

UNIVERSITI TEKNOLOGI MARA

**SYNTHESIS OF GOLD
NANOPARTICLES ON CARBON
NANOTUBES/ANODIZED
ALUMINIUM OXIDE FOR
CATALYTIC REDUCTION OF
P-NITROPHENOL**

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ABSTRACT

Gold nanoparticles (Au NPs) have been widely used in various applications specifically in the field of catalysis. Au supported catalyst are more favoured over the homogeneous one since it gives superior features such as simplicity in recovery and regeneration. In this research, Au NPs supported on functionalized carbon nanotubes (Au-fCNT) catalysts were successfully synthesized via deposition-precipitation (DP) as this method was a more efficient and simpler approach. However, the limitation of Au-fCNT catalysts in terms of practicality and recovery since Au-fCNT was presented in the powder form creates a new avenue to obtain free-standing catalytic membrane. Au NPs were utilized onto the combination of fCNTs and porous membrane support which is anodized aluminium oxide (AAO) membranes. AAO membranes help in reducing the restacking-induced surface area loss of fCNTs and gave homogeneous distributions of Au NPs. The free-standing catalytic membrane was synthesized through the fabrication of multi-layered assemblies fCNTs decorated with Au NPs on AAO membranes (Au-fCNTs-AAO) by an unsophisticated technique. The AAO membrane was coated with fCNTs by spin coating technique and decorated with Au NPs by an immersion method. Several parameters including the effect of pH, concentration, the voltage applied, and deposition time were studied to obtain an optimum condition in synthesizing Au-fCNT and Au-fCNTs-AAO. These catalysts were characterized by atomic absorption spectroscopy (AAS), Brunauer-Emmett-Teller (BET), Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), and field emission scanning electron microscope (FESEM), and transmission electron microscopy (TEM) to investigate the structure and morphology of these catalysts. The catalytic activities in the reduction of *p*-nitrophenol (*p*-NP) to *p*-aminophenol (*p*-AP) of Au-fCNT and Au-fCNTs-AAO catalysts were monitored using UV-Visible Spectrophotometer (UV-Vis). The Au-fCNTs-AAO exhibited superior and excellent catalytic activity compared to Au-fCNT in which the *k*-values were 0.678 min⁻¹ and 0.072 min⁻¹, respectively. This study offers cost-efficient route, easy separations, excellent reusability, high stability and catalytic efficiency for the large scale of application.

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