EasyChair Preprint

№ 8798

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September 6, 2022

Materials sciences And Engineering, (MSE'22)

MSE'22

Study of the biosorption of food coloring by a marine biomass

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Keywords:
Biomass
Biochar
Food dye
Adsorption

ABSTRACT

The elimination of sunset yellow dye in beverages, waters and pharmaceutical preparations is of great importance due to its negative side effects. In this context, a new effective adsorbent, green algae has been synthesized and applied for dye adsorption. The chemical properties of the proposed adsorbent were fully characterized using Fourier Transform Infrared (FTIR) spectroscopy. The adsorption performance of the adsorbent was studied including the influence of carbonization temperature, particle size, pH, contact time, adsorbent dose. Dye uptake was high (>90%). indicating that the adsorbent could be used in practical applications.

1. Introduction

Contamination caused by synthetic dyes is an important issue that should be considered by human beings. Sunset yellow (Yellow 6, E 110, or SY) is a food coloring providing a yellow-orange color that is added to fruit juices, candies, gummies, dairy products, pharmaceuticals, and beverages to improve food texture. It is notably added to beverages to improve and preserve color during storage and/or production of non-alcoholic beverages. Moreover, the addition of SY brings several improvements such as color uniformity, high oxygen, light and pH stability, relatively lower production costs and low microbiological contamination in beverages, food or pharmaceutical preparations. Nevertheless, excessive consumption of SY can cause several side effects, including nasal congestion, kidney tumors, abdominal pain, chromosomal damage, hyperactivity, diarrhea, severe weight loss, and allergies. Many technologies including flocculation, liquid-liquid extraction, (bio)adsorption and membrane filtration have been used to remove SY from food samples, effluents, pharmaceutical preparations and beverages. Among these techniques, adsorption has been declared superior to other techniques due to its high versatility, efficiency, relatively high cost, efficiency without secondary pollution. The preparation of an effective adsorbent for the elimination of SY is a difficult demand to protect both the environment and human health.

2. Objective

• The adsorption process based on a natural adsorbent would be much more economical than commercial activated carbon, plus it is a renewable source that naturally proliferates in the sea.

• Adsorbent is easily prepared using economical preparation, washing, drying, grinding, and sieving techniques.

The objective of this study is the preparation of an activated carbon from the valorization of a natural residue "green algae" and its application in the elimination of a dye "Orange yellow (Yellow 6, E 110 or SY)" contained in the water by the phenomenon of adsorption. The prepared material was characterized by. Then we studied the influence of certain parameters on the adsorption capacity such as: the carbonization time, the particle size, the mass of the adsorbent, the contact time and the pH.

3. Methods

The marine biomass was purified and then carbonized at a low temperature for different times in order to choose the best adsorbent.

A series of experiments was carried out to study the influence of certain parameters on the adsorption capacity of orange-yellow by this biochar such as the mass of the adsorbent, the contact time, the pH, the temperature and the concentration initial of SY. At the end of this study, the various parameters were set to give maximum adsorption rates.

4. Results and discussion

As an original work, marine biomass were converted into biochar via a low temperature carbonization process which was found to have the greatest effect on

carbon structure, resulting in carbon reorganization and the formation of more graphitized biochar. proven by their chemical bond. The prepared biochar was tested as adsorbents to remove orange-yellow dye, giving highest adsorption capacity with very low adsorbent dose and shortest equilibrium contact time.

5. Conclusion

The present work shows the efficiency of this low-temperature synthesis strategy in developing abundant biochar by converting an abundant natural material, making them excellent candidates for several applications such as wastewater treatment as excellent adsorbent, energy storage as an electroactive material, catalyst, biodetection, fertilizer,…

6. References

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