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EFFECTS OF DIFFERENT LOADING OF MAGNESIUM OXIDE ON ACTIVATED CARBON NANOFIBERS FOR METHANE ADSORPTION

Faten Ermala Che Othman[a,b], Norhaniza Yusof[a,b], Hasrinah Hasbullah[a,b], Ahmad Fauzi Ismail[a,b], Juhana Jaafar[a,b] and Norfadhilatuladha Abdullah[a,b]

[a] Advanced Membrane Technology Research Centre (AMTEC), Universiti Teknologi Malaysia, 81310 Skudai, Johor Bahru, Malaysia.
[b] Faculty of Petroleum and Renewable Energy Engineering (FPREE), Universiti Teknologi Malaysia, 81310 Skudai, Johor Bahru, Malaysia.

Corresponding Author's E-mail: norhaniza@petroleum.utm.my

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ABSTRACT

In the last few years, with the escalating world demand for energy, natural gas had been suggested as an alternative for replacing heavy fossil fuels as it produces cleaner combustion, less harmful and economical. Moreover, continuous world's depending on fossil fuels such as crude oils, coals and heavy fuels has become a major concerned to the entire world as the excessive burning of these fuels produced harmful gases that leading to global warming. For this reasons, in this work, PAN- based activated carbon nanofibers (ACNFs) with various loading of magnesium oxide (MgO) (0, 5, 10, and 15 wt.%) were prepared for methane (CH_4) adsorption. The nanofibers (NFs) were successfully produced via electrospinning process at optimize parameters. The resultant NFs underwent three steps of pyrolysis process which are stabilization, carbonization and activation at 275 ^{o}C, 600 ^{o}C and 800 ^{o}C, respectively. The ACNFs/MgO were characterized using scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), thermal gravimetric (TGA) analysis, X-ray diffraction (XRD) analysis, Brunaeur, Emmett and Teller (BET) method and CH_4 adsorption tests. The adsorption equilibrium of CH_4 on ACNFs/MgO was measured using a static volumetric technique. Adsorption of CH_4 on the ACNFs/MgO was conducted at 30 ^{o}C for pressures up to 4 bars. The equilibrium data were stimulated using the Freundlich and Langmuir isotherms, with both models having $R^2 > 0.98$. The results on BET surface area showed the ACNFs loading with 15 wt.% MgO has the highest surface area of 1893.09 m^2/g and it was assumed to be a major contributor for higher gas adsorption capacity. From these findings, it is believed that ACNFs/MgO will become a new adsorbent with great potential for gas adsorption and storage in the near future applications.

Table 1: The differences of specific surface area, pore size, total pore volume and micropore volume of ACNFs and ACNFs embedded with different amount of MgO

Samples	BET S.S.A.[a] (m^2/g)	Pore size (cm^3/g)	T.P.V.[b] (cm^3/g)	V_{micro}[c] (cm^3/g)
ACNF	478.23	0.19	0.21	0.16
ACNF/MgO 5%	164.15	0.08	0.09	0.06
ACNF/MgO 10%	599.40	0.29	0.30	0.20
ACNF/MgO 15%	1893.09	0.73	0.62	0.62

[a] BET specific surface area
[b] Total pore volume
[c] Micropore volume

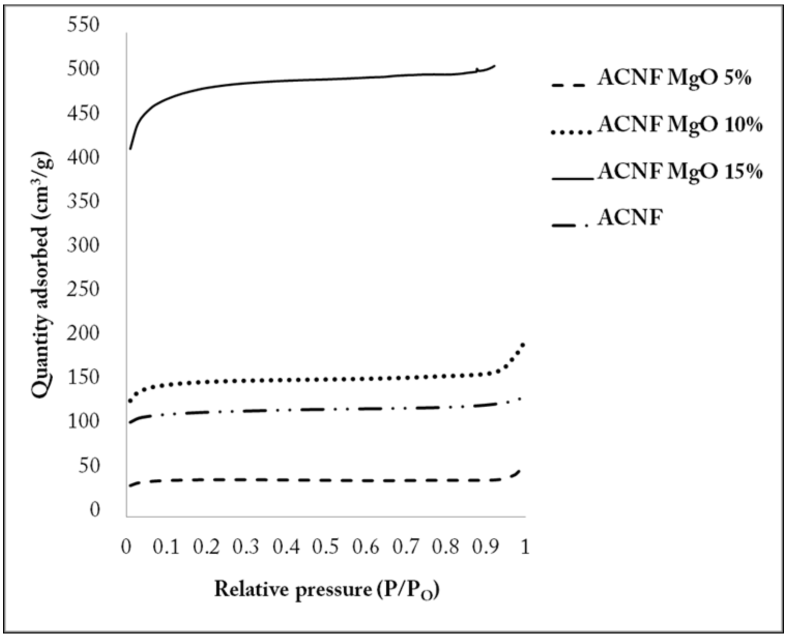

Figure 1: Nitrogen adsorption isotherms of ACNFs loading with different concentrations of magnesium oxide

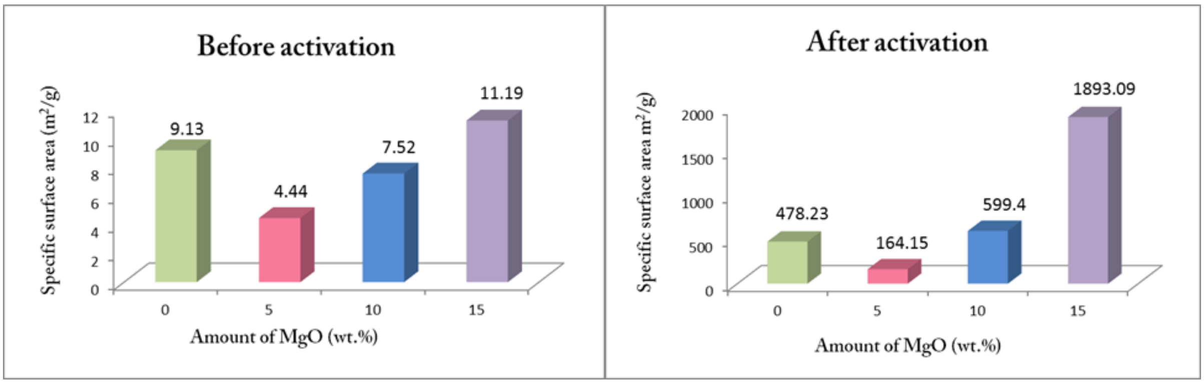

Figure 2: Specific surface area of nanofibers with different concentration of magnesium oxide before and after activation.

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