CNT-COOH/MnO_2/Fe_3O_4 nanocomposite as adsorbent for the removal of pesticides from their aqueous solution

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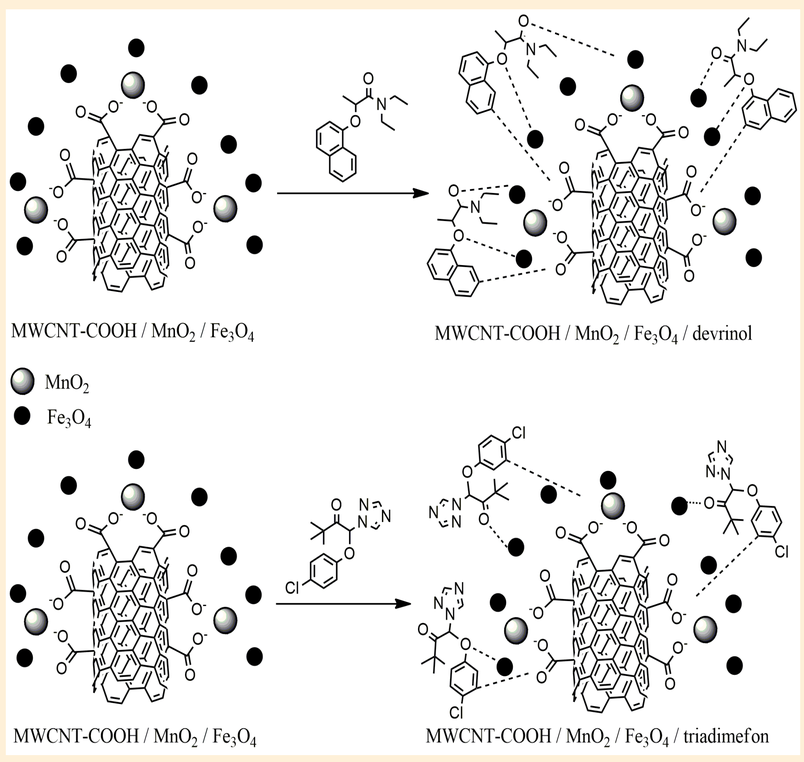
Introduction:

Pesticides are substances widely used in agriculture to protect plants from pests. Despite of the benefits, pesticides can persist long term in environmental compartments and causes significant problems and become a risk for ecosystems. For these reasons, the removal from water sources is urgent and the CNTs and metal oxides are found to be the new generations of materials that have improved properties for this purpose. These nanocomposites have large and chemically inert surfaces with a relatively uniform structure and providing multiple sites of adsorption.

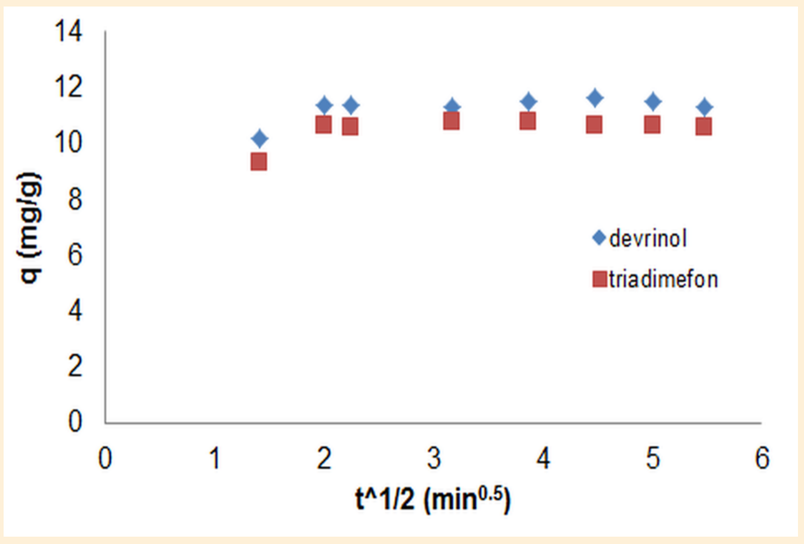
Scope:

- the preparation and characterization of physico-chemical parameters (pH of solutions, temperature, adsorbent dose, contact time and initial concentration of pesticide) to obtain the highest possible degrees of selected pesticides;
- the application of CNT-COOH/MnO_2/Fe_3O_4 nanocomposite to remove the pesticides like devrinol (napropamid), used as pre-emergence herbicide, and triadimefon, a good protectant and eradicate fungicide against powdery mildew and rust fungi.

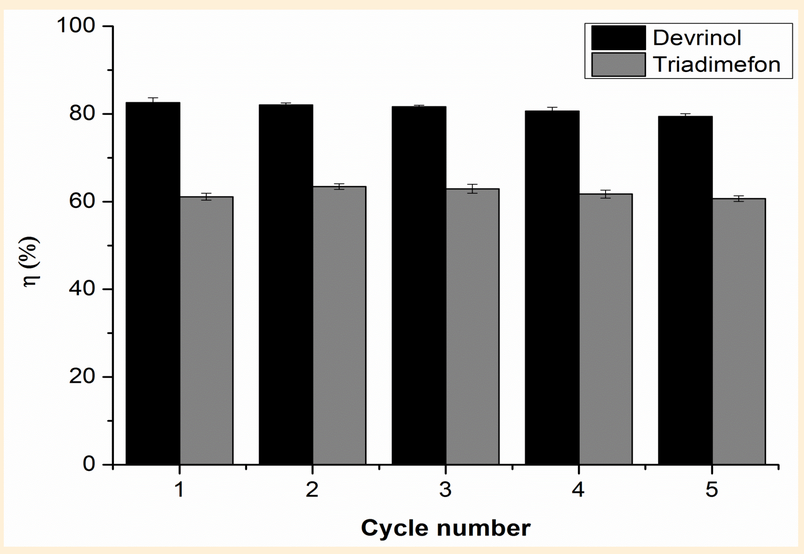
Mechanism of pesticides adsorption on nanocomposite



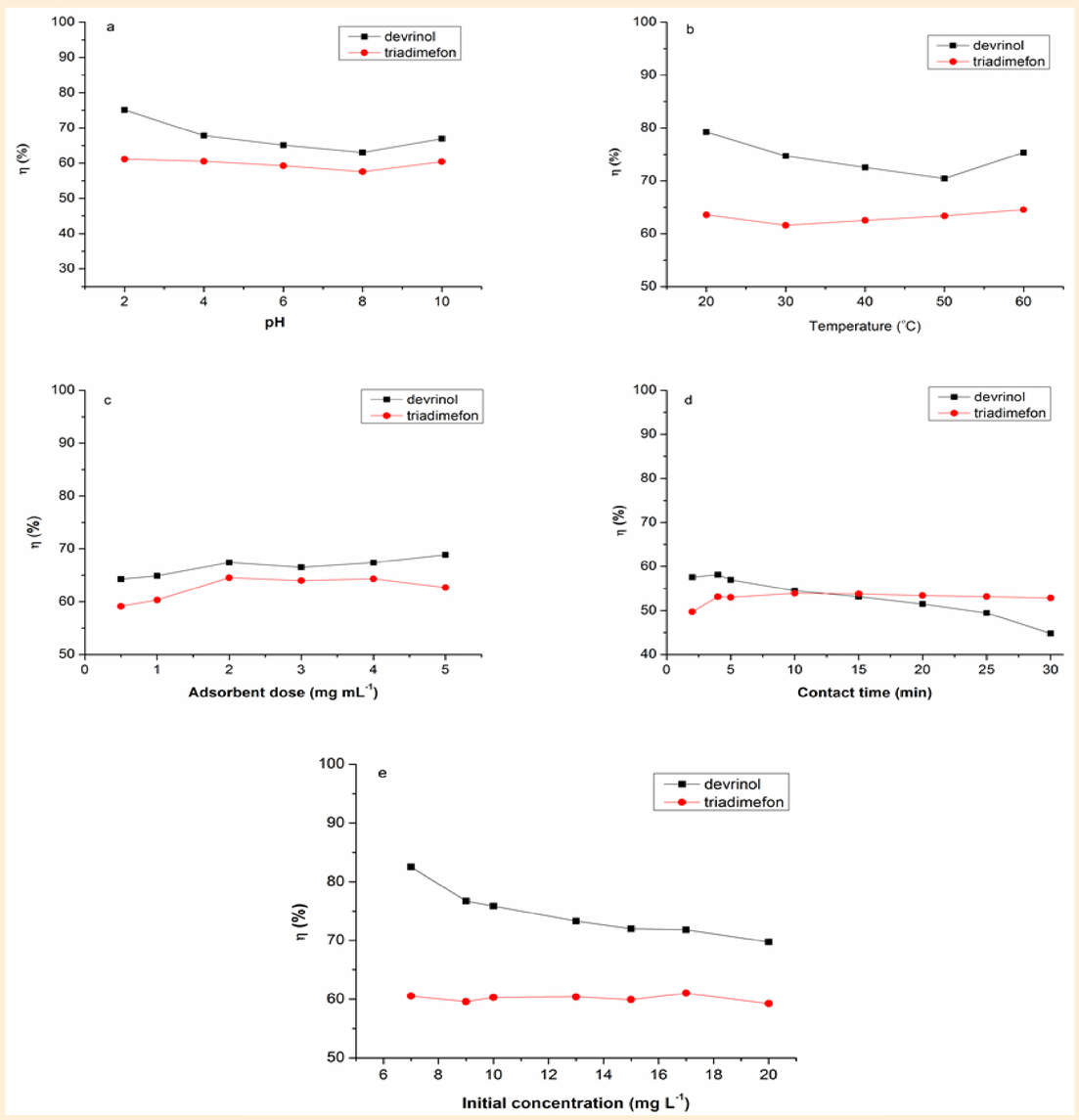
Kinetic modeling of the adsorption process



Desorption and reusability of the adsorbent



The effect of physico-chemical parameters on the adsorption process



Conclusions:

- ✓ The experimental data best fit with Langmuir isotherm model and follow the pseudo-second order kinetic model. Depending on the temperature, the adsorption capacity of pesticides on nanocomposite varies between 14.925 and 20.492 mg g^{-1} for devrinol and between 12.723 and 14.706 mg g^{-1} for triadimefon.
- ✓ The thermodynamic parameters indicated that the retention of devrinol and triadimefon onto CNT-COOH/MnO_2/Fe_3O_4 was spontaneous and endothermic.
- ✓ The experimental results obtained reveal that CNT-COOH/MnO_2/Fe_3O_4 nanocomposite is a promising adsorbent for pesticides removal from the wastewater.
- ✓ The removal degree of pesticides decreased during the five cycles, at the end of the cycles being 79.4% for devrinol and 60.7% for triadimefon.

Acknowledgements:

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