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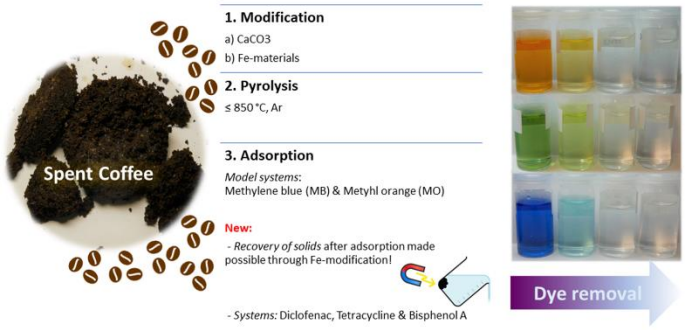
Modifications of spent coffee used as adsorbent for the filtration of water

Description



Water is becoming a highly valuable resource. Hence, economically viable and efficient methods to produce clean water for the growing world population gain more and more importance. One possible treatment for clean water production is the removal of pollutants via adsorption. Although quite expensive, activated carbon (AC) is commonly used for pollutant adsorption. However, spent coffee (SC) is an abundant and cheap raw material that is daily disposed worldwide in large amounts. It is already known for removal of e.g. heavy metals, dyes or organic acids [1-3].

The focus of our work lies on the preparation of carbon adsorbents for water treatment from SC, aiming for a cheap alternative to commercial activated carbon. Activation is carried out at high temperatures using $CaCO_3$, another abundant raw material. Also, we are looking into the prospect of recycling the carbon materials after adsorption, e.g. by modifying these materials by rendering them magnetic. Adsorption capacities are compared on water-soluble dyes methylene blue (MB) and methyl orange (MO) using adsorption time and adsorption mass. Though most materials have relatively small surface areas, all carbonaceous systems show great adsorption properties of MB and MO in the pilot systems [4]. First experiments show that the magnetic materials are quite efficient in adsorbing the model system dyes MB and MO as well and can then be recovered using a simple permanent magnet. Currently, we are broadening the spectrum of possible contaminants by evaluating the performance of the adsorbents for removal of the pharmaceuticals Diclofenac or Tetracycline, as well as Bisphenol A, a harmful component in plastics and resins. So far, all materials show an auspicious talent for removal of organic contaminants from aqueous solutions.

Spectrum of Methods

High-temperature furnaces – FTIR-ATR spectroscopy – X-ray diffraction (XRD) – Scanning electron microscopy (SEM) – UV/Vis spectroscopy – Nitrogen sorption/BET-Analysis

Literature

[1] Cerino-Córdova, F. J. et al; *Biosorption of Cu(II) and Pb(II) from aqueous solutions by chemically modified spent coffee grains,* Int. J. Environ. Sci. Technol.*,* **2013**, *10*, 611–622.

[2] Safarik, I. et al.; *Magnetically modified spent coffee grounds for dyes removal* Eur Food Res Technol, **2012**, *234***,** 345–350.

[3] Figueroa Campos, G. A. et al; *Preparation of Activated Carbons from Spent Coffee Grounds and Coffee Parchment and Assessment of Their Adsorbent Efficiency*, *Processes*, **2021**, *9*, 1396.

[4] Block, I. et al; *Carbon Adsorbents from Spent Coffee for Removal of Methylene Blue and Methyl Orange from Water*, MDPI Materials*,* **2021**, *14*, 3996.

Applications

- Water filtration
- Adsorption
- Water treatment

Keywords

- Spent coffee
- Water
- Filtration
- Adsorption
- Pyrolysis
- Surface modifications
- Purification

Interest in cooperation

- Research-based collaboration
- Contract research
- Industry-sponsored research

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