EuroSciCon

December 10-12, 2018
Rome, Italy

JOINT EVENT
22nd International Conference on
Advanced Materials and Simulation
&
22nd Edition of International Conference on
Nano Engineering & Technology

Nano Res Appl 2018, Volume 4
DOI: 10.21767/2471-9838-C7-028

Promising graphene materials from biomass waste for CO_2 capture

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The increase in climate related natural adversities have reinforced the obvious need of diminishing green-house gaseous emissions, predominantly those of CO_2 and is leading government agencies around the world to develop a sequence of roadmaps, which aspire at moving forward to a low carbon economy. Carbon capture and storage (CCS) has been identified as one of the key technologies that could contribute in a greater degree to reach the CO_2 emission reduction targets. In the present study we have established a synthesis route for production of porous graphene material from the oil palm empty fruit bunches (EFB) for CO_2 capture. We have used a wide range of instrumental techniques including scanning electron microscopy, atomic force microscopy, transmission electron microscopy, X-ray photoelectron spectroscopy, X-ray diffraction and Raman spectroscopy together with the Brunauer–Emmett–Teller surface area analysis and density functional theory models to provide insights into morphological and structural characteristics of the porous graphene. The porous graphene show excellent performance as adsorbents for post combustion CO_2 capture (>2.0 mmol g−1) which is considerably higher than other competitive CO_2 adsorbents, including zeolite, activated carbon and some metal organic frameworks. Thus, these results suggest that the biomass waste used in current study could be effectively valorized as efficient CO_2 adsorbent under post combustion conditions.

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