GREEN MICROWAVE-ASSISTED SYNTHESIS OF AuPd/C AND AgPd/C CATALYSTS FOR METHANOL ELECTROOXIDATION IN ALKALINE MEDIA

Ana Isabel Casas Hidalgo[a], Manuel Román Aguirre[b], Edgar Valenzuela[c], David Chávez Flores[a], Víctor Hugo Ramos Sánchez[a,*]

[a] Facultad de Ciencias Químicas Nuevo Campus Universitario, Circuito Universitario; Chihuahua, Chih., México, C.P. 31125

[b] Centro de Investigación de Materiales Avanzados S. C., Miguel de Cervantes #120, Complejo Industrial Chihuahua; Chihuahua, Chih., México, C.P. 31109

[c] Facultad de Ingeniería, Universidad Autónoma de Baja California, Campus Mexicali, Boulevard Benito Juárez S/N, Mexicali, B. C., México, C. P. 21900

[*] vramos@uach.mx

Key words: Green synthesis, microwave assisted, nanoparticles.

The stabilizing agent, reducing agent and reaction medium are the key factors for an effective nanoparticle synthesis. However, many of the most used reducing agents (N_2H_4, $NaBH_4$ and $NaBH_3CN$) and stabilizing agents (TPP and PVP) are often toxic, difficult to handle and to dispose; imposing therefore risks of safety and environmental nature.

In the last decade, many studies have reported the use of natural extracts as stabilizing and reducing agents for the green synthesis of metallic nanoparticles. In addition to this, the use of microwave-assisted methodologies make the synthesis process substantially more effective while less time-consuming.

For fuel cells applications, it has been found that some metals (*i.e,* silver and gold) provide a synergetic effect in catalysis when alloyed with palladium in nanometric scale. This proves that AgPd and AuPd are suitable options to replace platinum based catalysts, especially in alkaline media, in which kinetics for methanol oxidation (*MOR*) is better than in acidic media.

In this work, aqueous nutshell extract was used as a reducing agent, stabilizing agent and reaction medium to synthesize two bimetallic AuPd/C and AgPd/C catalysts under microwave radiation. This synthesis is a sustainable process as the extract is obtained from a natural waste (nutshell) of the agroindustrial activities in the northern of Mexico.

Results showed a particle size ranging between 7-20 nm and 72% alloying degree. With respect to catalytic activity, the electrochemical performance was comparable to that of commercial Pd electrocatalysts, with similar metal loadings.