# Xylitol Fermentation Experiments with Different Yeast Strains

## Arc technology and viable cell density measurements help to optimize xylitol fermentation

**Industry:** University
**Application:** Xylitol Fermentation
**Hamilton products:** EasyFerm Plus PHI Arc, VisiFerm DO ECS, Incyte, Arc Wi 1G BT adapters, Arc ECS adapter pH/ORP

Organic residues from agricultural important plants contain high amounts carbohydrates that are of interest for bio-refinery processes to produce bio-fuels and other bio-products. These residues are attractive raw-materials due to their low commercial value, renewability, abundant availability and they don't compete with food production. One of the most important and difficult steps is the fractionation of the carbohydrates into its core constituents: hemicellulose, cellulose and lignin. From the hemicellulose fraction containing arabinoxylan, xylose-rich and arabinose-rich sub-fractions can be produced. Xylose-rich sub-fractions have a great potential as raw material for microbial Xylitol production. Xylitol is an established anti-cariogenic sweetener in the food industry that also has a potential use in the pharmaceutical industry. Arabinose-rich sub-fractions can be used for Arabinose production as a non-caloric sweetener.

Xylitol can be produced by some bacteria and filamentous fungi, but the best producers are yeasts, especially species of genus Candida. Microbial production of Xylitol from hemicellulose hydrolysate is influenced by several factors including strain, fermentation conditions (pH, dissolved oxygen concentration, initial cell density, temperature) employed in the process and the composition of the fermentation medium.

**FEATURES**
**Arc / Bluetooth Communication / Incyte**

- Easy integration into existing controllers
- Robust digital Modbus or 4-20 mA analog signal directly from the sensor
- Wireless communication via Bluetooth adapters and ArcAir app
- Current and historical data to predict sensor life
- Sensor diagnostics for simplified troubleshooting
- Continuous monitoring of cell growth

The Technical University of Budapest, Hungary, is experienced in bio-refining processes and has made remarkable research effort to optimize microbial xylitol production. A two-step fermentation strategy was invented. It starts with low cell density and the propagation of Candida yeast under aerobic conditions. Later, after several hours the aeration is drastically reduced to micro-aerobic conditions to produce Xylitol without significant further cell growth. Another test was performed to examine the difference in the kinetic behavior of the consumption of different carbon sources. As expected Glucose was the preferred carbon source and a significant metabolism of Xylose was observed after the majority of Glucose was already metabolized. On the other hand side Arabinose was not metabolized by the yeast at all, allowing enrichment of arabinose in the fermentation medium.

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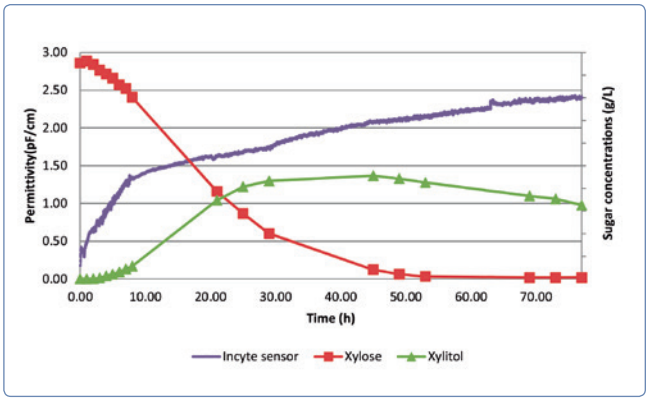
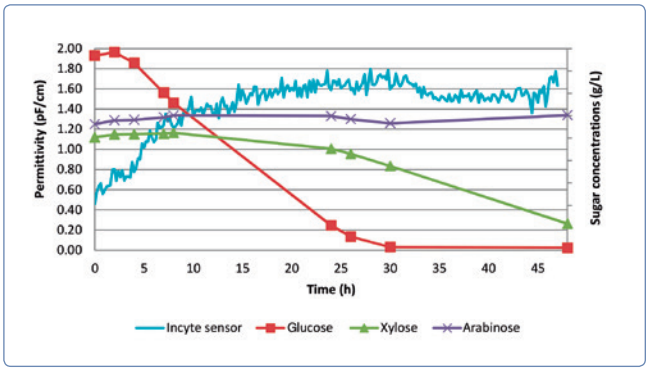
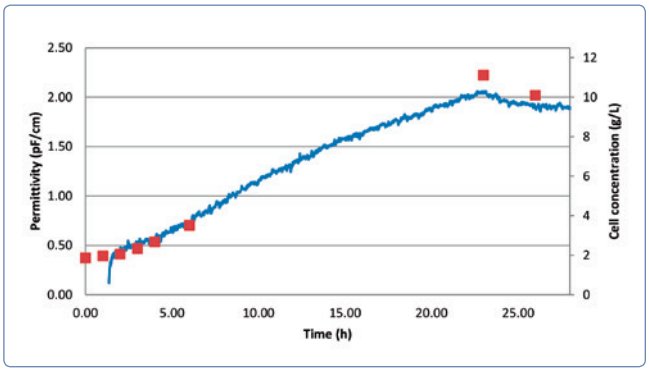



Two-step fermentation of Xylitol by using Candida yeast in bench-top bioreactor.




Consumption of sugars by Candida yeast under aerobic conditions in bench-top bioreactor.




Propagation of Ogateae yeast in bench-top bioreactor.

All these test were performed with the help of Hamilton products: VisiFerm DO and Incyte sensors allowed monitoring the dissolved oxygen content and the viable cell density continuously. In case of EasyFerm Plus Arc and VisiFerm DO the sensors could be configured, calibrated and monitored via the ArcAir app as well as on the controller. For an easy integration of the sensors into an older controller the Arc ECS pH adapter and the ECS version of the VisiFerm DO were chosen, upgrading the fermenter was not necessary. The online measurement of the viable cell density with Incyte demonstrated to be at least as good as the offline method (OD 600). Differences at the beginning are caused by the different detection limits of both methods.

## BENEFITS

### Arc / Bluetooth Communication / Incyte

- Easy maintenance
- Configuration, calibration and GMP reports wirelessly on any mobile device
- Stable and reliable readings
- Intelligent sensor technology
- No more hidden events with Incyte
- Increased yield
- Optimized feeding strategy

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