SIIC047

CHARACTERISTIC STUDY OF PSAC ADSORBENT MODIFIED WITH METAL OXIDE NANOPARTICLES FOR H_2S REMOVAL

Muhamad Faizul Azzim Bin Azamuddin[1], Dr. Norhusna Binti Mohamad Nor[1]
[1]Faculty of Chemical Engineering, Universiti Teknologi MARA Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang Malaysia

**Corresponding author: norhusna8711@uitm.edu.my*

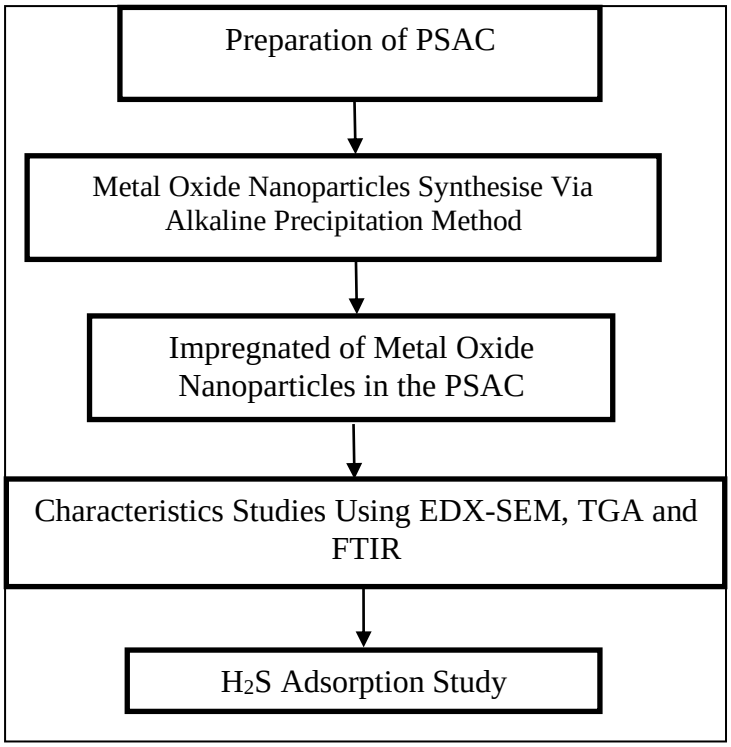
Abstract:
The focus of this research is to synthesised the metal oxide nanoparticles impregnated on PSAC and to study the effects of the adsorbents on removal of H_2S. The H_2S gas in the presence of air is capable to cause corrosion on the metal surface. H_2S is a colourless gas that also give harmful effect to the environment and human health. Therefore, it is essential to eliminate the H_2S gas before it is release to the atmosphere. Metals oxide nanoparticles was synthesised via alkaline precipitation method. The metal oxide nanoparticles that was synthesised were CeO_2, NiO, CuO, and Fe_2O_3. The metal oxide nanoparticles were undergoes SEM analysis, EDX analysis and TGA analysis. İt was found that the average size of the CeO_2 is 66.5 nm, NiO is 91.46 nm, CuO is 91.26 nm, and Fe_2O_3 is 37.17 nm in the SEM analysis. İn the TGA analysis, it was found that the calcine temperature of these metal oxide nanoparticles for remove impurities in the metals oxide nanoparticles were CeO_2 is 250℃, NiO is 450℃, CuO is 300℃, and Fe_2O_3 is 600℃. The synthesised metals oxide were impregnated in the pre-oxidised PSAC adsorbents (Ce/PSAC, Ni/PSAC, Cu/PSAC and Fe/PSAC). These adsorbents were undergoes FTIR analysis. İn this analysis the adsorbents shows the present of graphite groups, carbonyl group, alcohol group, carboxyl group and also free element. These adsorbents also were study the effects of different metal oxide nanoparticle impregnated on PSAC for removal of H_2S. İt shows that different metals oxide nanoparticles impregnated on PSAC shows the different the breakthrough time and the adsorption capacity of the adsorbent. Based on the result of the sorption, the metals oxide nanoparticles impregnated on PSAC adsorbent is more efficient than raw PSAC adsorbent. İt shows that Cu/PSAC has the higher adsorption capacity (86.60 mg H_2S/g Cu/PSAC) and breakthrough time (80 minutes) than raw PSAC which has adsorption capacity 2.85 mg H_2S/g raw PSAC and the breakthrough time is 3 minutes. From overall perspective of MO/PSAC, Ce/PSAC has 4 minutes of breakthrough time and 4.03 mg H_2S/g Ce/PSAC of adsorption capacity, Ni/PSAC has 9 minutes of breakthrough time and 9.06 mg H_2S/g Ni/PSAC of adsorption capacity, and Fe/PSAC has 10 minutes of breakthrough time and 11.08 mg H_2S/g Fe/PSAC of adsorption capacity which shows the Cu/PSAC adsorbent is the best adsorbent of MO/PSAC.

***Keywords*:** *Metal Oxide Nanoparticles, Palm Shell Activated Carbon (PSAC), TGA analysis, FTIR, H_2S application.*

Objectives:

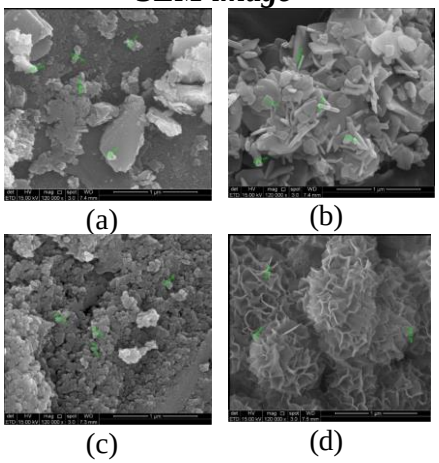
- To synthesis PSAC adsorbent modified with different types of metal oxides nanoparticles.
- To study the characteristics of PSAC adsorbent modified with a different type of metal oxide nanoparticles towards H_2S removal application.
- To study the adsorption capacity of different metal oxide nanoparticles impregnated on PSAC for H_2S removal.

Methodology:

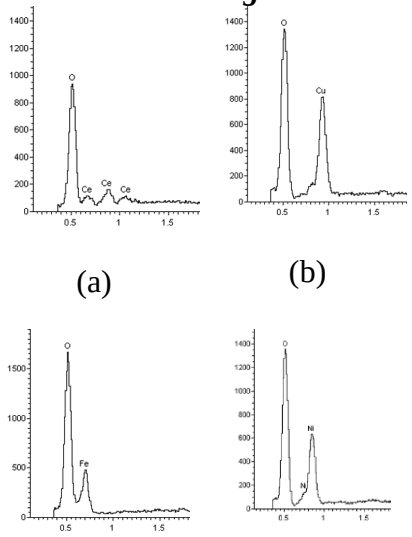


Results:

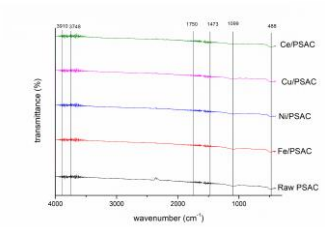
SEM image



EDX image

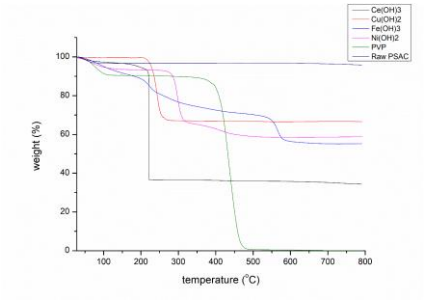


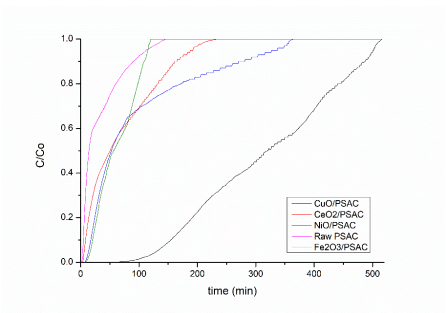
FTIR



(c) (d)

TGA ***H_2S adsorption application***





Conclusion:

In conclusion, the metals oxide nanoparticles were synthesised using the alkaline precipitation method that resulting in metals hydroxides. The metal hydroxides nanoparticles undergo TGA, SEM and EDX analysis. The TGA analysis shows the temperature needed to calcine for the metals hydroxides for the decomposition of impurities. The TGA analysis gives the result of $Fe(OH)_3$ was at 600℃, $Ce(OH)_3$ was at 250℃, $Ni(OH)_2$ was at 450℃, and $Cu(OH)_2$ was at 300℃. The EDX shows the result of the weight and the atomic percentage of the metals oxide nanoparticles which major consist of metals element and O element. The SEM shows the morphology of the metals oxide nanoparticles and average size (Fe_2O_3 = 37.17 nm, CeO_2 = 66.55 nm, NiO = 91.46 nm, CuO = 91.26 nm). It shows that the metal oxides are present of nanoparticle which is the size average should be <100 nm in size. The metals hydroxides were than impregnated with peroxidised PSAC and calcined to produced M-O/PSAC nanoparticles adsorbent. FTIR shows the presence of (C–OH) alcohol group, (C–O) carboxyl groups, (O–H) hydroxyl group, (C=O) carbonyl group and (M-O) group in the metals oxide nanoparticles impregnated with PSAC adsorbent (MO/PSAC). Lastly, the application of H_2S removal was applied to the MO/PSAC adsorbent. From this parameter studies, Fe_2O_3/PSAC, CeO_2/PSAC, NiO/PSAC, and CuO/PSAC adsorbent is more promising than without metal oxide nanoparticle which is the raw PSAC adsorbent itself. From the MO/PSAC adsorbent, the Cu/PSAC adsorbent has the best adsorption capacity among the MO/PSAC.