Synthesis and CO_2 Adsorption Capacity of biomass waste functionalized by nanoparticles.

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The excessive green-house gases emissions, such as CO_2, are becoming a severe environmental issue for their effects on the global warming.

Numerous strategies have been developed to deal with this issue, especially, with the advancement in nanoscience and nanotechnology studies and research, direct CO_2 adsorption is becoming an effective strategy to capture CO_2 and transform it directly into valuable chemical compounds in delicate environments.

Among the several sorbents, char made from biomass waste carbonization has proven to have outstanding CO_2 adsorption capacities. Carbon-based adsorbents because of their vast surface area, the ability of pore structure modification, and ease in renewing, low preparation cost and a low environmental impact, are considered to be one of the most capable materials for CO_2 sequestration.

Generally, converting biomass into porous carbons for CO_2 capture includes: carbonization, activation through exposure to high temperature and CO_2 and steam environments (physical activation) or using potassium hydroxide KOH (chemical activation), and surface modification by addition of additives like metal oxides, that can potentially improve the surface chemistry and adsorption chemistry by improving the interaction between the adsorbent surface and the CO_2 molecule.

In this work a sorbent composed of hematite nanoparticles (Fe_2O_3) supported on a lignocellulosic matrix was synthesized, thus allowing the valorisation of an industrial waste.

The physico-chemical characteristics of the produced adsorbent samples were characterized in this study using several analytical methods. In particular, the particles were characterized by Scanning electron microscopy (SEM) analyses.

To a far greater degree, the pore size plays a significant role in the low-pressure CO_2 adsorption and in particular, the pore size within the range of 0.5–1.0 nm is most effective for CO_2 adsorption.

The technique for CO_2 adsorption made from biomass might be proven to be one of the most affordable and environmentally beneficial ways to combat climate change.