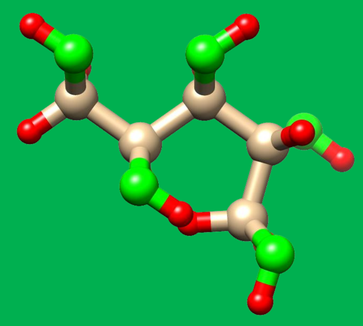
Batch crystallization of xylitol by cooling, evaporation and anti-solvent addition



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Introduction

This contribution focusses on investigating various crystallization methods for xylitol to achieve crystal uniformity as well as a desired size and shape.

In this study, three different techniques for xylitol crystallization and their operation parameters were evaluated regarding their influence on the product crystal properties: cooling, evaporative, and anti-solvent crystallization.

Figure 3. Brookfield DV-E Viscometer

Results

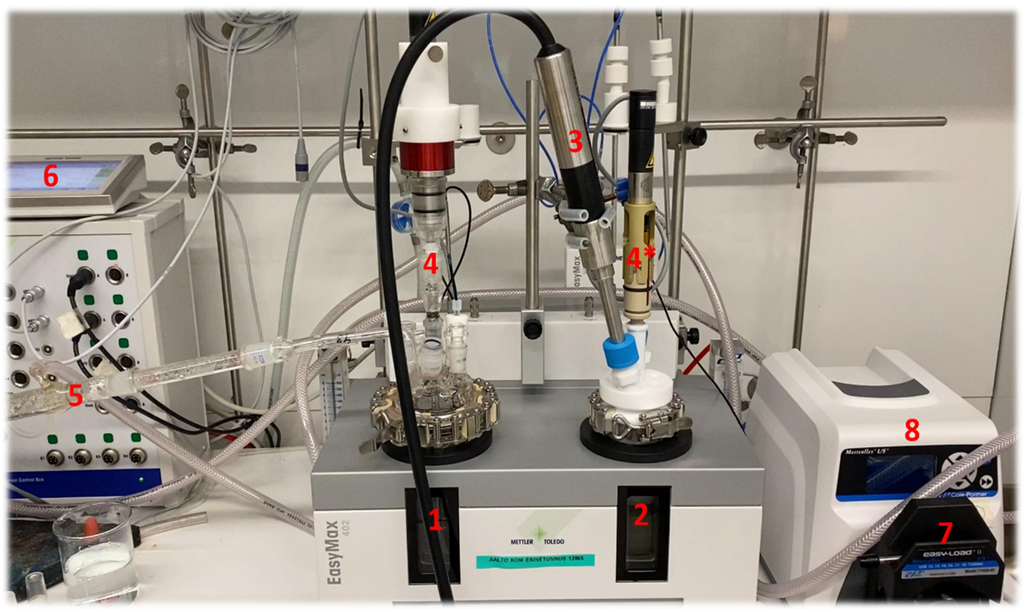

Figure 1. EasyMax 402 crystallization system (1, 2) reactors, (3) FBRM, (4,4*) stirrers, (5) vacuum system, (6) control panel, (7) pump head, (8) digital drive.

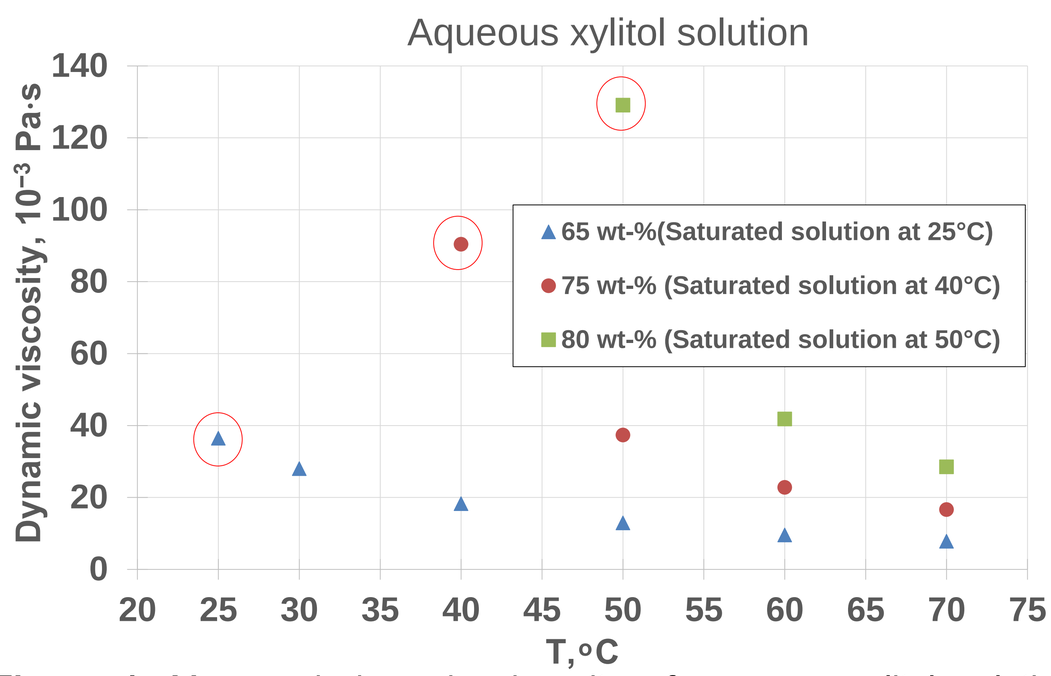

Figure 4. Measured dynamic viscosity of aqueous xylitol solutions at various concentrations.

Table 1. Operational conditions used in crystallization studies ('CR' cooling rate).

Crystallization type	T, ℃	Seed amount %	CR, K/min	Time, h	Yield, %	Crystal size: average / d(0.5), µm
Cooling	40→25	1	0.125	2	94	480/447
			0.083	3	95	460/427
			0.063	4	95	447/408
			0.050	5	96	502/471
	50→40		0.083	2	91	702/666
	40→30				93	468/437
Antisolvent	40		-	2	91	460/430
Evaporative	50		-	2	81	263/216

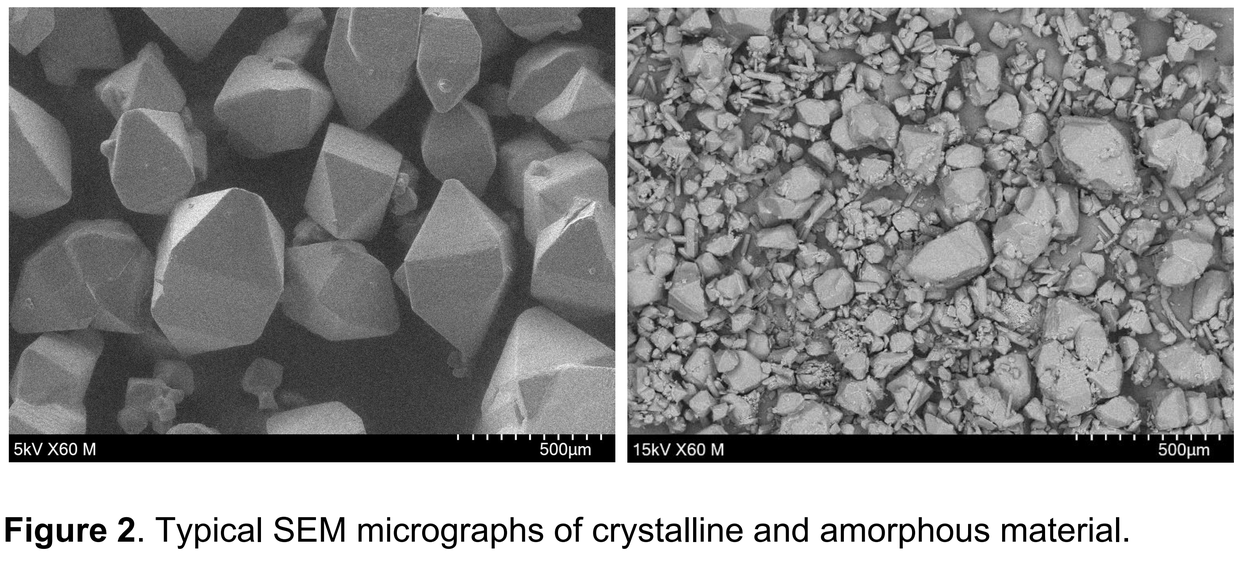

Figure 2. Typical SEM micrographs of crystalline and amorphous material.

Conclusion

The viscosity have a key role in crystallization kinetics.

- Especially in **cooling and evaporative crystallization**
- In **anti-solvent crystallization**, the solutions have **lower viscosity** due to lower solubility levels and the presence of anti-solvent

The largest crystals were obtained by cooling crystallization

- **Anti-solvent crystallization** resulted in the **smallest xylitol crystals**, as expected
- In the case of **evaporative crystallization**, obtained xylitol crystals were **smaller and less uniform** than the crystal product obtained by cooling crystallization.

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