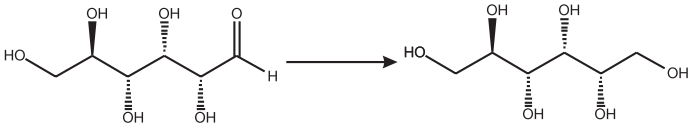
Hydrogenation of *D*-Glucose to *D*-Sorbitol Using Continuous Flow Hydrogenation Apparatus

This application note will demonstrate the H-Cube Pro™'s increased productivity in the hydrogenation of *D*-glucose to *D*-sorbitol, which is believed to be a key intermediate in biofuel production. Hydrogen is generated in situ through electrolysis of water. Both the use of elevated temperature and increased concentration were proven to be advantageous for the outcome of the reaction, resulting in higher selectivity of the desired compound and higher throughput over the H-Cube® system.

EXPERIMENTAL PROCEDURE

Reaction parameters such as temperature, pressure, flow rate, and hydrogen production were set on the touch screen interface of the H-Cube Pro™. After placing a Raney Nickel filled 70 mm long CatCart® in position, the system was washed with water until stabilization of reaction parameters were reached. Before performing any experiments, it was ensured that all lines (from solvent or reactant to waste or product) were washed carefully. *D*-glucose was dissolved in water and, after stabilization, the solution was passed through the system at the previously set reaction conditions and the product was collected from the product line. When the required amount of *D*-sorbitol solution was collected through the H-Cube Pro™, the position of the Inlet Valve was switched to Solvent to wash the system thoroughly before starting the next reaction. According to the flow rate, the position of Outlet Valve was switched to Waste after 1 minute in order to maximise product collection. Finally the product solution was concentrated *in vacuo* and analyzed by ^{1}H-NMR.



Conc. (mol/L)	Flow rate (mL/min)	T (°C)	p (bar)	H_2 production (%)	Product (%)*
0.10	3.0	100	90	10	92
0.20	3.0	100	90	10	90
0.40	3.0	100	90	100	93
0.40	3.0	150	90	100	96

Table 1. Reaction conditions and product purity
* Purity was determined by ^{1}H-NMR of the crude products

RESULTS

As shown in Table 1., reduction of *D*-glucose to *D*-sorbitol was successfully carried out using flow hydrogenation technology. The increased amount of hydrogen in the H-Cube Pro™ enabled the use of higher concentration (up to 0.4 M) and flow rate (up to 3 mL/min) that could not have been achieved with the standard H-Cube®. The higher temperature (150°C instead of 100°C) also resulted in slightly higher purity.

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