Biochars obtained from arabica coffee husk by a pyrolysis process: characterization and application in the Fe(II) removal in aqueous systems

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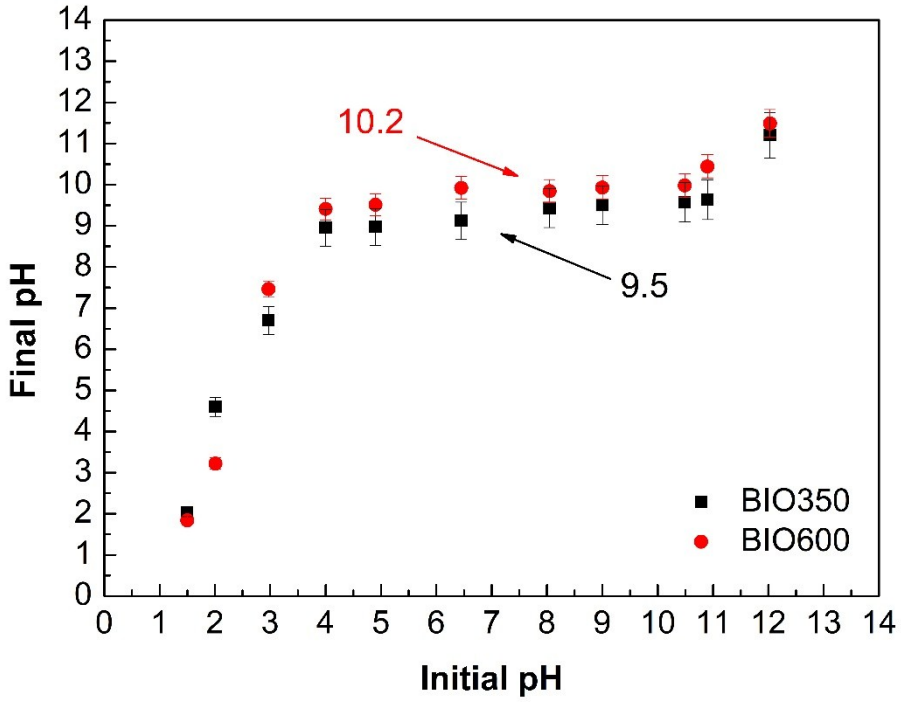


Figure S1. Point of Zero Charge of BIO350 and of BIO600. Experimental conditions: 50 mL of 0.1 mol/L NaCl; 24 hours of resting time; 0.1 g of material.

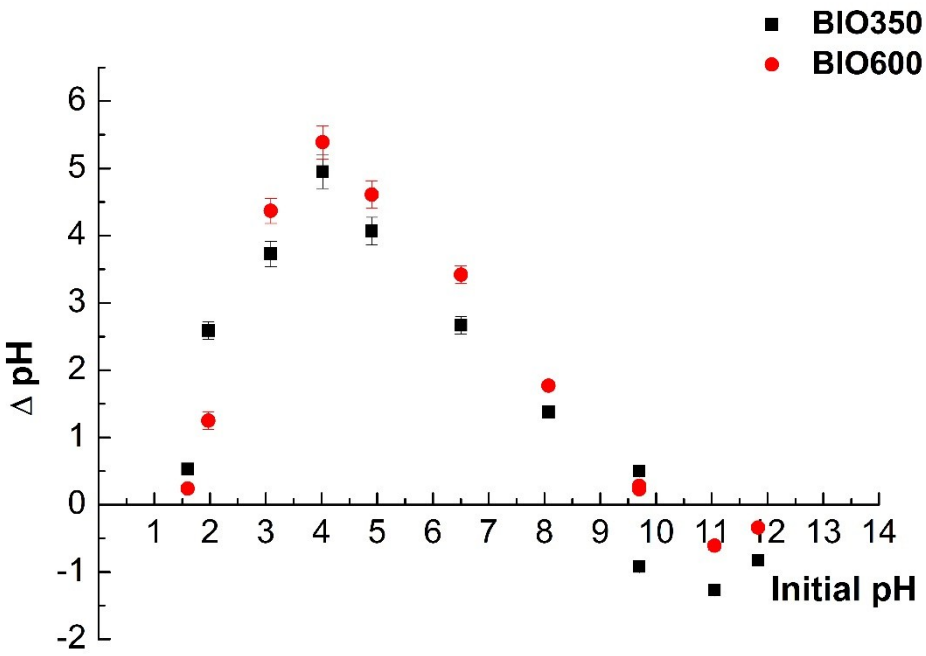


Figure S2. ΔpH *versus* initial pH.

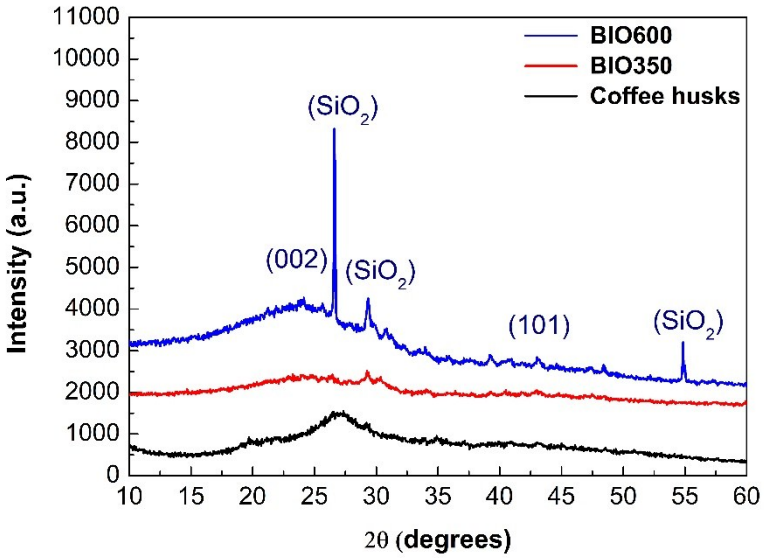


Figure S3. X-ray diffractograms of *in natura* coffee husks, BIO350 and BIO600.

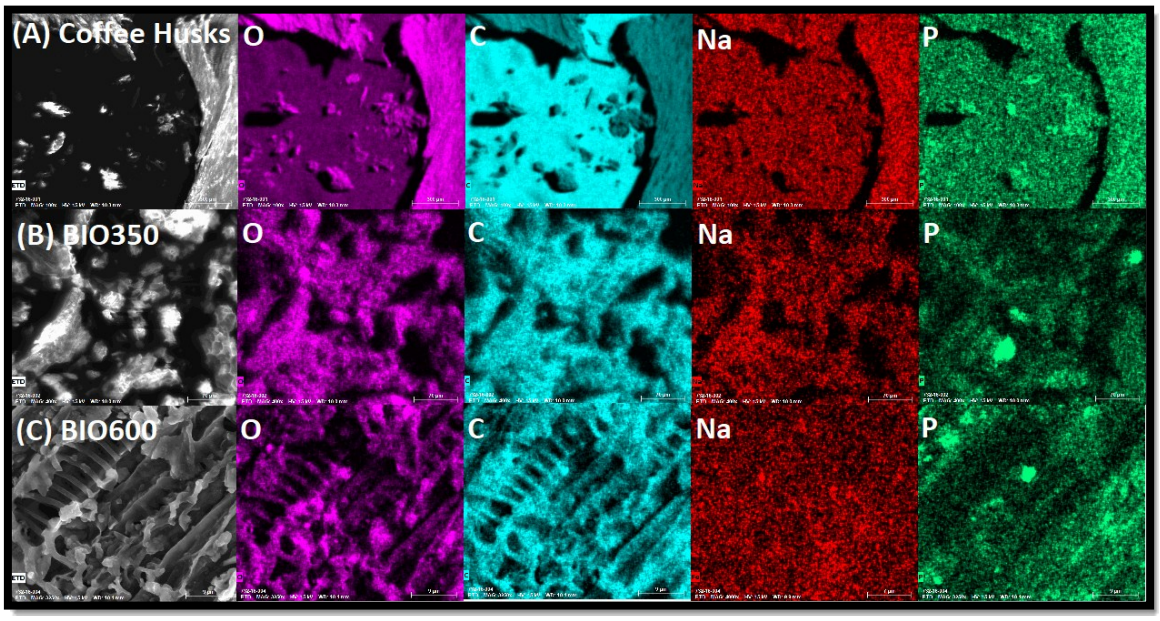


Figure S4. Images and chemical mapping using EDS for (A) in natura coffee husks, (B) BIO350, and (C) BIO600.

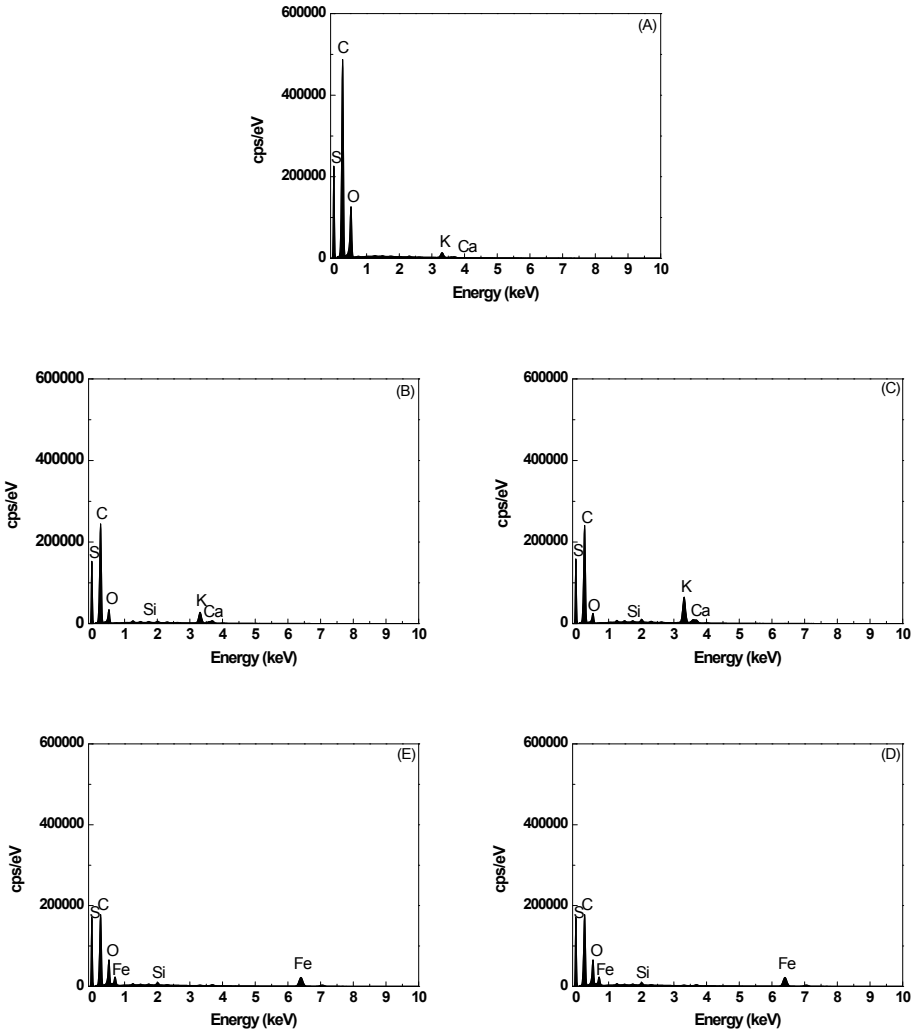


Figure S5. EDS espectrum for (A) *in natura* coffee husks, (B) BIO350, (C) BIO600, (D) BIO350Fe(II), and (E) BIO600Fe(II).

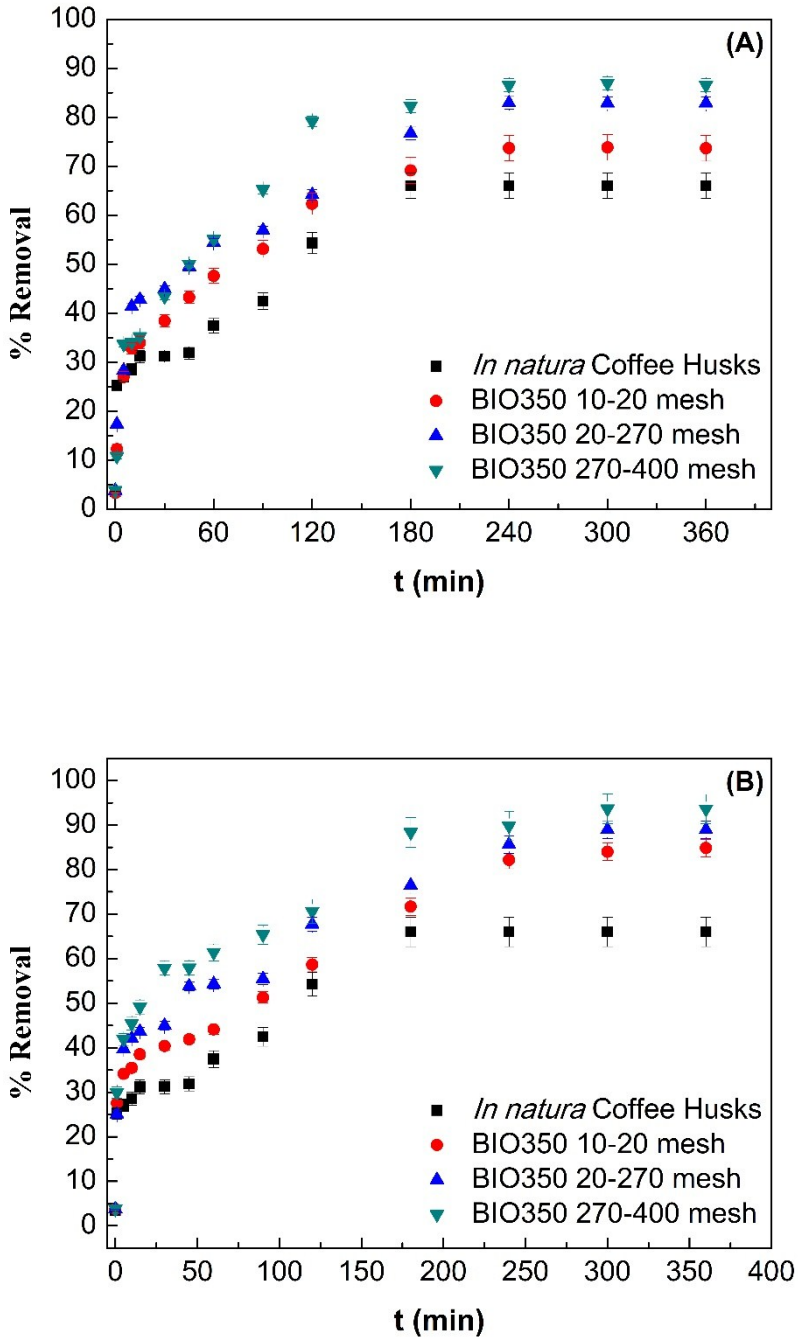


Figure S6. Granulometry effect on Fe(II) removal by biochars from arabica coffee husks (*Coffea arabica*); BIO350 (A) and BIO600 (B). Experimental conditions: 100 mL of Fe(II) solution 150 mg/L; 0.1 g of material; pH=4.8; 25 °C.

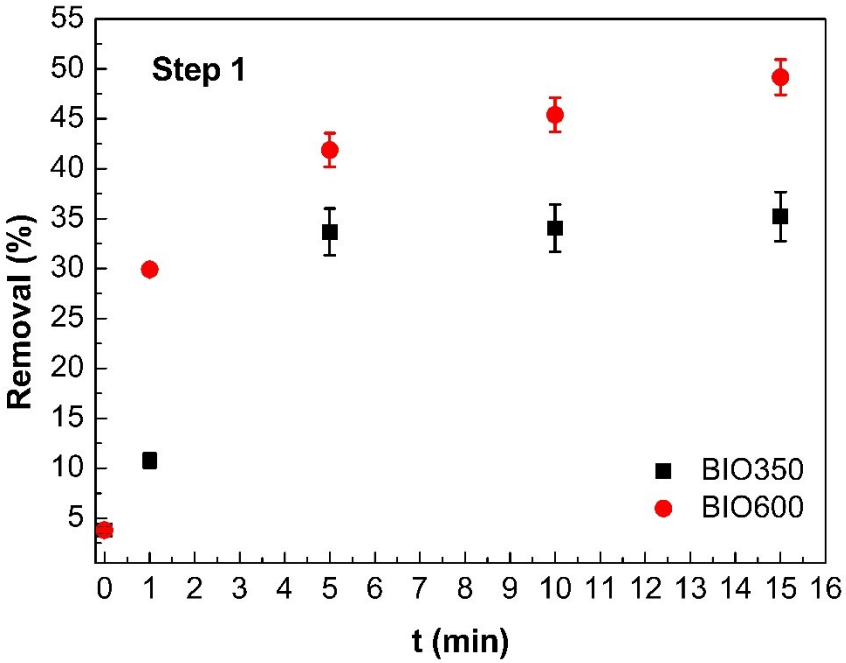
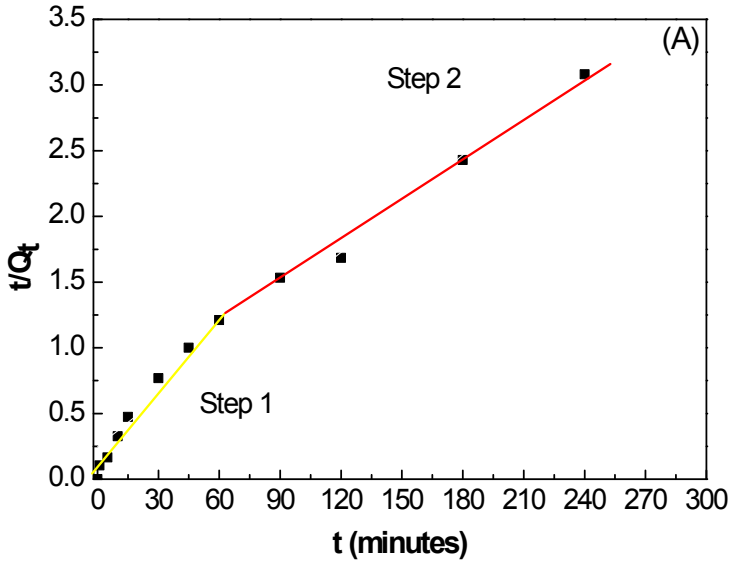


Figure S7. Removal of Fe(II) using biochars from arabica coffee husks (Coffea arabica). (270-400 mesh). Experimental conditions: 100 mL of Fe(II) solution 95 mg/L; 0.1 g of biochar; pH=4.8; 298 K, Step 1 (time from 0 to 15 minutes).



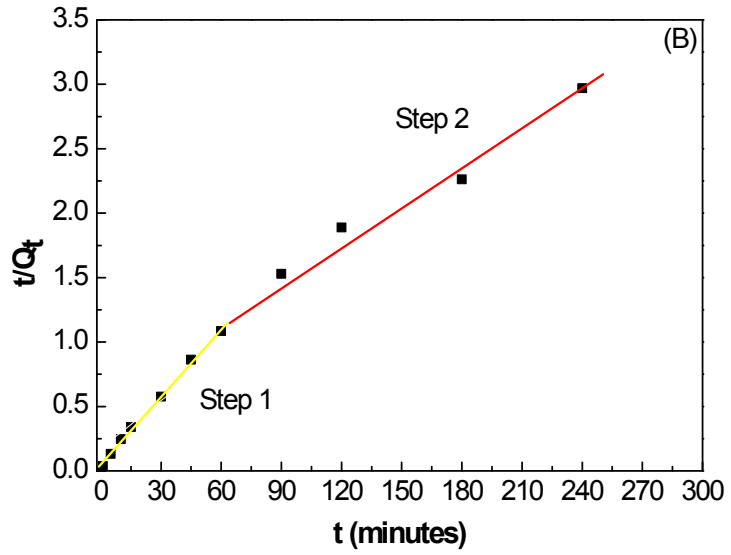


Figure S8. Adsorption knetics, pseudo-second order model fitting (Step 2) for (A) BIO350 and (B) BIO600.

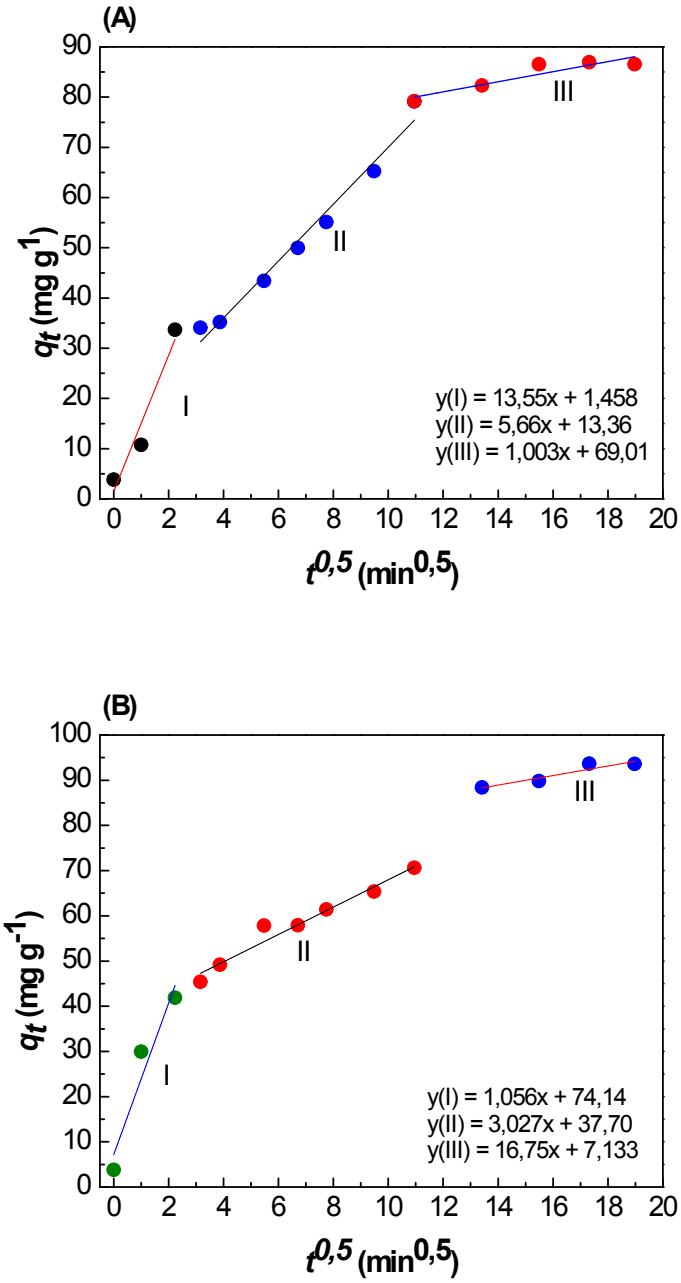


Figure S9. Adsorption knetics, intra particle diffusion model fitting for (A) BIO350 and (B) BIO600.

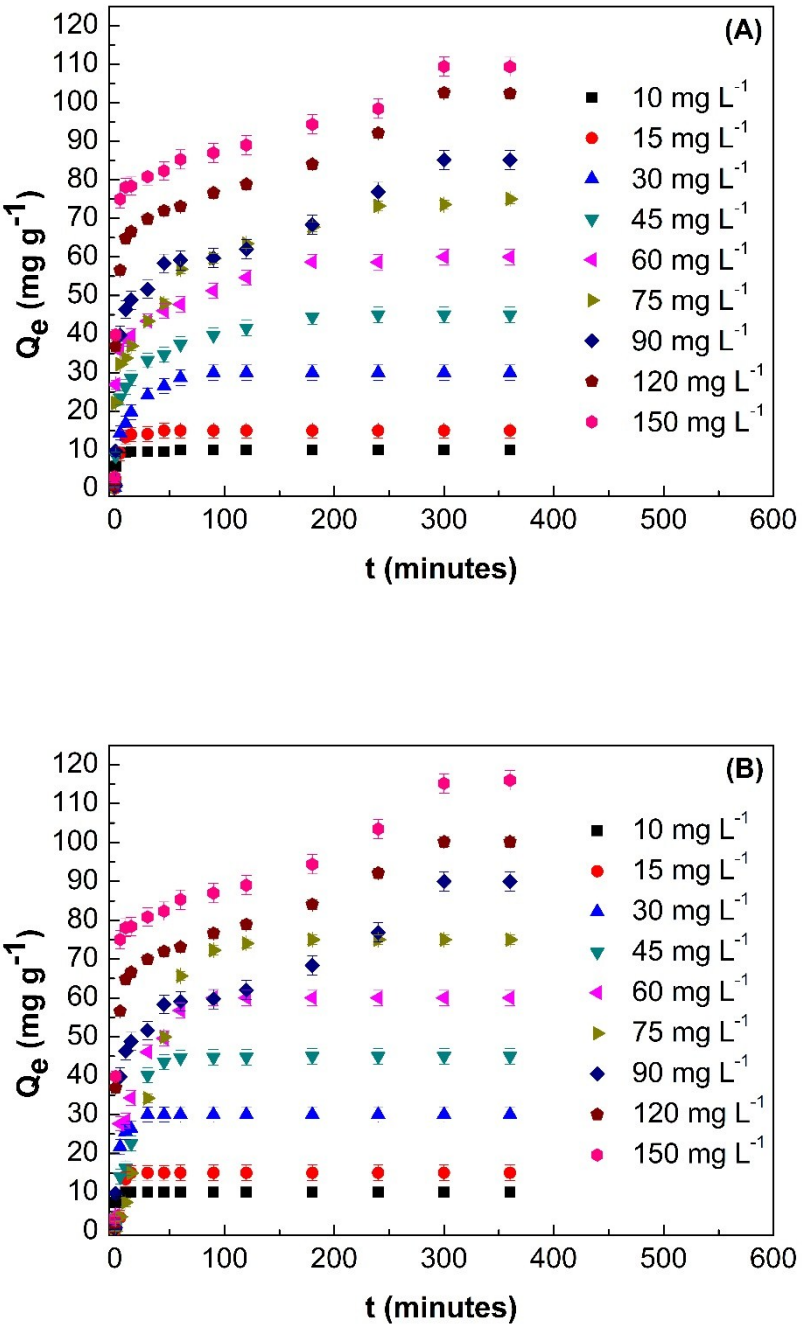


Figure S10. Maximum adsorption capacity of Fe(II) on biochars BIO350 (A) and BIO600 (B). Experimental conditions: 100 mL of Fe(II) solution; 0.1 g of material (270-400 mesh); pH=4.8; 25 °C.

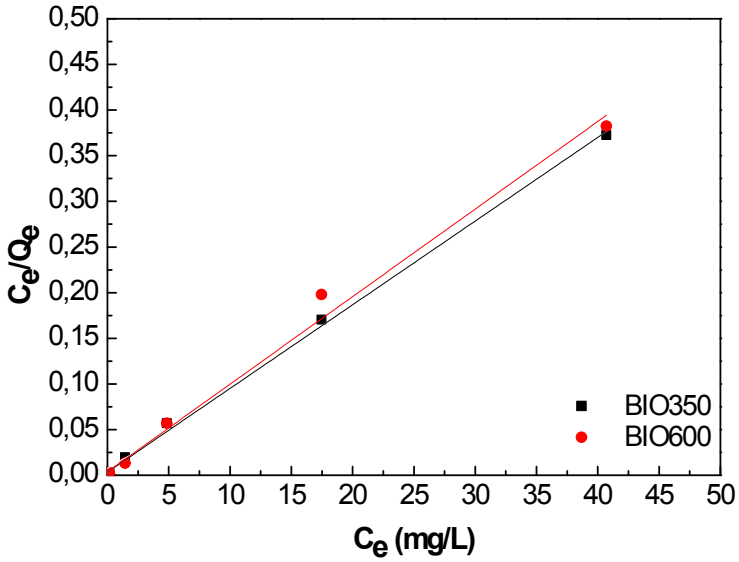


Figure S11. Adsorption isotherm, Langmuir model fitting for both the biochars.

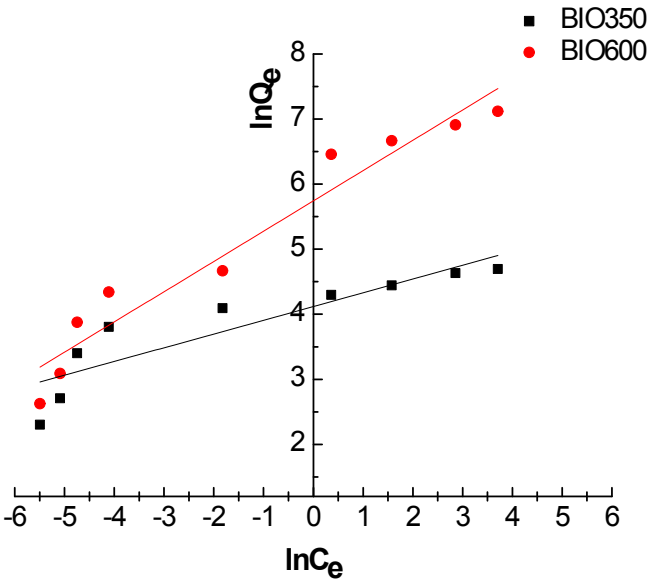


Figure S12. Adsorption isotherm, Freundlich model fitting for both the biochars.

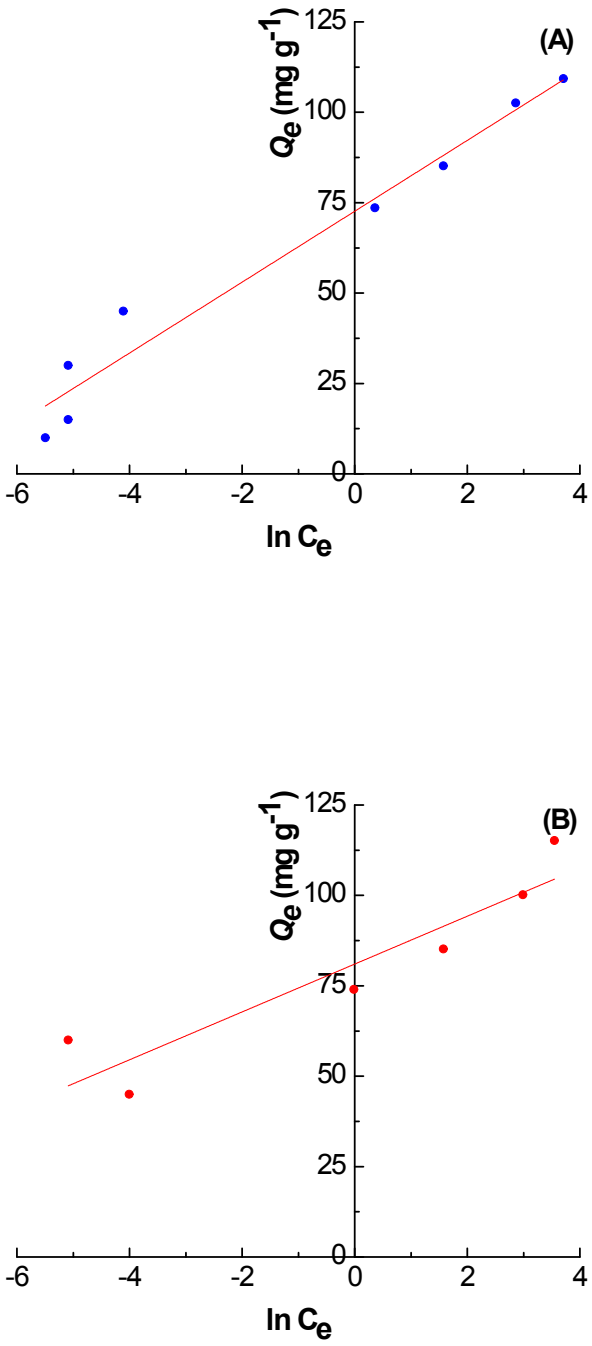
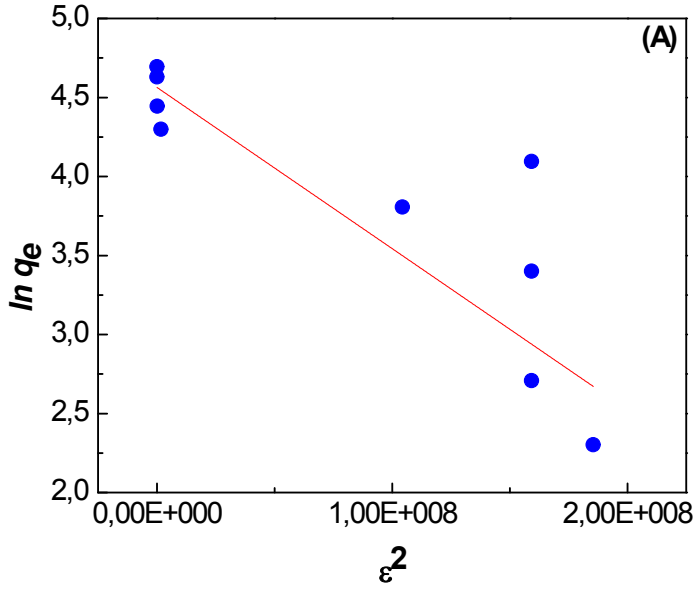


Figure S13. Adsorption isotherm, Temkin model fitting for (A) BIO350 and (B) BIO600.



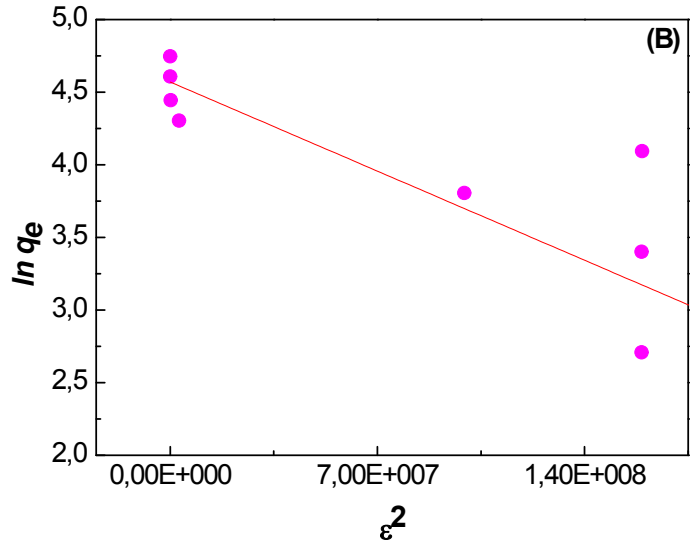


Figure S14. Adsorption isotherm, Dubinin-Raduskevich model fitting for (A) BIO350 and (B) BIO600.

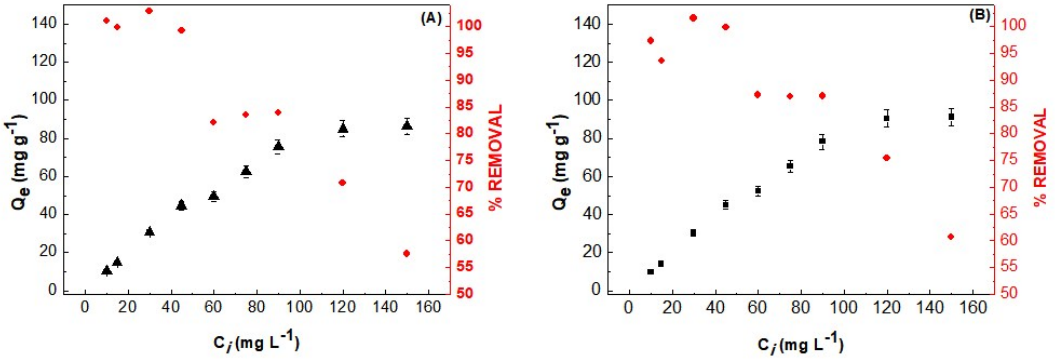


Figure S15. Maximum capacity and % of Fe(II) adsorption on biochars from arabica coffee husks (Coffea arabica). Experimental conditions: 100 mL of Fe(II); 0.1 g of (A) BIO350 and (B) BIO600; pH=4.8; 288 K.

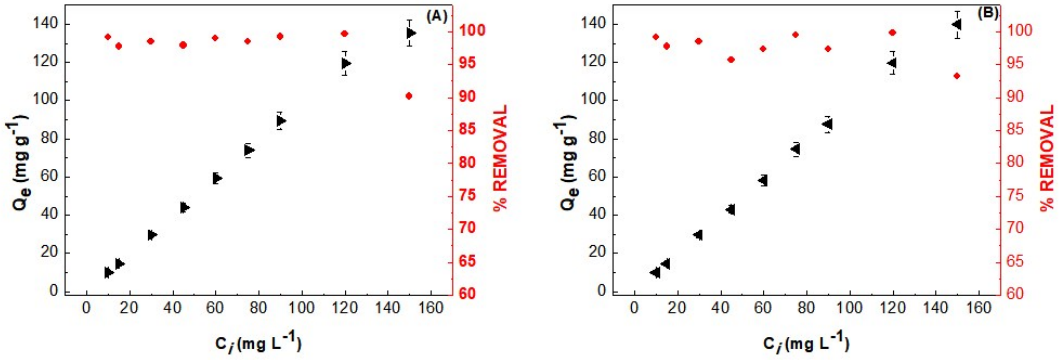


Figure S16. Maximum capacity and % of Fe(II) adsorption on biochars from arabica coffee husks (Coffea arabica). Experimental conditions: 100 mL of Fe(II); 0.1 g of (A) BIO350 and (B) BIO600; pH=4.8; 308 K**.**

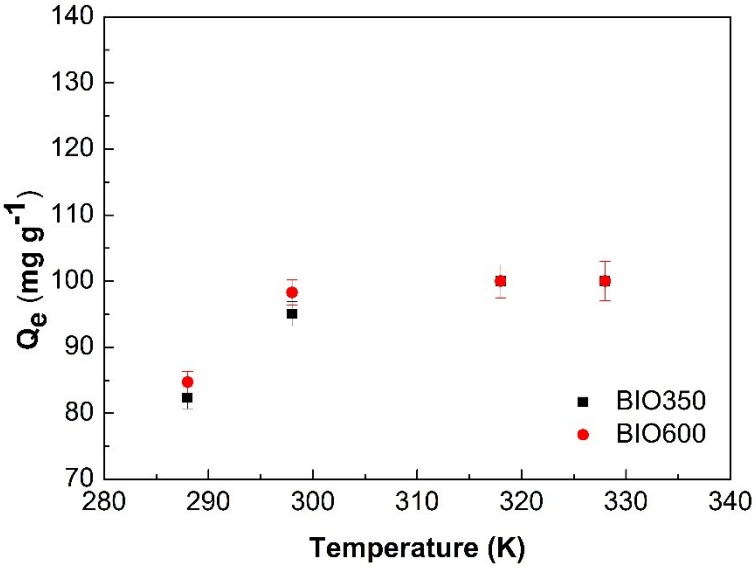


Figure S17. Maximum adsorption capacity of Fe(II) a function of temperature (A) BIO350 and (B) BIO600. Experimental conditions: 100 mL Fe(II) solution 100 mg/L; 0.1 g of material; pH=4.8; 3 hours.

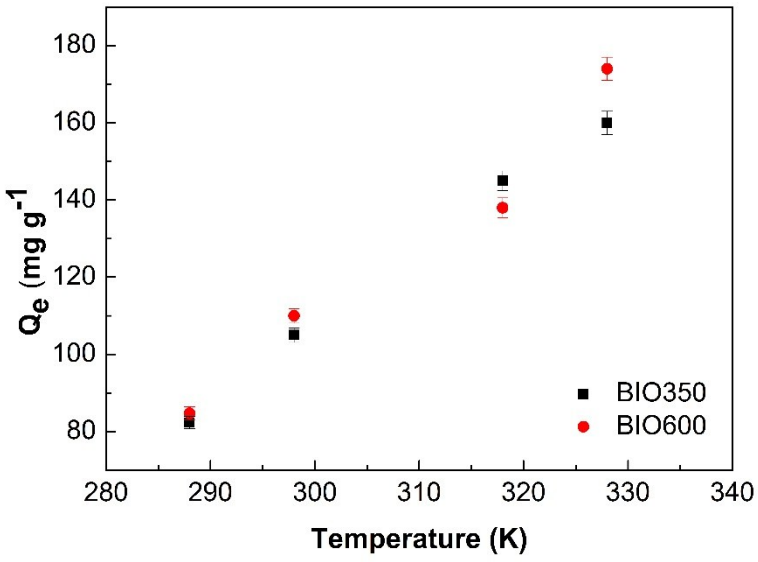


Figure S18. Maximum adsorption capacity of Fe(II) a function of temperature (A) BIO350 and (B) BIO600. Experimental conditions: 100 mL Fe(II) solution 200 mg/L; 0.1 g of material; pH=4.8; 3 hours.

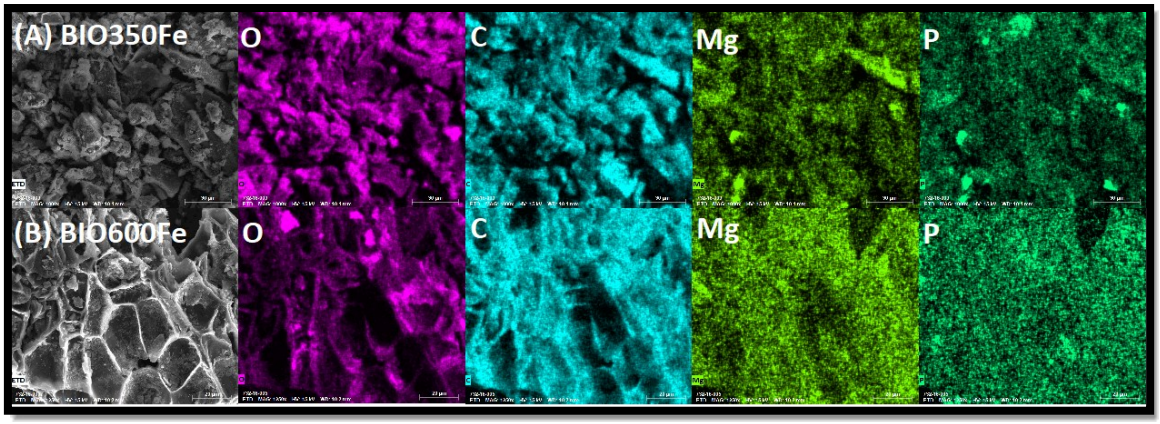


Figure S19. Images and chemical mapping using EDS for (A) BIO350Fe, and (B) BIO600Fe.