ADSORPTION OF METALLIC IONS ON MAIZE STALK BEFORE AND AFTER THERMAL TREATMENT

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Introduction

Nowadays, most industries produce significant quantities of wastewater, which, before discharge into surface waters or sewerage networks of municipalities, must comply with the limits imposed by current legislation, including metals. A number of conventional technologies may be involved to eliminate metals form wastewater, including chemical precipitation, ion exchange, membrane separation and adsorption using various materials. These methods are sometimes not so efficient when the concentration of metals in aqueous medium is low. In addition, large amounts of generated waste require treatment and storage. On the other hand is expensive to treat large volumes of water where metals are found in low concentrations. In recent years, bio sorption using various natural materials has emerged as an ecological alternative for keeping metallic ions at low concentrations. Moreover, this approach is environmentally eco-friendly and the materials used are cheap and available in abundance. Also bio sorbents can retain metals selectively and efficiently. In our study the adsorption characteristics of maize stalk before and after thermal treatment were tested for removal of Cu(II), Pb(II), Cr(III) and Fe(III) ions from synthetic solutions.

Materials and methods

- The maize stalk with particle size between 1 (a) and 2mm(d) was used as a bio sorbent before and after thermal treatment for Cu(II), Pb(II), Cr(III) and Fe(III) adsorption.
- Thermal treatment of maize stalk was carried out for 2 hours at 250° C in an oven in the presence of inside oxygen. Mass losses were 30% (c) for 2.7012g and 69% (d) for 2.6092g for particle size of 1mm and 2mm, respectively. In order to determine adsorption characteristics batch laboratory experiments were carried out.
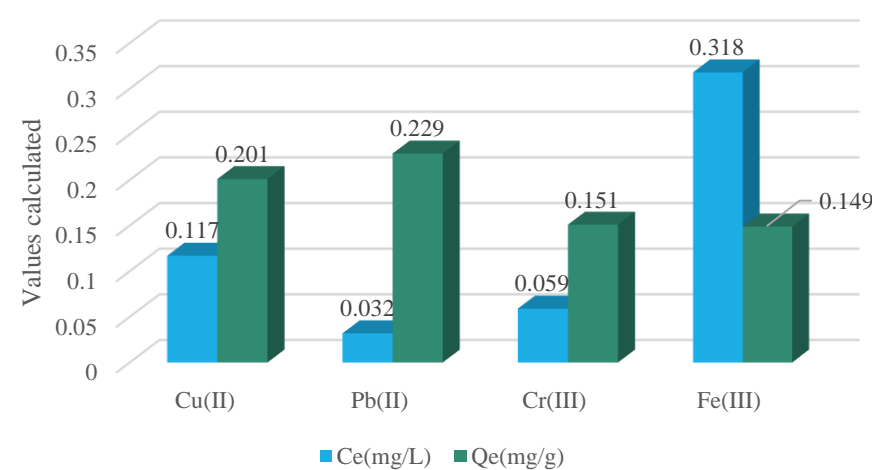

a) b)
c) d)
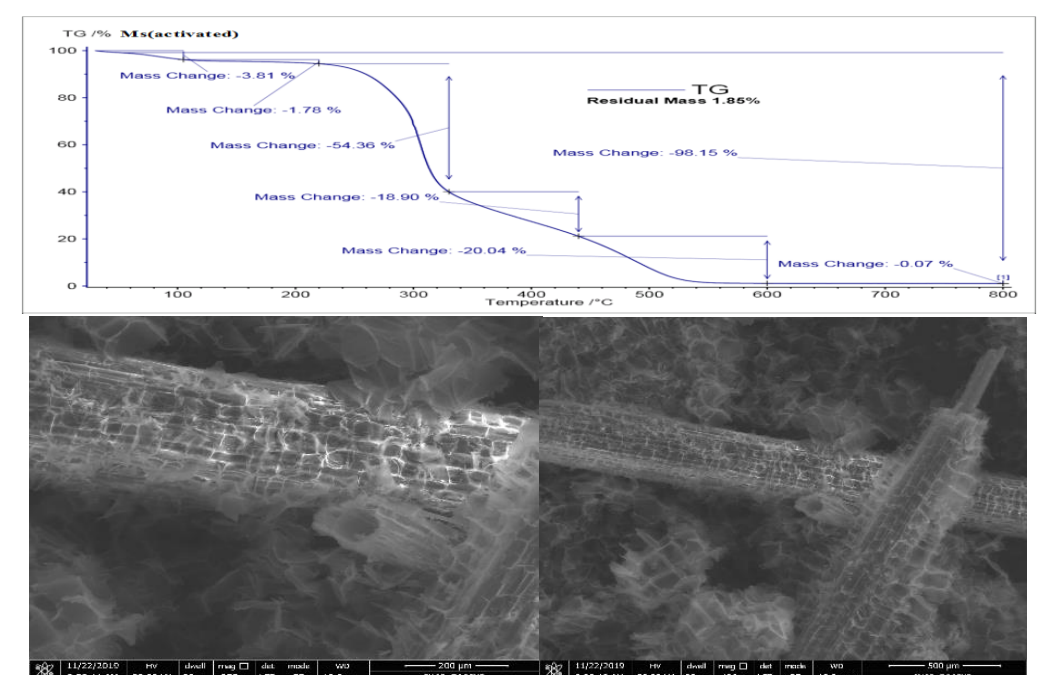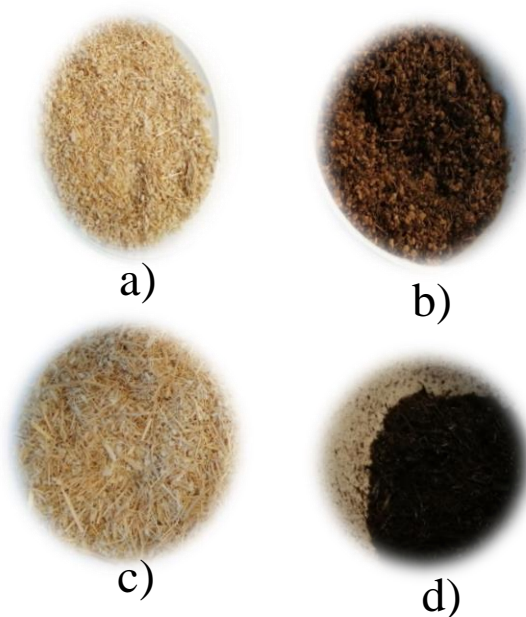
Also, thermal analysis and SEM micrographs of maize stalk sample 1a) were achieved;
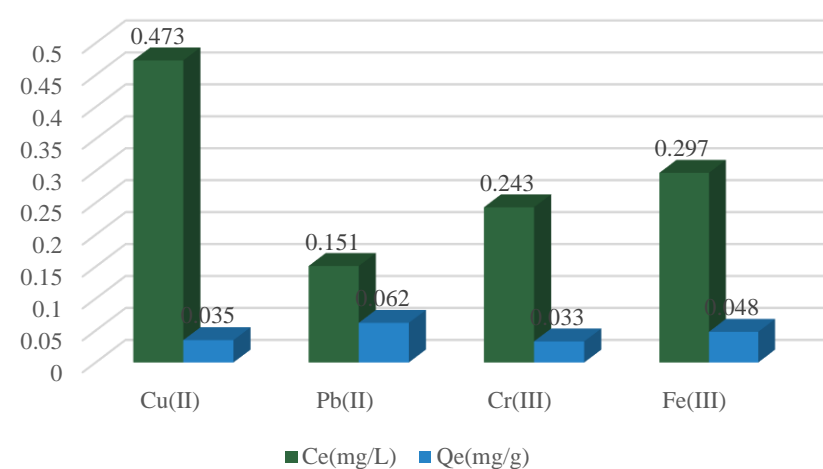
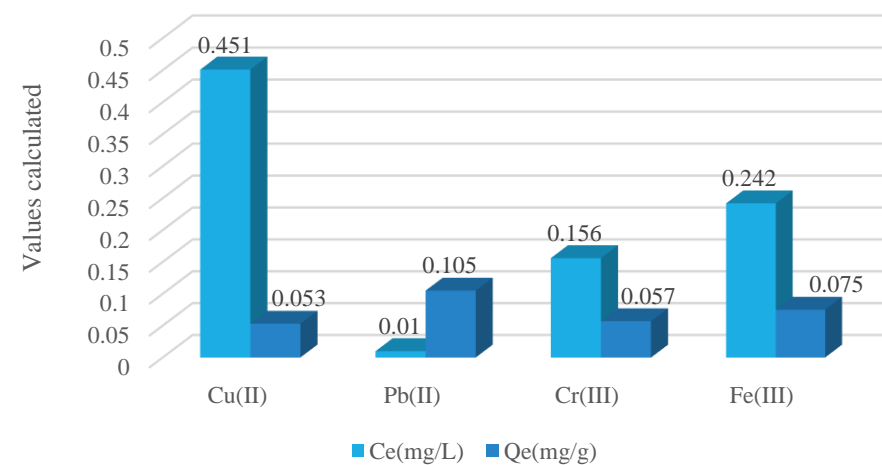## Results and conclusions

Sample 1
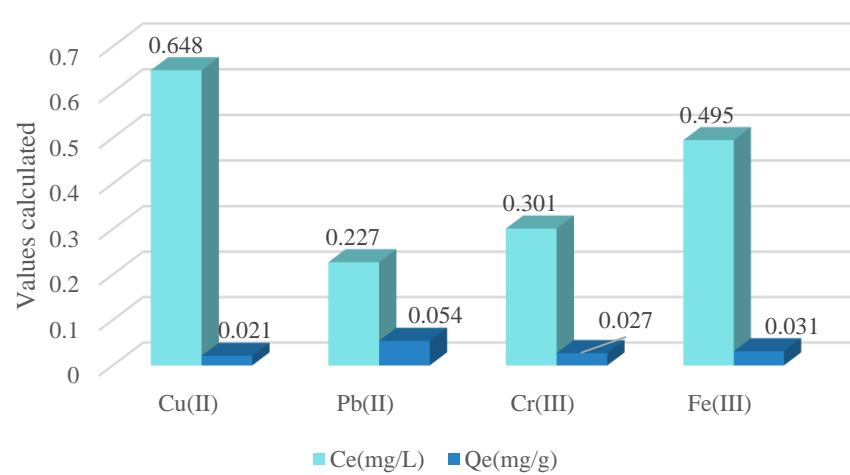
Sample 2

Sample 3

Sample 4

The IR studies available within literature that focuses on low cost materials characterisation suggest that physical bonds are lost and certain functional ionic groups of carboxyl and hydroxyl type which would encourage the retention of metallic ions from aqueous medium are highlighted after thermal treatment.

As can be seen from figures of samples 1-4, the amount of metal ion retained on mass to biomaterial (Qe) is higher for material obtained after thermal treatment compared to maize stalk activated with hydrochloric acid.

Also all concentrations measured at equilibrium (Ce) decrease for all experiments if compared to the initial concentrations of metallic ions.

It should be emphasized also the degree of selectivity in terms for maize stalk, useful aspect when the biomaterial is used in wastewater treatment process at industrial scale.

where: sample 1 represents maize stalk activated with HCl for particle size to 2 mm, sample 2 is obtained after thermal treatment for maize stalk with particle size of 2mm, sample 3 was obtained for maize stalk with 1mm particle size after being activated with HCl and sample 4 was achieved for maize stalk after thermal treatment for 1mm particle size.

✓ Moreover, the analysis of organic matter shows that the organic compounds from structure of maize stalk are solubilized in aqueous medium, while for all samples obtained after thermal treatments the values of these compounds concentration decrease highlighting their chemical transformation.
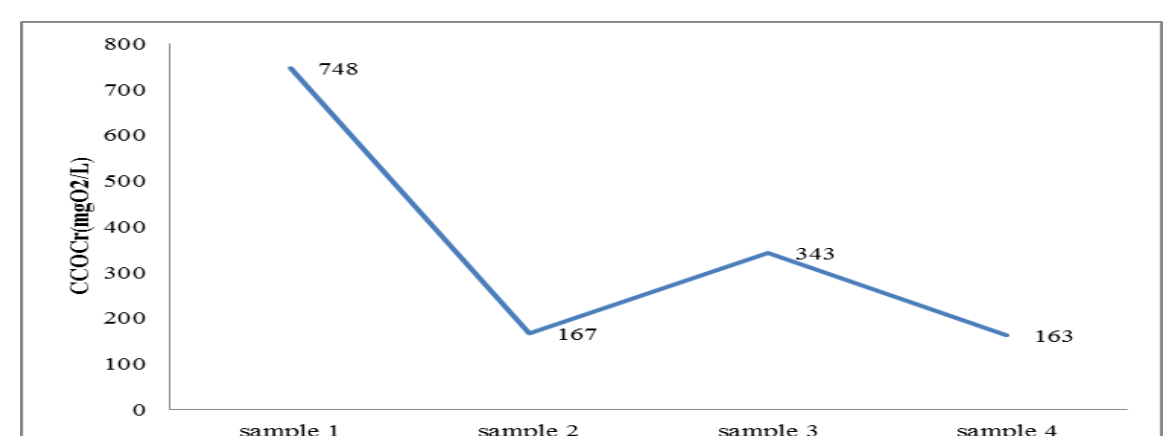
Determination of CCOCr in supernatant solution of maize stalk before and after thermal treatment