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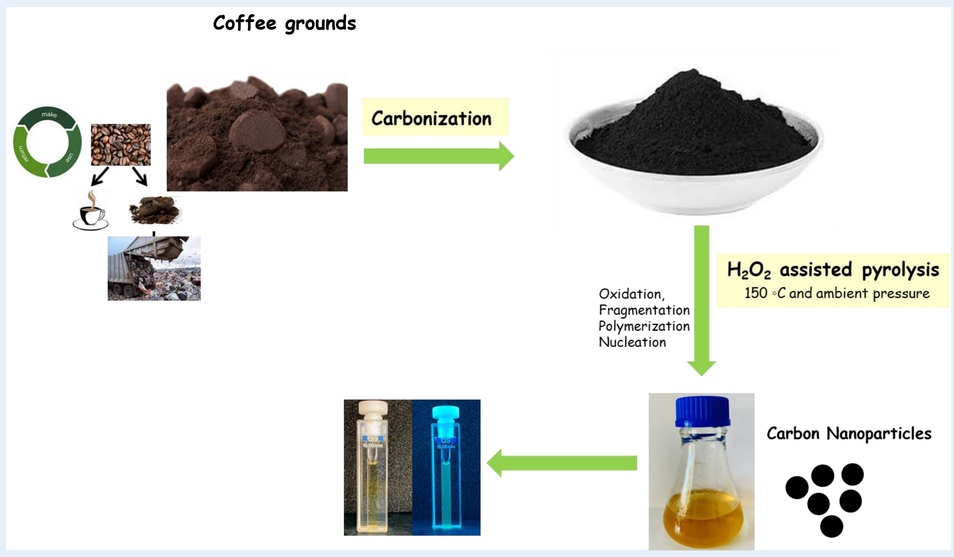
Facile synthesis of carbon nanoparticles (CNPs) for efficient Cr(VI) water remediation

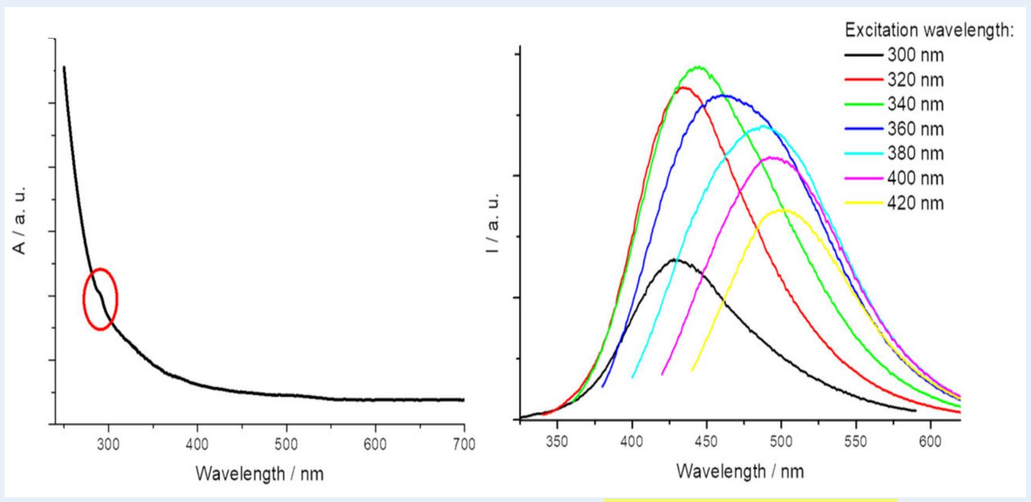
R.Pagano, M. Ottolini, S. Bettini, G. Giancane and L. Valli

CNPs Synthesis procedure

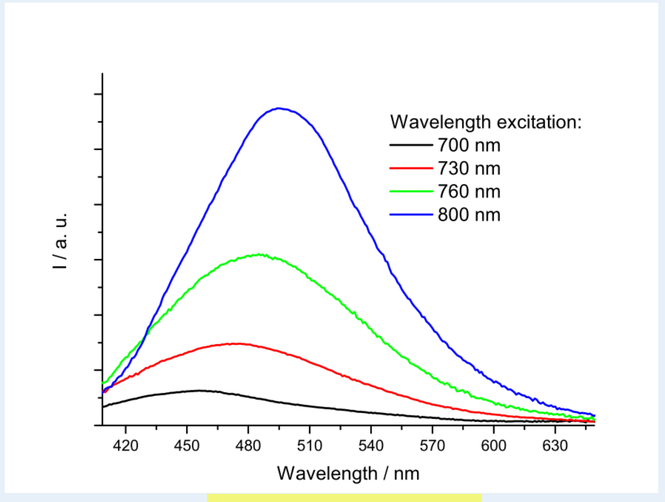


Carbon nanomaterials are a group of materials characterized by sp2/sp3 carbon backbone which, combined with surface atoms and/or chemical groups, ensures peculiar physical chemical features for a wide range of applications. Among these materials, carbon dots and carbon nanoparticles belong to carbon nanomaterials with a few nanometer dimensions. In this work, carbon nanoparticles were produced from spent coffee grounds as sustainable carbon source through a simple, cheap and eco-friendly procedure according to an oxidation process (at controlled temperature) driven by hydrogen peroxide. Atomic Force Microscope (AFM) and fluorescence, UV-Vis absorption, FT-IR and Raman spectroscopy were used to assess the formation of carbon nanomaterials of about 10 nm with the typical emission and absorption properties of carbon dots and peculiar surface features. In fact, the presence of heteroatoms, i.e., phosphorus, and the carbonyl/carboxyl surface groups on carbon nanoparticles, was proposed to confer peculiar properties allowing the fast Mn(VII) reduction to Mn(II) at neutral pH and the Cr(VI) reduction to Cr(III) in weak acid aqueous media.

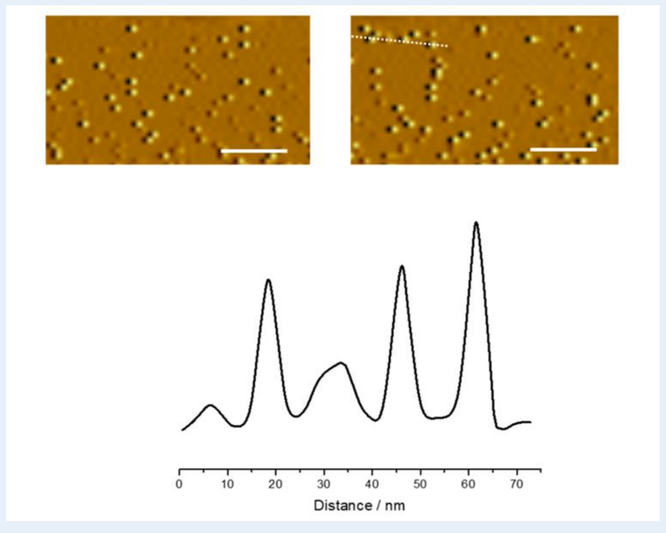
CNPs spectroscopic characterization

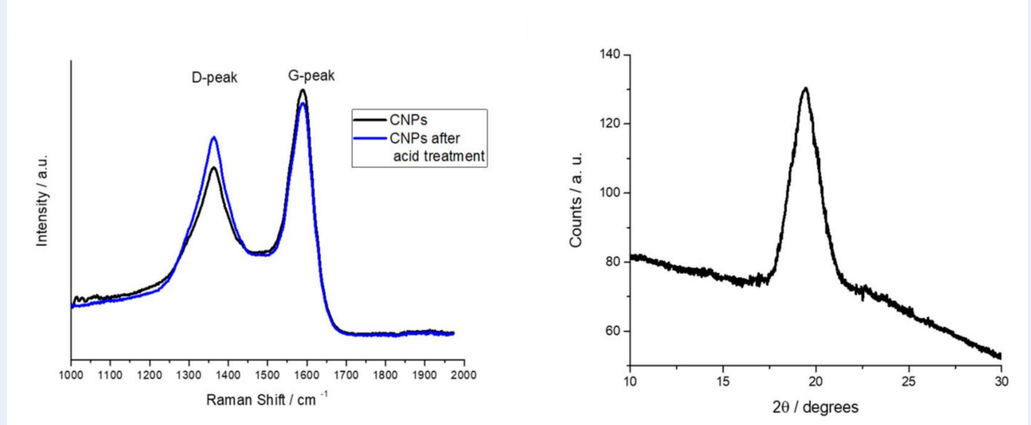


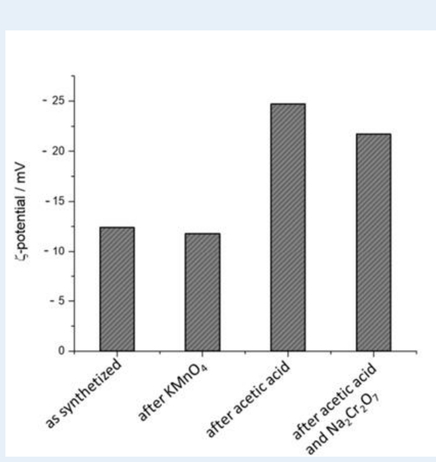
Down conversion

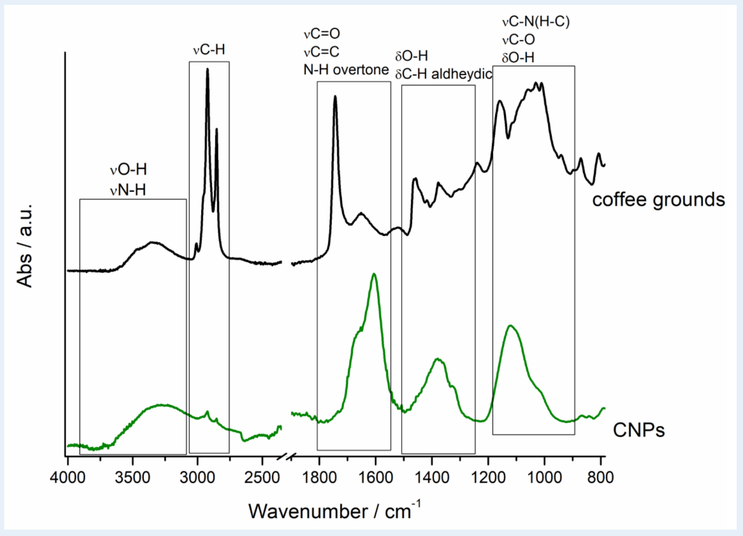


Up conversion









Remediation Experiments