Influence of cerium content on ZrO_2-SO_4^{2-} on the transformation of cumene in the alkylation of benzene with propylene

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Introduction

The processes of refinement of petroleum have been characterized lately by the exigencies of quality and environmental normatividad in refined products. Well it is known that the components of the gasolines that have greater octane number and low steam pressures come from the processes of alkilation and isomerization. In which it concerns to the alkilation process the use of catalysts in phase eliminates for example acid hydrofluoric (HF) exposes to great risks by its physicochemical characteristics. This process includes the separation, recovery and reactivation of acids. this presents forts contamination problems, corrosion in the operational directions and the reactor by the humidity presence in the load and with it diminishes the acidity causing therefore the reactivation of acid generating problems of handling of the product, maintenance of equipment, affecting the economy of the companies, due to the cost that have these disadvantages. It is why it must look for new alternatives and one of these is the use of solid catalysts that diminish these risks.

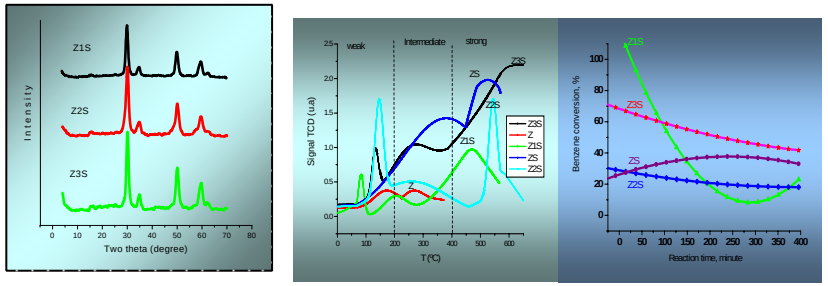
In the present work the sulphated zirconium oxide was synthesized studying the effect of the variation of the cerium oxide concentration in the texturales properties, structural as well as the acidity of these materials, for its use in the alkilation of aromatic, to obtain cumene, which is used in the synthesis of detergents. Although it is destined mainly to the material interesting manufacture of fenol and acetone of use in petrochemical processes. Used the liquid acid catalysts more in the alquilación are acid phosphoric, hydrofluoric acid (HF), sulfuric acid (H_2SO4), among others of similar characteristics, which due to the nature of the reaction system the use of one more a separation stage implies; one of the options that in this investigation appear as the use of a solid acid support that eliminates the situations of serious ecological,process and human damage.

Experimental

The synthesis of sulphated zirconia modified with cerium oxide was carried out by means of the method sol-gel from zirconia butoxide, using terbutilic alcohol as solvent. The sulfatation was made with ammonium sulphate 1M with 20 wt% of concentration of the SO4 ion in the solid, using the sulfatation method in situ. The cerium oxide content used as source the cerium nitrate varied from 10, 20 to 30 wt%. Once synthesized the materials these were dried at 120ºC during 24h and later calcined at 600ºC. Characterization: The crystalline structure was analyzed by means of X-Ray Diffraction using a Difractometer D8 Advance Bruker Axs, equipped with x-rays cathode of Cu Kα1(1.5406 Å) that operate to 35 kV and 25 mA. The specific surface of pure zirconia, sulphated circonia and mixed oxides, was measured from the nitrogen isotherms using the BET method in a Quantachrome Autosorb-1 model. In order to measure the acidity and acid sites on the surface of the catalyst these were carried out with ammonia TPD in a In-situ Research Instruments RIG-100-19.The alkylation reaction took place in a microplant to obtain cumene using a GC online.

Results and discussions

Sulphated zirconia oxide with 10, 20 and 30 wt% of cerium stabilized the tetragonal phase support was determinated by XRD in the 1.2 grades in the 2θ scale. Textural properties showed surface areas from 58 to 122 m^2/g for source support attributable to the presence of mesoporous of III type were founded. Distribution of the population of acid sites image showed allowed to establish a very significant influence of the CeO_2 on the acid properties of the ZrO_2-SO_4 being modified directly the acid strength of the sites. The best performance in the catalytic activity and selectivity toward cumene was when Z3S with a content of 30 wt% CeO_2 was used.



a) **b)** **c)**

Figure1. Diagrams of a) DRX for the mixed oxide ZrO_2-SO_4-CeO_2, b) distribution of acid sites of different force, c) studied the effect in the conversion and selectivity in the reaction of alkylation of benzene with propilene for the obtaining of cumene.

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