

Synopsis Seminar

Seminar Title	: Synthesis of <i>Pterospermum acerifolium</i> fruit derived activated carbon for carbon dioxide capture
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Venue	: Department Library (CH)
Date and Time	: 18 Jul 2025 (11.00 a.m.)
Abstract	: Carbon dioxide (CO ₂) is a major greenhouse gas contributing significantly to global warming and climate change, posing a serious threat to environmental and human systems worldwide. As anthropogenic emissions continue to rise, the development of efficient and sustainable CO ₂ capture technologies has become a global priority. This study focuses on the synthesis of activated carbon from <i>Pterospermum acerifolium</i> fruits using three chemical activators—H ₃ PO ₄ , KOH, and K ₂ CO ₃ —for CO ₂ adsorption applications. The process parameters, including impregnation ratio, pyrolysis temperature, and activation time, were optimized using Response Surface Methodology (RSM) based on a Box-Behnken Design (BBD). The optimized conditions yielded iodine numbers of 1197.05 mg/g (H ₃ PO ₄), 1124.12 mg/g (KOH), and 1252.10 mg/g (K ₂ CO ₃), with respective yields of 35%, 11%, and 12.68%. Comprehensive characterization was performed using TGA, CHNS, FTIR, Raman, FESEM, TEM, and BET analyses. To improve handling properties, KOH-activated carbon was further converted into granules using potato starch and polyvinyl alcohol as binders. The maximum CO ₂ uptake was recorded at 303 K: 18.53 mmol/g for KOH powder and 12.18 mmol/g for starch-based granules. Adsorption data best fit Freundlich, Sips, and Dubinin–Astakhov isotherm models, indicating heterogeneous surface adsorption. Kinetic analysis followed a pseudo-first-order model, suggesting a physisorption mechanism, while thermodynamic studies confirmed an exothermic and spontaneous process. The adsorbents retained ~99% adsorption capacity over five cycles. An Artificial Neural Network (ANN) model effectively predicted CO ₂ uptake under varying conditions, demonstrating high correlation with experimental results.

Keywords: Activated carbon CO₂ adsorption capacity Box-Behnken design Artificial Neural Network Isotherm models Kinetic models