the water which could interfere in the overall results.
- **Loading of MnO_2 crystal on acid treated biochar:** biochar was added with HNO_3 and $KMNO_4$ solution. The mixture was stirred vigorously and then kept in a stainless Teflon liner and placed in a hot air oven at 140ºC. After cooling, the mixture was washed with distill water and pH of the solution was made neutral. After that the modified biochar was dried in a furnace.

III. RESULTS

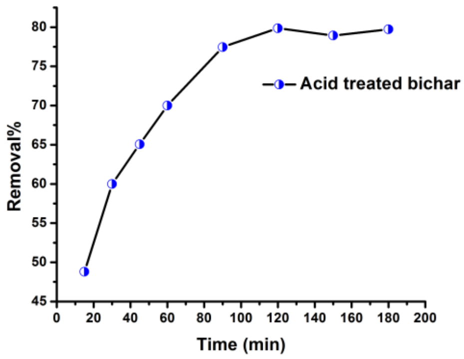
Results for FESEM



Results for Equilibrium dose of Adsorbent

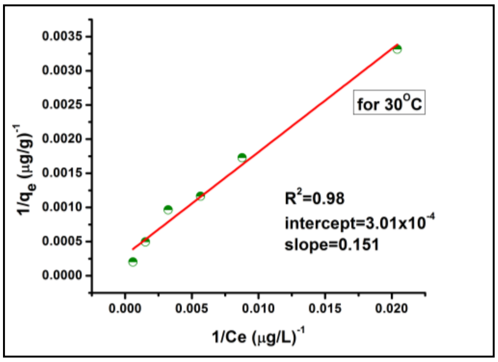


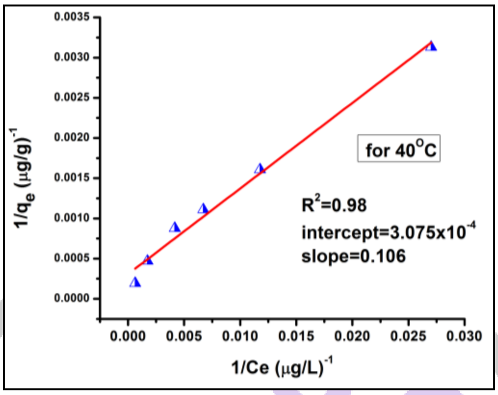
Equilibrium Contact Time

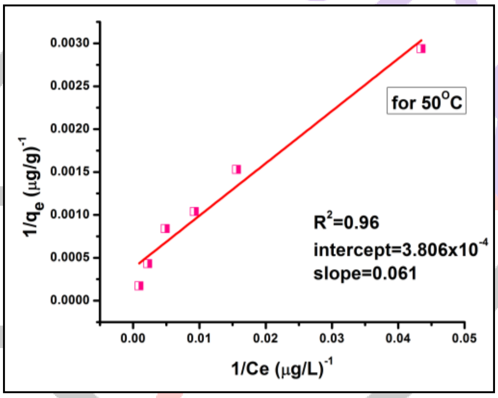


Result of Isothermal studies at different temperature

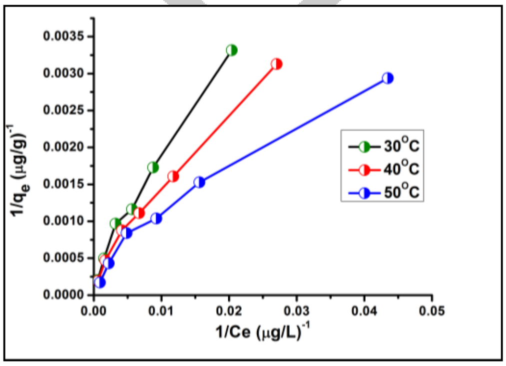
Langmuir Isotherm at 30^0, 40^0 and 50^0 C



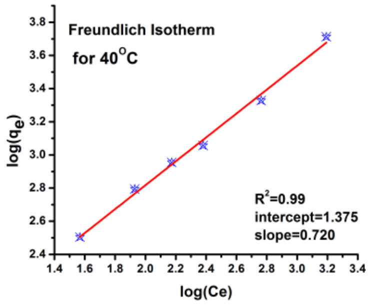


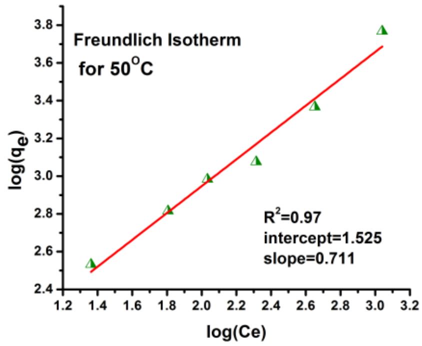


Langmuir Isotherm (different temp.)

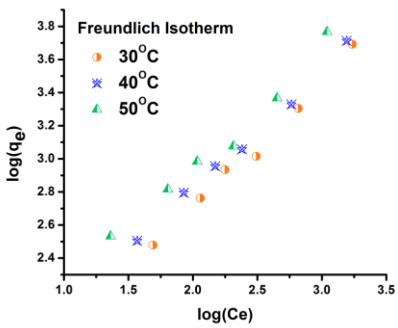


Freundlich Isotherm at 40^{0}C and 50^0 C





Freundlich Isotherm(different temp.)



IV. CONCLUSIONS

Biochar made from vetiver grass is an environmental friendly adsorbent. Modification of biochar by acid introduces many (10^{21} sites/g) active sites on the surface of biochar and makes it active for adsorbent. Adsorption of Arsenic on the adsorbent were studied with different parameters. Adsorption was found suitable at higher temp. Indicating its endothermic nature. The isotherm states indicate that both the Langmuir and the Frundlich isotherm describe the adsorption process in both the cases. The max adsorption capacity (q_m) was found to be 3.32 mg/g, 3.25 mg/g, 2.26 mg/g at 30°C, 40°C and 50°C respectively for acid treated biochar. The values of R_L is both the cases for both the adsorbents tell the feasibility of adsorption. Analysis the Frundlich Isotherm it also indicate the feasibility of adsorption. The presence of $FeSO_4$ has been found to have played a detrimental role in removal of Arsenic for the adsorbents. Whereas, the presence of bicarbonate plays a detrimental role in the removal percentage for acid treated biochar.

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