Synthesis of thin shell carbon-encapsulated nZVI from olive mill wastewater and application to advance oxidation of pollutants

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Nanoscale zero-valent iron (nZVI) has demonstrated to effectively remove a wide range of pollutants from water, such as chlorinated compounds, heavy metals and dyes. It is a versatile nanomaterial, acting by reduction, adsorption, co-precipitation and, in the presence of dissolved oxygen or hydrogen peroxide, as iron source in heterogeneous Fenton process. However, its use in environmental remediation is limited do to its lack of stability and easy aggregation [1]. Another limitation of nZVI is the release of dissolved iron in the treated water under acidic conditions [2]. To address these issues, iron particles supported on carbonaceous porous materials are being recently developed [3]. A promising way of synthesizing this kind of materials is by encapsulation of nZVI inside carbon spheres via hydrothermal carbonization (HTC) from an organic compound, such as glucose or sacarose [4].

In this work, thin shell CE-nZVI are synthesized from olive mill wastewater (OMWW) to apply them in the oxidation of 2,4-D by the heterogeneous Fenton process. This novel method, in addition to meet the green chemistry principles, makes profit of the high polyphenol content of OMW to maximize the fraction of incorporated iron into the nZVI. Moreover, the carbon layer surrounding the nZVI protects it against oxidation and avoids its aggregation. Several HTC conditions are explored to study their implications in the characteristics of the material obtained. A deep characterization of the encapsulated nZVI is also presented. Finally, the nanoparticles are applied for the oxidation of the herbicide 2,4-D.

References

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