

SUPPLEMENTARY MATERIAL

Agro-Industrial Waste as Potential Heavy Metal Adsorbents and Subsequent Safe Disposal of Spent Adsorbents

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2. Materials and methods

2.3. Biomass characterization

X-ray Diffraction (XRD) (PANalytical X'Pert PRO equipment, with CuK α radiation $\lambda = 1.5406$ nm and operating conditions 40 kV and 40 mA) where the crystalline phases present were identified with the HighScore Plus software and the International Center for Diffraction Data X-ray powder diffraction pattern database

3. Results and Discussion

3.1 Biomass characterization

XRD was used to determine the crystallographic structure of the residues used as adsorbents. The diffraction analysis is presented in Figure S1. The biomasses showed the presence of semi-crystalline cellulose as an organic component, with peaks at 16°, 22° and 35° 2 θ , and low crystallinity due to the presence of amorphous non-cellulosic materials such as lignin and hemicellulose [1]. A peak at 26° 2 θ in the diffractogram of the corn residues corresponded to the presence of SiO₂, in a quartz structure, that is part of the mineral fraction of the biomass.

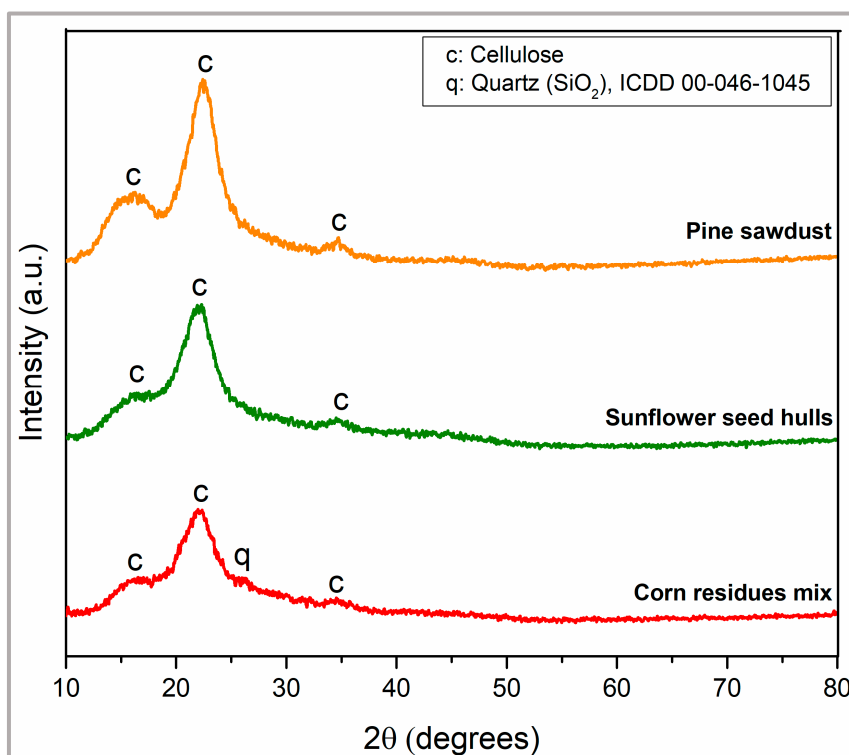


Figure S1. XRD patterns of pine sawdust, sunflower seed hulls, and corn residues mix.

3.2 Adsorption process characterization

Table S1 compares the obtained adsorption results in this paper with those reported in the literature for Ni(II), Zn(II), and Cd(II) batch adsorption experiments on sawdust, sunflower, and corn residues.

Table S1. Main results of literature studies about the adsorption of Ni(II), Zn(II) and Cd(II) on sawdust, sunflower and corn.

Adsorbent	Heavy metal	A% (%)	Reference
Pine sawdust (<i>Pinus elliottii</i>)	Ni(II)	54.4 ± 0.3	This paper
	Zn(II)	72.0 ± 0.9	
	Cd(II)	76.5 ± 0.4	
Bamboo sawdust (<i>Gigantochloa scortechinii</i>)	Zn(II)	74.0	[2]
Poplar wood sawdust	Zn(II)	74.0	[3]
Sawdust (<i>Picea smithiana</i>)	Cd(II)	83.3	[4]
Sunflower seed hulls (<i>Helianthus annuus</i>)	Ni(II)	71 ± 2	This paper
	Zn(II)	89.2 ± 0.3	
	Cd(II)	96.6 ± 0.2	
Sunflower seed husk	Ni(II)	84.8	[5]
Sunflower achene head	Cd(II)	40.0	[6]
Sunflower stalk (<i>Helianthus annuus</i>)	Cd(II)	95.0	[7]
Corn residues (<i>Zea mays var. saccharata</i>)	Ni(II)	58.9 ± 0.7	This paper
	Zn(II)	82.8 ± 0.1	
	Cd(II)	90.7 ± 0.2	
Corn cob	Ni(II)	79.2	[8]
Corn cob	Cd(II)	50.0	[6]
Corn cob	Cd(II)	98.7	[9]

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