From Waste to Clean Water: Utilizing Chestnut Shell Wastes-based and Coal-based Adsorbents for Pesticides Remediation

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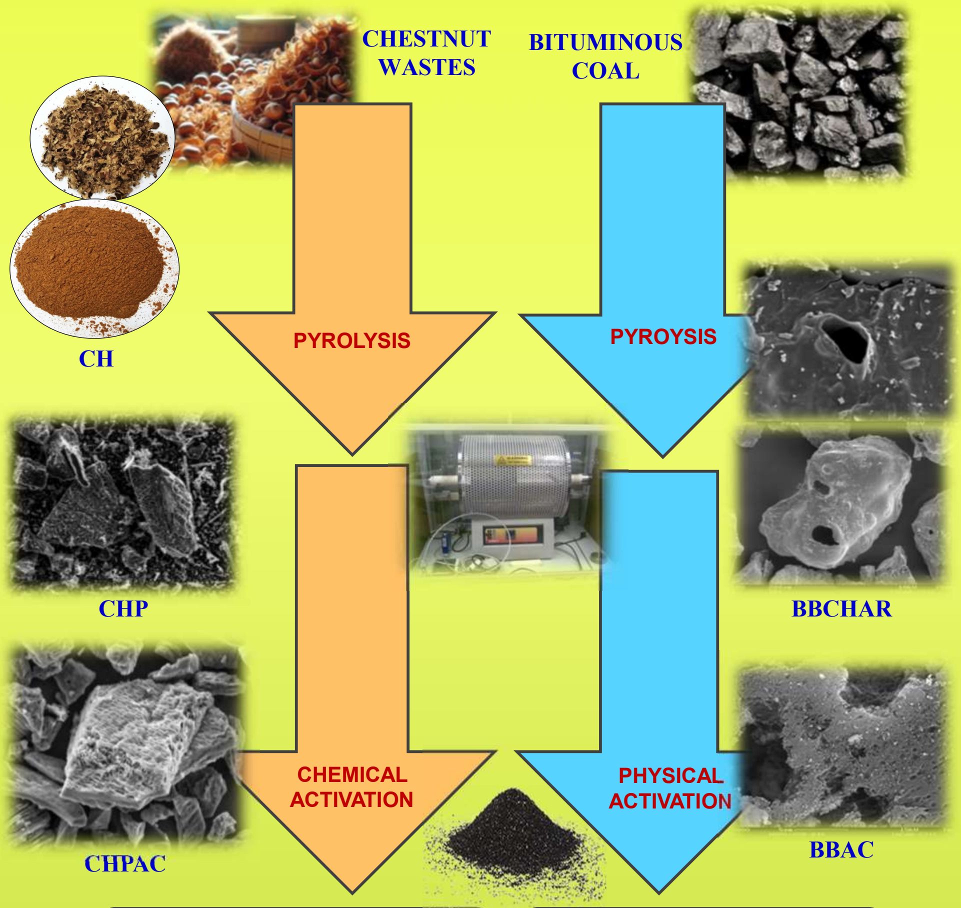
Introduction

- Pesticides are widely used in agriculture for pest control.
- In 2021, more than 3.54 million metric tones were used, and the consumption is increasing.
- The presence of some of these organic compounds is increasing in surface waters affecting animals, environment and human alike.

- Chestnut industries generates significant amounts of lignocellulosic wastes as hedgehogs, leaves and chestnut shells.
- Activated carbons are adsorbents materials with good textural development and widely used in different environmental applications
- This research focuses on the re-evaluation of chestnut waste into biochar and activated carbons as adsorbents, alongside coal-based activated carbons for pesticide removal in aqueous media.

Materials & methods



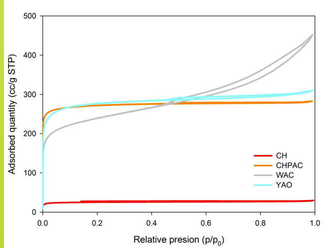
CHESTNUT SHELL PYROLYSED ACTIVATED CARBON (CHPAC)

BITUMINOUS BASED ACTIVATED CARBON (BBAC)

Results & Discussion

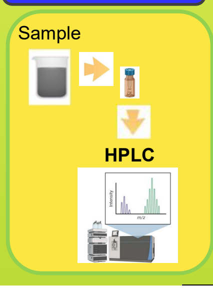
TEXTURAL CHARACTERIZATION AC

Adsorbent	Raw material	Activation	S_{BET} ($m^2 g^{-1}$)
CHP	Chestnut shell		101
CHPAC	Chestnut shell	Chemical	1100
YAO	Coconut shell	Physical	1092
WAC	wood	Physical	893
BBAC1	Bituminous	Physical	837
BBAC5	Bituminous	Physical	1128
MAC	lignite	Chemical	1100



ADSORPTION

ANALYSIS



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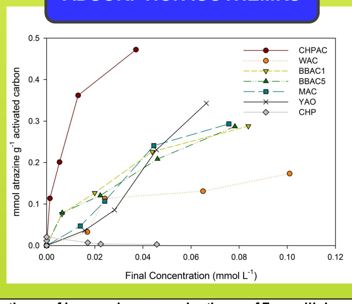

ADSORPTION SIMULATION

		Isotherm of Langmuir			Isotherm of Freundlich		
Activated carbon	Compound	qmax	kl	OF	kf	n	OF
MAC	Dichlorvos	0.9006	301.09	0.5350	1.8134	4.5065	0.3272
	Diazinon	0.5917	133.39	0.1837	1.8903	2.6137	0.1216
	Malathion	0.5858	429.31	0.1691	2.9811	2.5954	0.1488
BBAC1	Dichlorvos	0.1282	77.03	0.0107	0.1978	4.0388	0.0063
	Diazinon	0.0568	109.07	0.0074	0.095	4.1408	0.0031
	Malathion	0.4993	246.84	0.0748	1.9198	2.5144	0.0542
BBAC5	Dichlorvos	0.1681	121.12	0.0180	0.1908	4.2212	0.0340
	Diazinon	0.1456	22.12	0.0228	0.3292	1.9936	0.0155
	Malathion	0.4794	358.53	0.0866	1.2858	3.4831	0.0432

Conclusions

- Chestnut shells have been shown to be a promising material as a precursor for biochar and activated carbon
- KOH activation with previous pyrolysis step enhances the micropore structure in biowaste adsorbent materials.
- Physical activation can be more suitable for coal-based materials.
- The presence of different functional groups in the surface adsorbents influence by different way the adsorption of atrazine.
- The adsorption of the different pesticide was mainly produced on micropores.

Acknowledgements

This work was financially supported by Universitat Politècnica de Catalunya Project ALECTORS-2023 (R-02393) and project L-00783.The authors thank the industry Palacio de Canedo for providing the chestnut-Shell industrial waste and Eurocarb for supply the activated carbons YAO and WAC