

Supplementary Information

Highly selective and efficient catalytic conversion of ethyl stearate into liquid hydrocarbons over Ru/TiO₂ catalyst under mild conditions

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Experimental

Materials

Anatase titanium oxide (TiO₂) was purchased from Nanjing High Technology Nano Material Co., Ltd. (HTNano), particle size 10-20 nm, surface area 150 m²/g. Alumina was purchased from Sinopharm Chemical Reagent Co. Ltd. (SCRC) company, pore size 58 Å, surface area 155 m²/g, and it was calcinated at 300 °C (3h) in air to remove some volatile impurities before used. Silica gel was purchased from Sigama-Aldrich, with pore size 60 Å, surface area 300 m²/g.

All chemicals are commercially available and used without further purification.

Catalyst Preparation

1wt % Ru/TiO₂ was prepared by impregnation method. Anatase TiO₂ was calcined at 300 °C for 5 h in air before used as support. After impregnation, the slurry was dried at 50 °C under vacuum, followed by calcination in air at 300 °C for 3 h, and the obtained catalyst had no further treatment and was reduced in situ in the reaction system. The SiO₂, Al₂O₃ supported ruthenium catalyts were also prepared with the above method as comparasion.

Activity Test

Typically, the experiments were carried out in a 50 ml stainless steel autoclave. After ethyl stearate, catalysts and hexane were added into the autoclave, it was then pressurized with hydrogen to 3.0 MPa. The reactions were operated under a stirring rate of 1300 rpm (without diffusion limitation) at a temperature range of 200-230 °C and reaction time range of 1-16 h. After the reaction, the autoclave was cooled to room temperature. The products were collected and then analyzed by gas chromatography with FID detector with a DB-1 capillary column and GC-MS respectively. The procedure for the reactions with additional alumina, firstly the Ru/TiO₂ and alumina were added into the autocalve, and the solvent hexane was added stirred vigorously, and then the reactant was added, the following procedure is the same as above described.

Table S1. Comparison the catalytic activities in the hydrogenation of ethyl stearate^a

Entry	Catalyst	Conversion (%)	Selectivity (%)
1	Ru /SiO ₂	3.4	30.5
2	Ru /Al ₂ O ₃	5.8	88.0
3	Ru /TiO ₂	95.8	98.5
4	Pd/TiO ₂	<3.0	-
5	SiO ₂	<1.0	-
6	γ-Al ₂ O ₃	<3.0	-
7	TiO ₂	<3.0	-

^aReaction conditions: ethyl stearate 0.5 mmol, catalyst 30 mg , hexane 5.0 ml, H₂ 3.0 MPa, 230 °C,4 h.

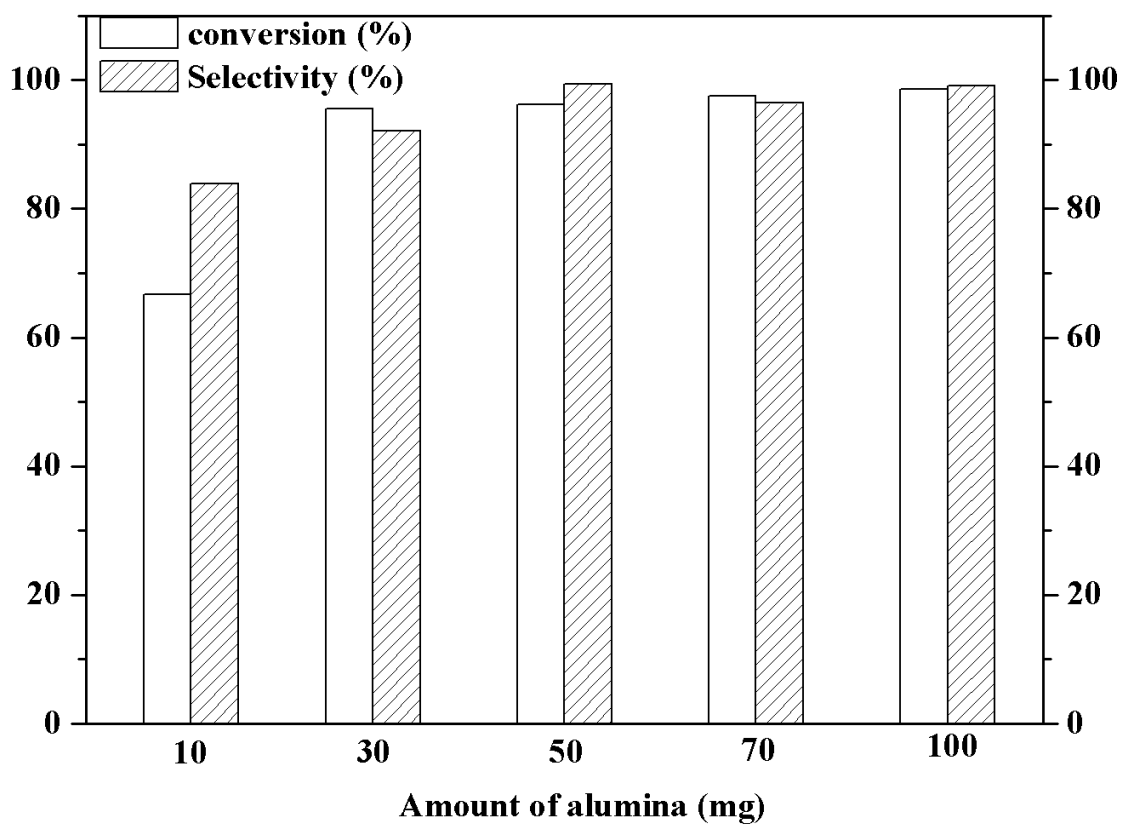


Figure S1 Effects of amount of alumina on the hydrogenation reaction.