

Micro-cellulose carbon aerogel as nickel and iron support for ammonia adsorption and decomposition

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Abstract

The use of lignocellulosic biomass to obtain energy via gasification has taken a strong interest in efforts to diversify the world energy matrix. This technology allows obtaining gases rich in H₂, CO, CH₄ and heat energy in the process. One of the main barriers to its use is the composition of the gases obtained. Compounds such as tar, ammonia, chlorinated and sulphur substances limit the gases applications. Research to improve the quality of the gas has focused on reducing the concentration of these, especially in the elimination of tars. However, ammonia, even at low concentrations, is inadmissible in F-T synthesis processes and may limit the use of combustion gases by the possibility of generating NO_x. Elimination routes such as washing can completely eliminate ammonia but generate a residual stream with tars difficult to be treated. Decomposition reactions can decrease the presence of both tar and ammonia, and increase the H₂, CO and CH₄ content of the gases. These reactions must be catalyzed to achieve the necessary results, being reported as active transition metals such as nickel and iron. Due to the high concentration of carbonaceous compounds, the catalysts undergo coking rapidly. One way to mitigate this problem is the use of a support that delays the formation of coke, literature reports coals as active in their decomposition. In this work a carbon aerogel (CAG) obtained by pyrolysis of cellulose microfibers (CM) is prepared to be used as iron and nickel catalysts support. As a first step to propose a mechanism for simultaneous decomposition of tar and ammonia, the process of adsorption and decomposition of ammonia in carbon aerogel and catalysts between 50 and 150 ° C and between 135 and 390 ppm of ammonia is studied. Results show that catalysts exhibit higher adsorption capacity than carbon aerogels (with no metal content), indicating chemical interaction between ammonia and metals, which is consistent with the calculated thermodynamic parameters. This is probably caused by unpaired electrons of nitrogen atom and d orbitals of both metals interaction. Decomposition test show activity in support and both catalysts.

Citotoxicidad de Nanopartículas a Base de Óxido de Grafeno y Quitosano Cargadas con Proantocianidinas

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El óxido de grafeno (OG) es un nanomaterial que ha sido ampliamente usado en aplicaciones médicas debido a sus propiedades biológicas que aumentan al ser modificado con polímeros biocompatibles incrementando su estabilidad, efectividad en el transporte de drogas y reduciendo su citotoxicidad. Uno de los biopolímeros usados para esta función es el Quitosano (CS) que tiene reportada biocompatibilidad y solubilidad dependiente del pH del medio [1]. Estas respuestas inteligentes al medio unidas al carácter adsorbente del OG permite la creación de carriers inteligentes para el transporte y liberación sostenida de fármacos. La baja biocompatibilidad de las proantocianidinas de uva, las cuales son polifenoles de la familia de los flavonoides con gran capacidad antioxidante e inhibe la enzima convertidora de angiotensina, podría ser mejorado al ser transportado por estos carriers de OG-CS [2].

El objetivo de este estudio es desarrollar nanocarriers de OG-CS y probar la mejora de la citotoxicidad del fitofármaco cargado. Para esto sintetizamos y caracterizamos estos nanocarriers realizando comparación de sus propiedades a través de FTIR, UVvis, TGA, XDR, AFM, Espectro Raman y TERS. Además se comprobó su citotoxicidad con ensayos MTT con células HEK 293, de riñón humano, incubadas 24 horas. Hemos establecido la capacidad de carga y la liberación del fármaco en medios fisiológicos. Los resultados muestran la influencia de tamaño y potencial-z a la capacidad de carga. Los ensayos citotxicológicos muestran la mayor biocompatibilidad del nanocarrier en comparación al OG y también del fármaco cargado en estos carriers en comparación al fármaco aplicado por sí solo. Los resultados muestran además que la citotoxicidad es dependiente de la dosis.

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Referencias

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