Batch cooling crystallization of xylitol produced by biotechnological route

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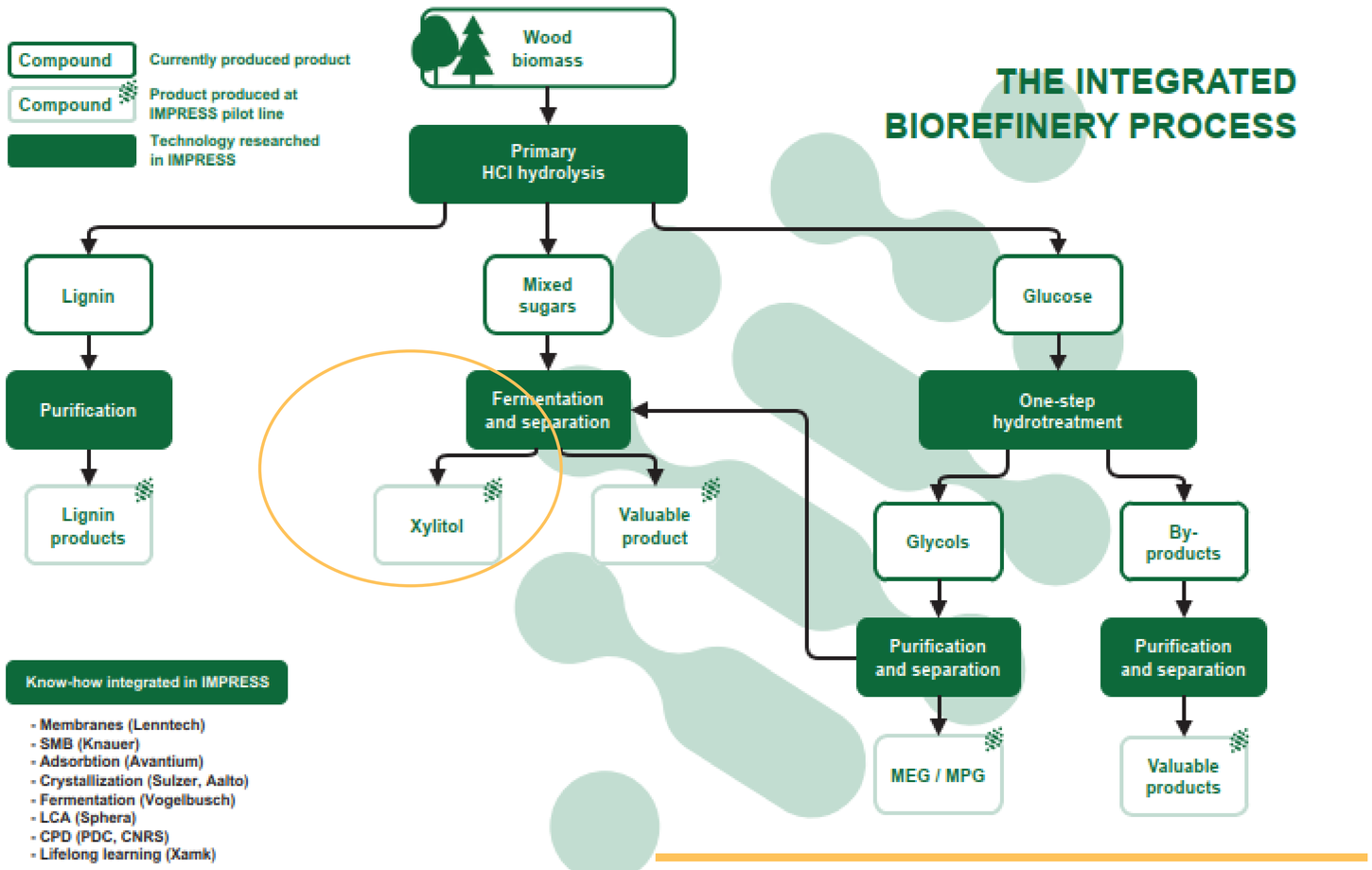
Introduction



•**Xylitol Properties**: Xylitol is a five-carbon sugar alcohol used in the food and pharmaceutical industries due to its anti-cariogenic properties. It does not rely on insulin for glycogenolysis pathways.

•**Commercial Production**:

• Commercially obtained through a chemical process based on xylose reduction.

• Requires high temperature, pressure, and an expensive catalyst.

•**Biotechnological Approach**:

• Investigating biotechnological production using yeast cells as an alternative to the chemical process.

Xylitol Recovery Methods:

•Hydrolysis or fermentation solutions are commonly used.

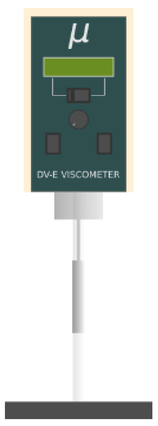
•Cooling crystallization is employed to obtain pure xylitol from impure solutions.

Research methodology

1) Concentration of the fermentation broth:
Used saturated solutions prepared through evaporation at 60°C.

2) Cooling crystallization:
Employed a constant cooling rate of 0.083 K/min over 3 hours in the temperature range of 40 to 25°C.

3) Impact of impurities:

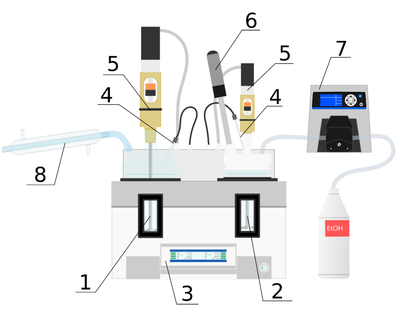


Impurity concentrations in the crystallizing liquid ranged from 1.5 to 41 wt%.

4) Purity Analysis:
Purity of crystals analyzed using High-performance liquid chromatography (HPLC)

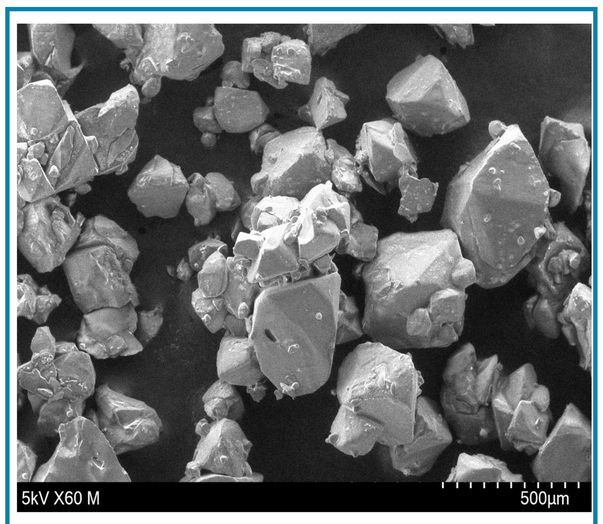
5) PSD, SEM studies

6) Viscosity measurements

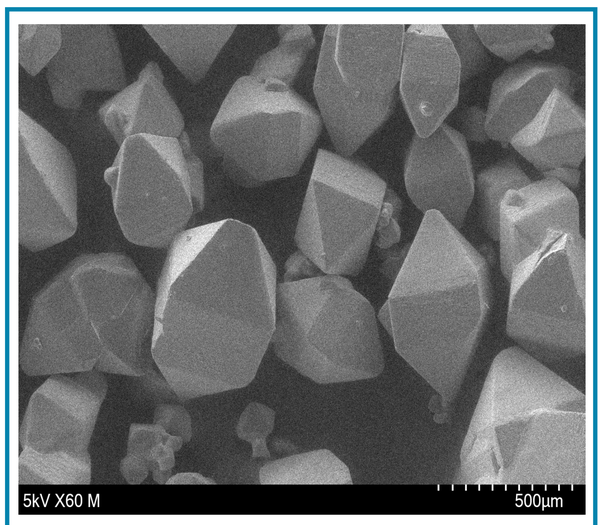


EasyMax 402 crystallization system:
1 – 400 mL reactor, 2 – 100 mL reactor, 3 – control panel, 4 – thermocouples, 5 – stirrers, 6 – FBRM, 7 – peristatic pump, 8 – condenser

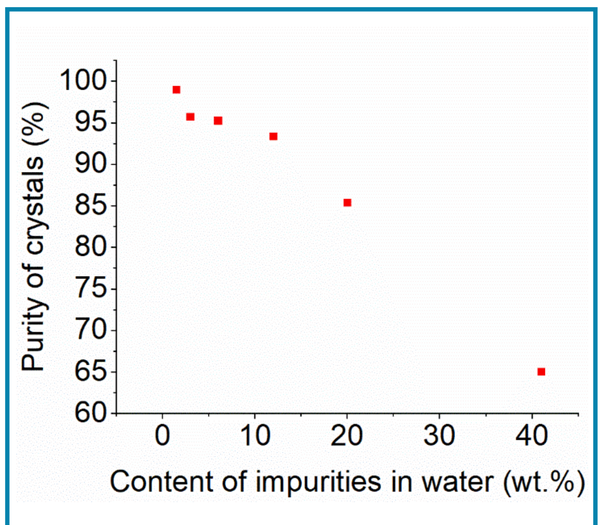
Results and discussions



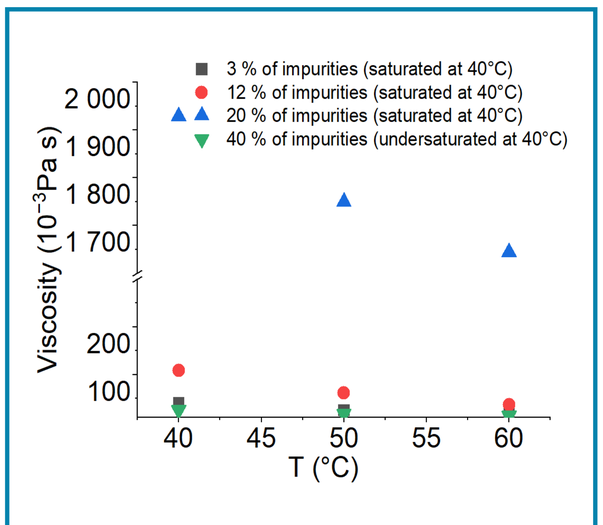
SEM measurement results – xylitol crystallized from fermentation broth



SEM measurement results – xylitol crystallized from water



Purity of xylitol crystals obtained by batch cooling crystallization from water containing 0-40 wt.% of impurities



Viscosity measurement results

CSD of xylitol varied with impurity concentration and increased with impurities up to 20 wt.%, beyond which crystals formed agglomerates. Viscosity played a crucial role in mass and heat transfer efficiency, affecting crystal growth kinetics.

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