Oxidation total of aromatic compounds for photocatalysis in gas phase

González-Paredes O. R.[1], Sandoval-Robles G.[1*], García-Alamilla R., Melo-Banda J. A.[1], Silva-Rodrigo R.[1], Arriaga-Gaona M. L.[2], Terres-Rojas R.[3], Alonso-Nuñez G.[4], Paraguay-Delgado F.[4]

[1]División de Estudios de Posgrado e Investigación, ITCM, J. Rosas y J. Urueta s/n. Col. Los Mangos, C.P. 89440. Tel-Fax (+52 833)215854, Cd. Madero, Tamaulipas, México, *E-Mail: jgsandor@yahoo.com.mx

[2]Universidad Veracruzana (Facultad de Ciencias Químicas), Región Poza Rica, AV. Venustiano Carranza S/N. Col. Revolución Tel: (782) 8227363 Poza Rica, Veracruz México.

[3]Instituto Mexicano del Petróleo, Programa de ingeniería molecular. Eje Central Lázaro Cárdenas 152. C.P. 07730, México D.F.

[4]Centro de Investigación de Materiales Avanzados, S.C..Miguel de Cervantes S. #120 Complejo industrial de Chihuahua, Chihuahua, Mex.

Introduction

At the present time, the use of aromatic hydrocarbons classified as volatile organics compounds (VOC s) as benzene, toluene, xylene, ethylbencene, ciclohexane considered as carcinogen materials represent a big risk for the human life. Its excessive use as solvents generates new cycles of contamination being required advanced technologies for its decrease or transformation to other less toxic compounds [1, 2]

This work had as objective the total degradation of toluene and etylbenzene in gas phase using titanium dioxide supported in glass fiber, glass spheres and pellets of alumina.

Materials and methods

Titanium dioxide was prepared by sol-gel method [3]. The titanium hydrogel obtained was impregnated on glass spheres, glass fiber and alumina spheres. Then, the materials were calcined in air flow at 530°C. Degradation test were carried out in a continue system in gas phase, in all the cases, the catalysts were placed in a glass reactor irradiated with two UV light lamps of 25 watts. The products of reaction were analyzed for GC. In the feedstock to reactor a molar ratio of 0.99, 0.0057 and 0.0007 of air, aromatic compounds and water was used in all the experiments. Aromatics and water were placed in two separated saturators and were introduced together to the reactor by air flow used as carrier gas. The effect of temperature degradation was studied from 40 to 140°C to different GHSV.

Results and discussion

In the three catalysts, anatase with traces of rutile phase was observed by DRX analysis. A value average in Eg around of 3.306 eV was obtained in all the photocatalyts as can be observed in the figure 1. With the three catalysts a wavelength of approximate 375 nm is necessary for the catalysts activation. This value is high slightly to the reported for titanium dioxide unsupported.

In the table 1, the results of degradation test at 40 and 100°C using 50 ml/min of feeding mixture.

The maximum degradation was obtained around of 100°C although a room temperature the degradation is possible. At 100°C, the ethylbenzene was oxided to major extension that the toluene. CO_2 and water was the only product of the reaction.

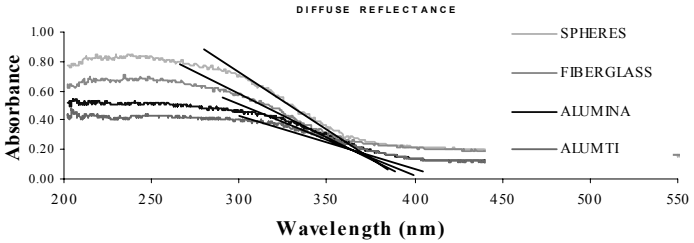

Figure 1. Diffuse Reflectance of TiO_2 of prepared catalysts.

Table 1. Results obtained in the reaction system to 100 ºC, with a flow of feeding of 50 ml/min and ΔP of 1.0 cm of column of water.

Catalyst TiO_2/supports	% Deg. Toluene	% Deg. Xylene	% Deg. C_8H_{10}	% Deg. C_6H_{10}
Alumina	63	75	72	62
Glass fiber	49	63	86	71
Glass pearls	67	31	90	68

Conclusions

The total oxidation de ethylbenzene and toluene was obtained using dioxide of titanium supported in glass fiber and spheres respectively. The better support was glass spheres due probably to a bigger surface area or surface with most defects that hold a higher quantity of titanium dioxide in their surface.

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