D-glucose hydrogenation over Ni based hypercrosslinked polystyrene

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Abstract

D-glucose catalytic hydrogenation to D-sorbitol can be considered a promising step in cellulose feedstock transformation technology to fuel components and valuable chemicals. Besides D-sorbitol has wide application in food, nutrition and chemical industries. Traditionally D-glucose is hydrogenated in bath reactor systems using Ru, Ni, Pd impregnated over different organic and inorganic supports. The catalysts based on active metals incorporated in a different type of carbon supports are more selective compared to the catalysts based on oxide type supports. However catalytic hydrogenation of D-glucose is characterized by the formation of numerous side products such as D-mannitol, gluconic acid. D-glucose hydrogenation was provided over Ni based hypercrosslinked polystyrene in autoclave reactor under 40 bar of hydrogen reaction pressure. The formation of side products results in appropriate decrease in the process selectivity. There for synthesis of selective catalyst is of great importance for this process. Catalysts initial activity of HPS-Ni was found to be 1.3 kg(Glu)/(kg(Cat)*h) at 99.3-99.6% D-glucose conversion. Process selectivity to sorbitol was 97.6-97.8%. Gluconic acid and maltitol are found in traces during the analysis and can be considered the main side products. The investigation of the catalysts long term stability showed that after 10 reaction cycles of 2 hours hydrogenation the HPS-Ni catalyst was ground by a reactor mixer therefore catalysts particles diameter becomes smaller than 0.01-0.07 mm compare to initial.