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Valorization of glycerol into fuel additives over zeolites as catalysts

H. Serafim[a], I.M. Fonseca[b], A.M. Ramos[b], J. Vital[b], J.E. Castanheiro[a,*]

[a] Centro de Química de Évora, Departamento de Química, Universidade de Évora, 7000-671 Évora, Portugal
[b] REQUIMTE, CQFB, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal

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ABSTRACT

Acetalisation of glycerol with butanal has been investigated over a range of zeolites with different pore structures and acidity (USY with different Si/Al ratio, BEA and ZSM-5). The products of glycerol acetalisation were (Z+E)-(2-propyl-1,3-dioxolan-4-yl) methanol (five-member ring acetal) and (Z+E)-2-propyl-1,3-dioxan-5-ol (six-member ring acetal). The results showed an optimum in activity for Si/Al ratio in USY zeolite that corresponds to 30. BEA zeolite presented the highest catalytic activity of all zeolites while ZSM-5 zeolite presented the lowest activity. All catalysts exhibited high selectivity to five-member ring acetal product (77–82%).

The effects of reaction temperature, catalyst loading and molar ratio of glycerol to butanal on this reaction, over BEA zeolite, have been studied. It was found that the glycerol conversion increased with the catalyst loading, with the temperature and with molar ratio of glycerol to butanal.

BEA zeolite was recycled four times with the same catalyst sample. It was observed a stabilization of the catalytic activity (after the fourth use, the zeolite showed 93% of its initial activity).