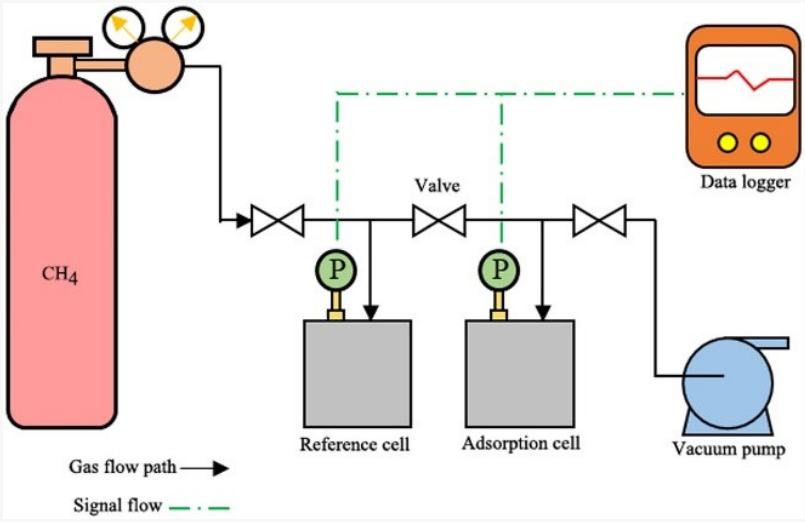
Innovative Activated Carbon from Palm Kernel Shells Enhances Methane Storage

Published in Journal of Bioresources and Bioproducts



Schematic diagram of methane adsorption unit

NANJING, CHINA, May 10, 2024 /EINPresswire.com/ -- In a significant development for clean energy, researchers at Universiti Teknologi MARA have made a breakthrough in the field of methane storage technology. Their study, recently published in the Journal of Bioresources and Bioproducts, introduces an innovative method for synthesizing activated carbon (AC) from palm kernel shells (PKS), which significantly enhances methane storage capacity.

The research was conducted against the backdrop of a global shift towards cleaner fuels, with natural gas, and particularly methane, being recognized for its potential as an alternative to traditional fossil fuels. The team aimed to improve the adsorptive properties of AC for methane storage by experimenting with different activation agents, including steam, carbon dioxide (CO2), and a combination of both.

The process involved a meticulous procedure of impregnating PKS with zinc chloride, followed by carbonization and activation with the selected agents. The AC samples were then characterized for their surface area, pore volume, and size, with the methane adsorption capacity measured at room temperature using a volumetric approach.

The results were nothing short of groundbreaking. The AC produced using a combination of CO2 and steam as activating agents demonstrated the highest burn-off and surface area, translating into a maximum methane gas adsorption capacity of 4.500 mol/kg. The data fitted well with the Freundlich isotherm model, suggesting the formation of multilayer adsorption on the AC surface.

Kinetic analysis revealed that the adsorption process followed the pseudo-first-order model, indicating that the rate of methane adsorption was influenced by both the adsorbent and the adsorbate, and was primarily governed by physical adsorption. The study also employed the intraparticle diffusion model to understand the rate-controlling steps in the adsorption process.

The research concludes that the sequential combination of CO2 and steam activation is highly effective for producing AC with superior methane adsorption capabilities. This discovery is not only a significant step towards the practical application of ANG but also contributes to the sustainable use of PKS, a byproduct of the palm oil industry.

The study's findings hold immense promise for the clean energy sector, potentially offering a solution to reduce CO2 emissions by 25%–30% compared to traditional fuels. As the world continues to grapple with the challenges of climate change, innovations such as this could play a crucial role in the global transition towards a more sustainable future.

DOI
https://doi.org/10.1016/j.jobab.2022.11.002

Original Source URL
https://www.sciencedirect.com/science/article/pii/S2369969822000706?via%3Dihub

Journal of Bioresources and Bioproducts
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