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Biomass to Energy and Chemicals

WP 3
Project Info 7

Catalytic oxidation of n-butanol

Introduction

Butanol has a high potential to be used as a biofuel as it has higher energy density (~36 MJ/kg) compared e.g. with ethanol (~30 MJ/kg). Further, butanol can be distributed via existing pipelines due its low vapour pressure. Butanol is also less water soluble and less corrosive than ethanol.

Catalytic oxidation of butanol

Catalytic oxidation of n-butanol over supported Pt catalysts is examined to evaluate catalytic oxidation of n-butanol in the combustion engine. Supported Pt catalysts (0.5-3 wt%) were prepared by wet impregnation and calcined at 400 ºC. Catalysts were also well characterized. Specific surface area, pore volume, metal dispersion and crystal structure of the catalysts were determined.

Catalytic activities and selectivities of n-butanol oxidation were studied. Catalytic and thermal experiments were done by introducing n-butanol with a syringe pump and carrier gas into the reactor system (Figure 1). Reaction products were separated and quantified with an on-line GC/TCD-FID equipped with several columns and analyzed with on-line FTIR (Gasmet Dx4000N).

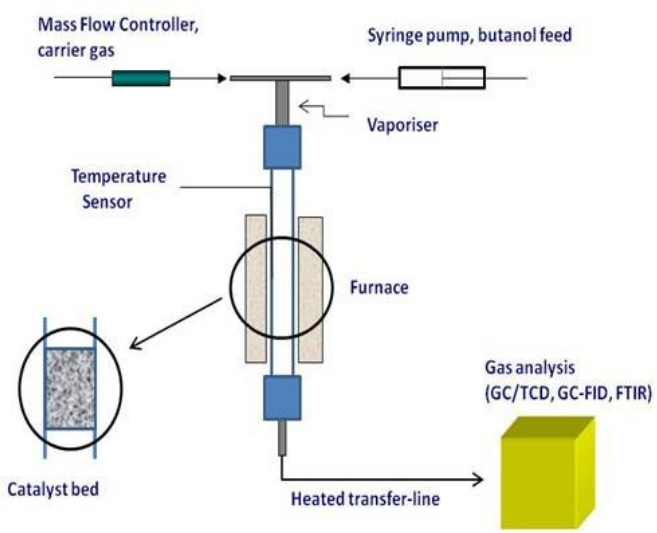

Figure 1. Catalytic oxidation of n-butanol. Experimental set-up for catalytic activity and selectivity measurements.

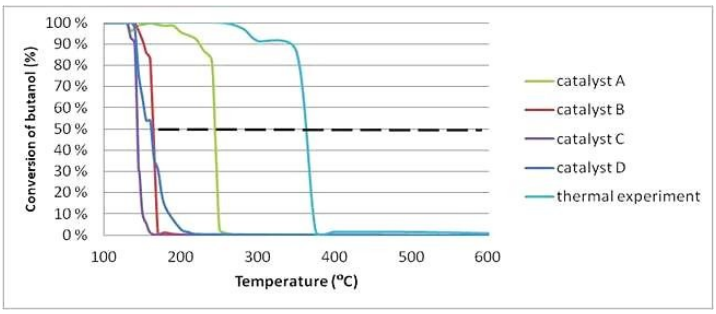

Figure 2. Catalytic oxidation of n-butanol over supported Pt catalysts.

Conclusions

n-butanol can be easily converted to CO_2 and H_2O over Pt catalysts. Catalytic conversion of n-butanol became appreciable in the 120-140 ºC range whereas for thermal (homogeneous) experiment 350-370 ºC temperatures are required, which is consistent with earlier results [1,2].

Formation of by-products, butyraldehyde and butyric acid, was observed having a maximum close to 142 ºC. Anyhow, selectivities to CO_2 and H_2O were high in all experiments.

Based on the results, traditional oxidation catalysts can be used to oxidise biobutanol, "the transportation fuel of the future".

References

[1] P. Papaefthimiou, T. Ioannides, X.E. Verykios, Appl. Catal. B 13(1997)175.
[2] J. Hermia and S. Vigneron, Catal Today 17(1993)349.

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