



## Mechanisms Involved In the Removal of Phenolic Compounds from Aqueous Solution Using Activated Carbons Based Palm Kernels Shells

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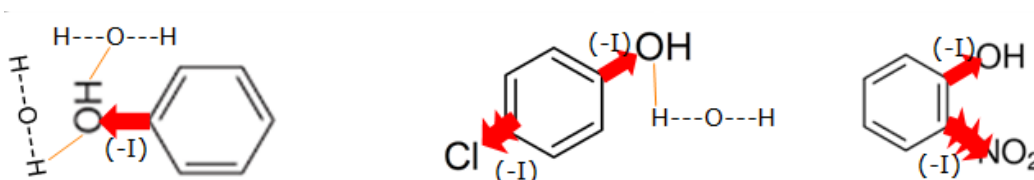
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### ABSTRACT

The batch removal of phenol (Ph), 4-chlorophenol (4CPh) and 2-nitrophenol (2NPh) was investigated onto two physico-chemically prepared activated carbons namely ACPKS-KOH and ACPKS-H<sub>3</sub>PO<sub>4</sub>, in order to determine their adsorption efficiency. The mechanisms involved known as the  $\pi$  -  $\pi$  interactions, the acceptor-donor complex formation together with the solubility and the hydrophobicity were thoroughly elucidated on the removal of Ph, 4CPh and 2NPh. The acidic functional groups present on the activated carbons reduced significantly the  $\pi$  -  $\pi$  interactions together with the establishment of hydrogen bonds which inhibited the adsorption of pollutants. The basic functional groups favourize the formation of acceptor-donor complex thus increasing the percentage removal. Both Langmuir and Freundlich isotherms models were used to describe the adsorption equilibrium. The maximum adsorption capacities obtained from Langmuir equation were found to be 79.36 mg g<sup>-1</sup>; 113.63 mg g<sup>-1</sup> and 238.09 mg g<sup>-1</sup> for Ph, 4CPh and 2NPh respectively onto ACPKS-KOH, while a significant decrease was observed onto ACPKS-H<sub>3</sub>PO<sub>4</sub>, where it was found to be 44.84 mg g<sup>-1</sup>; 46.08 mg g<sup>-1</sup> and 84.03 m g<sup>-1</sup> for Ph, 4CPh and 2NPh respectively. Therefore, these adsorbents prepared are a promising route for the removal of phenolic compounds from wastewaters.

### Graphical Abstract/Highlights of Abstract:



**Hydrogen Bonds:** (-OH) group of phenol (Ph) and 4-chlorophenol (4CPh) easily establishes hydrogen bonds with water molecules whereas (-OH) group of 2-nitrophenol (2NPh) doesn't establish hydrogen bonds.

**Inductive effect:** (-OH), (-Cl) and (-NO<sub>2</sub>) have inductive attractive effects I(-) hence the electronic density of aromatic ring is reduced significantly, thus increase their acid character and acceptor of elector.

**Acceptor-donor complexes formation:** 2NPh (more acidic) forms more complexes with oxygen functions of activated carbons: thus the more adsorbed specie. Ph and 4CPh (less acidic) form fewer complexes with oxygen functions of activated carbons: thus the less adsorbed species. Basic functional groups of activated carbons act as electron donor to the aromatic ring.

**Keywords:** Palm kernel shells; Activated carbons; Phenolic compounds; Acceptor-donor complexes.

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