



SOLVENT- ANTISOLVENT PRECIPITATION OF STARCH NANOPARTICLES IN A SPINNING DISC REACTOR

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Applications of starch nanoparticles

Ultra-high performance from **Goodyear GOODYEAR GT3**



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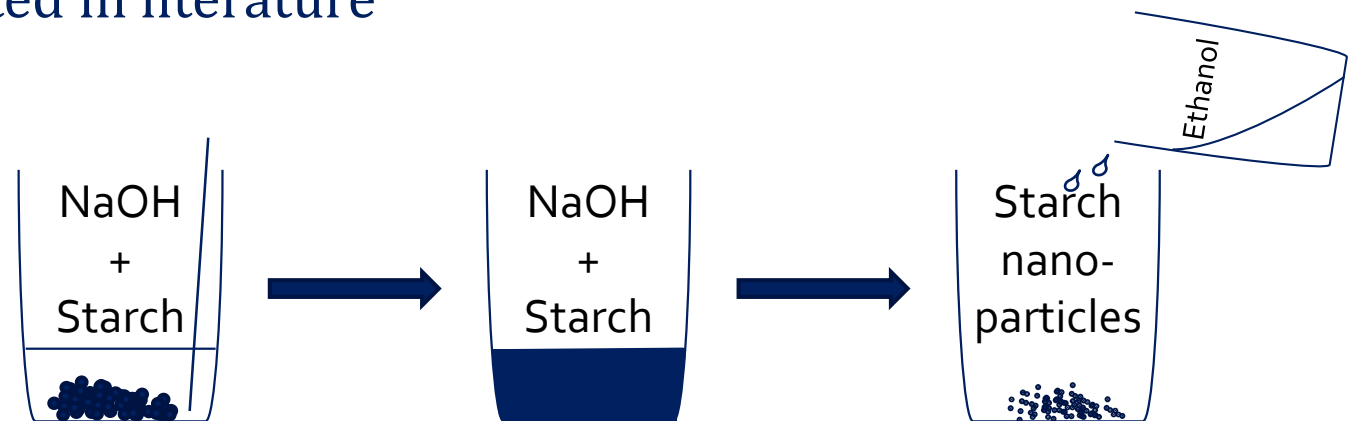
The Goodyear GT3, with BioTRED technology, will revolutionise the industry with its impact on our environment and safety. Goodyear's BioTRED technology partly replaces oil derivatives and silica in the tread compound with a new ingredient derived from cornstarch, which impacts on the environment at three levels: Environment – corn plants absorb CO₂ to release O₂ in the atmosphere..Production – requires less energy to produce, reducing CO₂ emissions..End user – requires less energy to move the car, providing up to 5% savings in fuel consumption.. This makes the GT3 a true environmentally friendly tyre. In addition, Goodyear's 3D-BIS technology in the centre rib blocks delivers new benchmarks in wet traction and braking.

- Nanocomposite filler
 - Enhance mechanical, barrier and thermal properties
- Wastewater treatment
 - Remove organic pollutant
- Carrier for drug delivery systems
 - Biodegradable, non-toxic
- Packaging

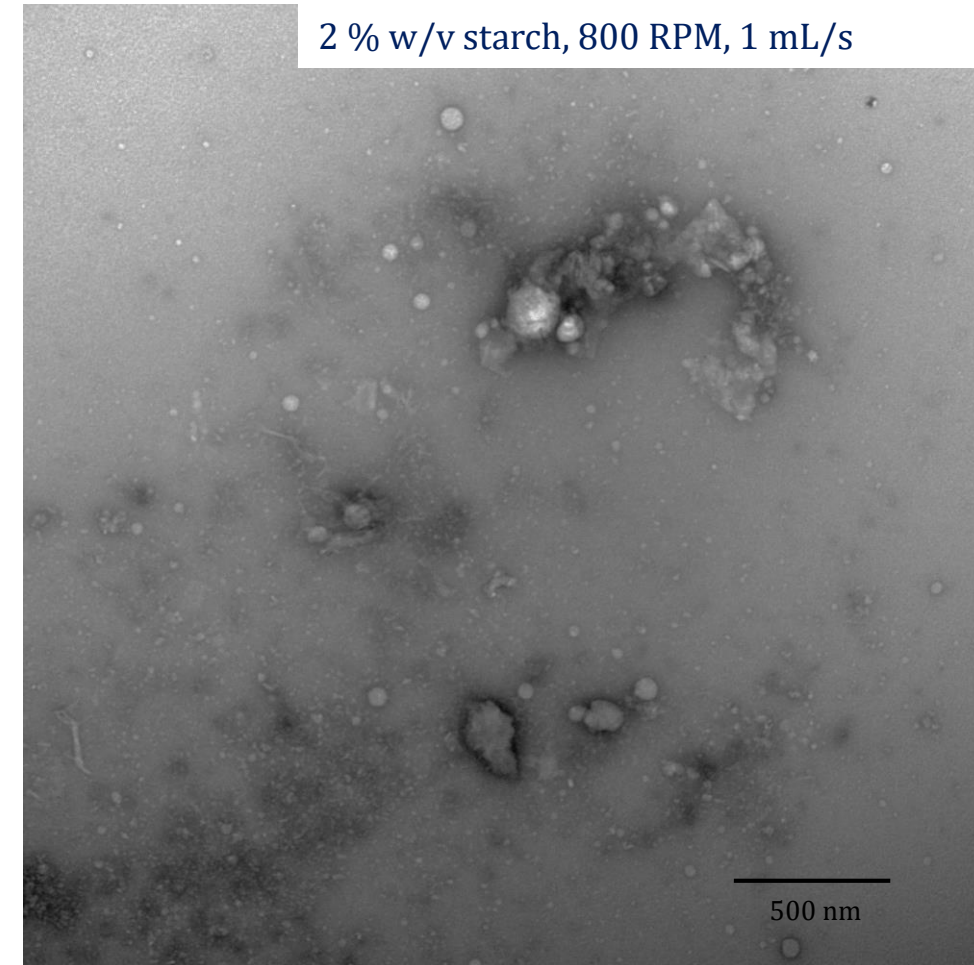
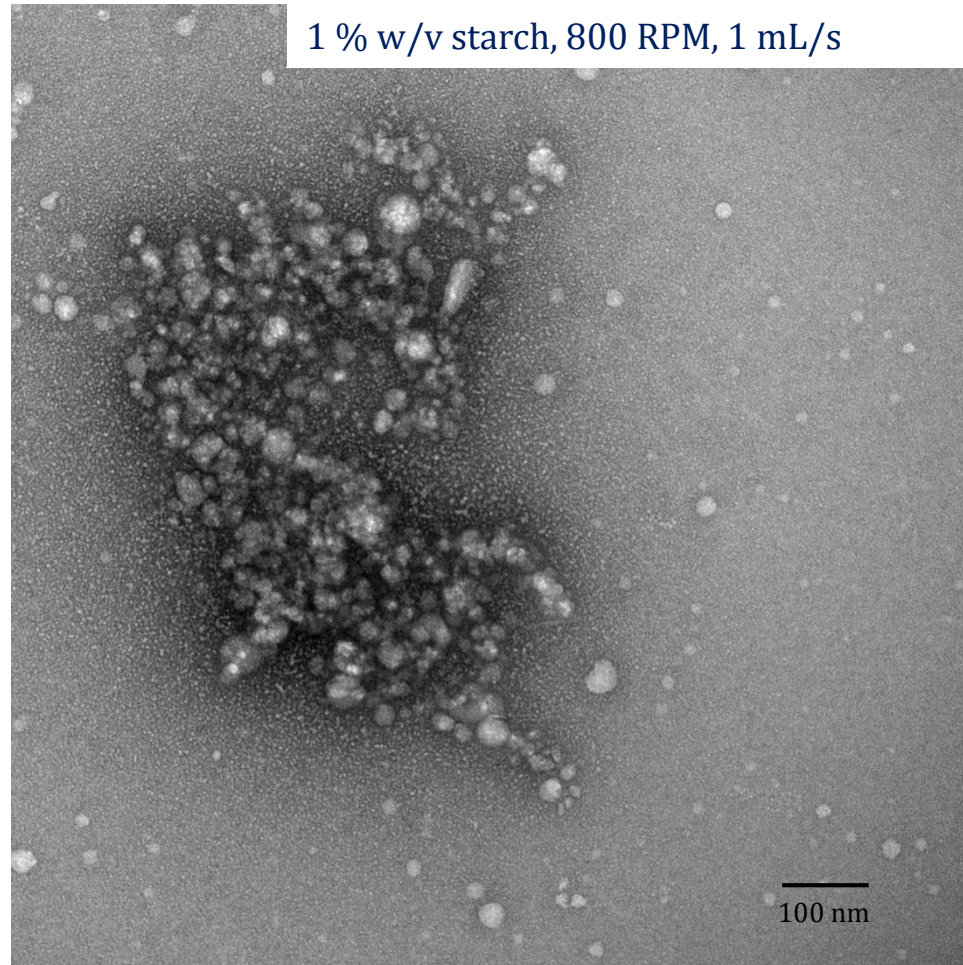


Solvent-antisolvent precipitation: a brief literature review

- Dropwise addition of antisolvent to solvent-solute mixture
- Size of nanoparticles 50 – 200 nm [1]
- Limitations:
 - Adding drops of ethanol to avoid agglomeration may be time consuming
- No study of flow systems reported in literature



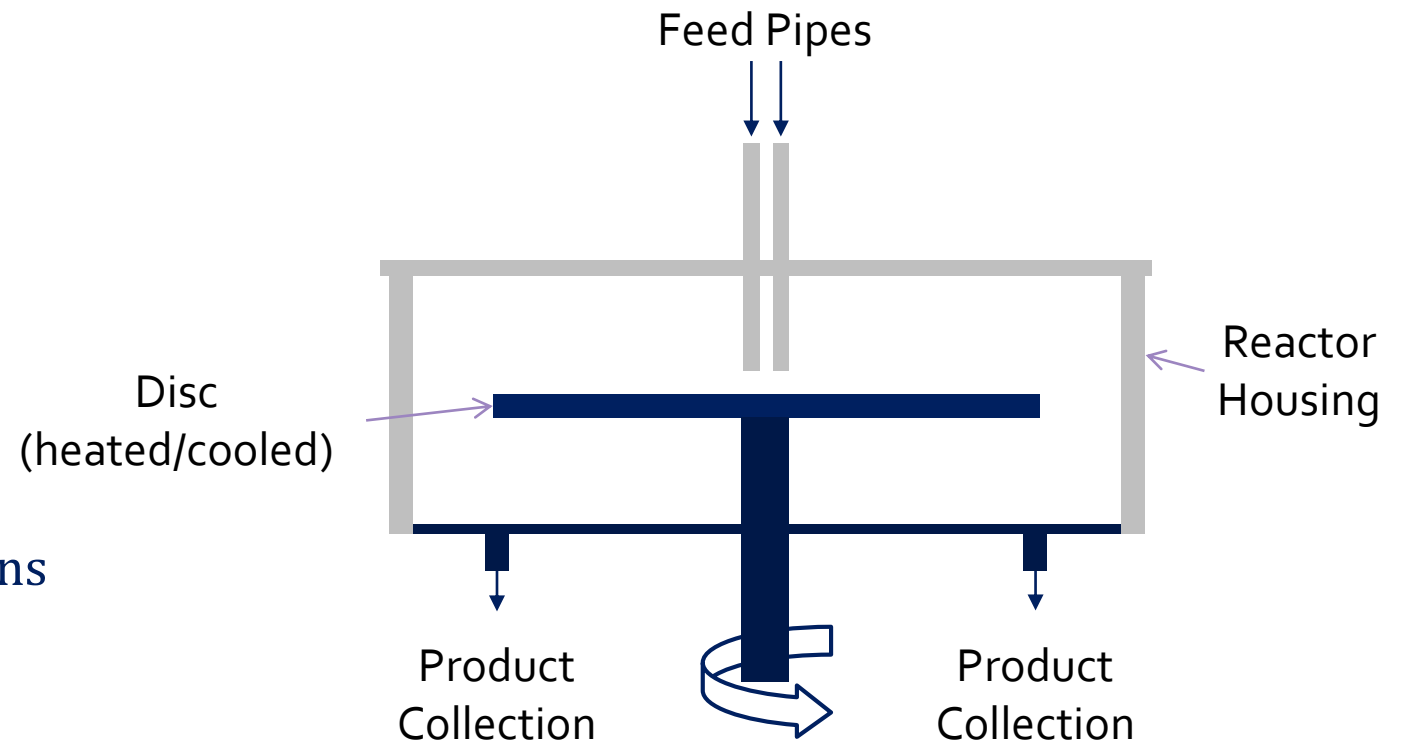
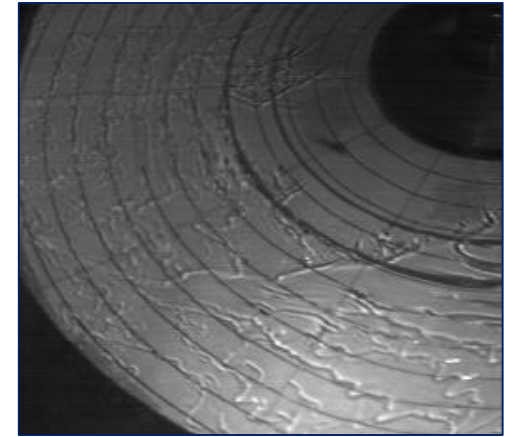
Semi-batch process



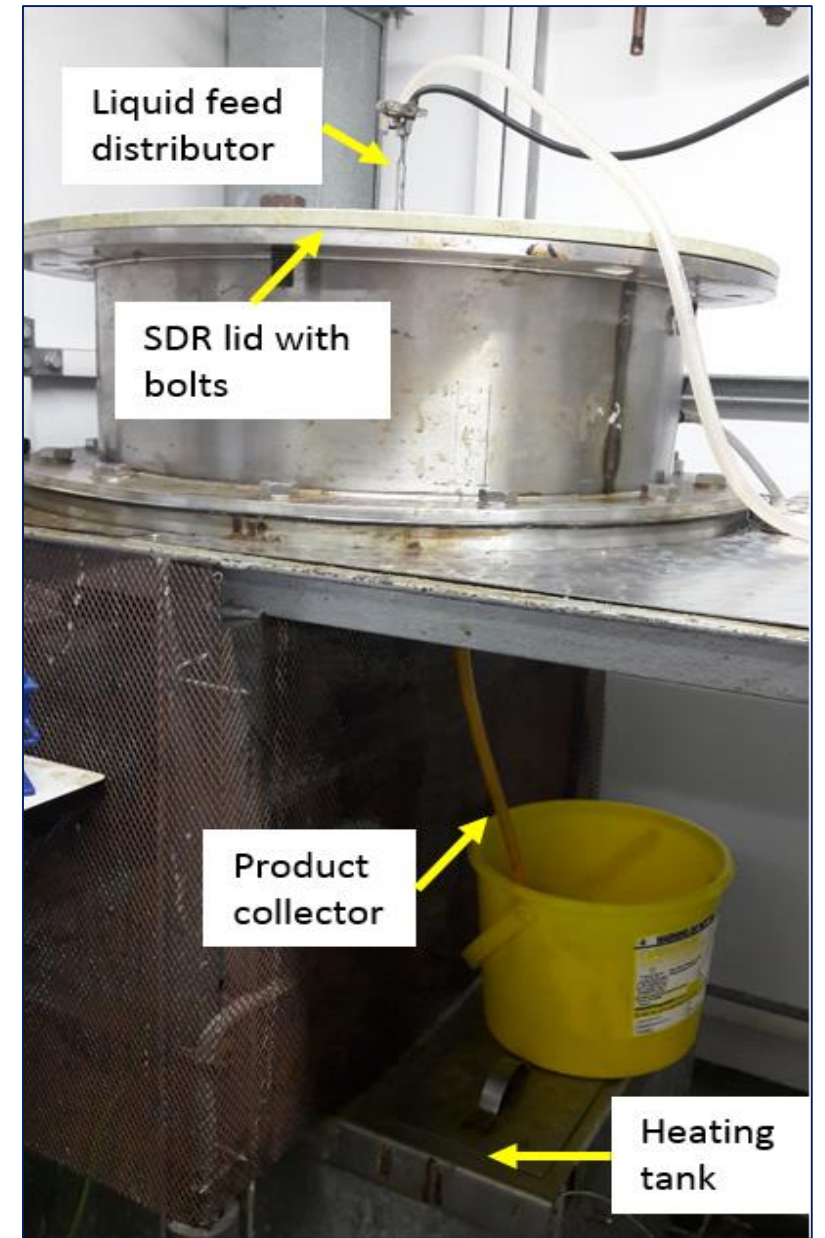
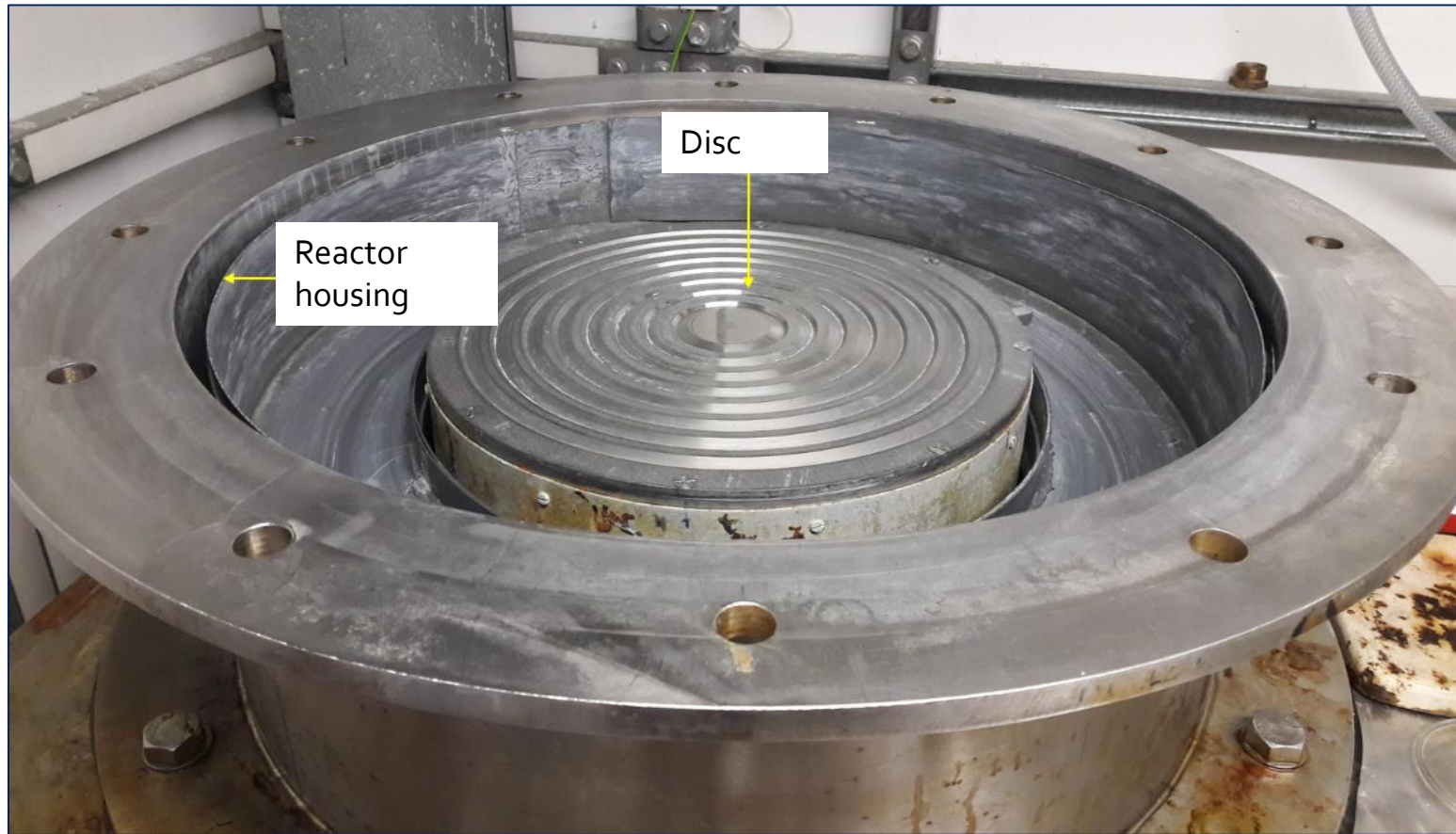
Intensifying with SDR

- Applied to processes including:
 - Polymerisation
 - Crystallisation
 - Catalytic reactions

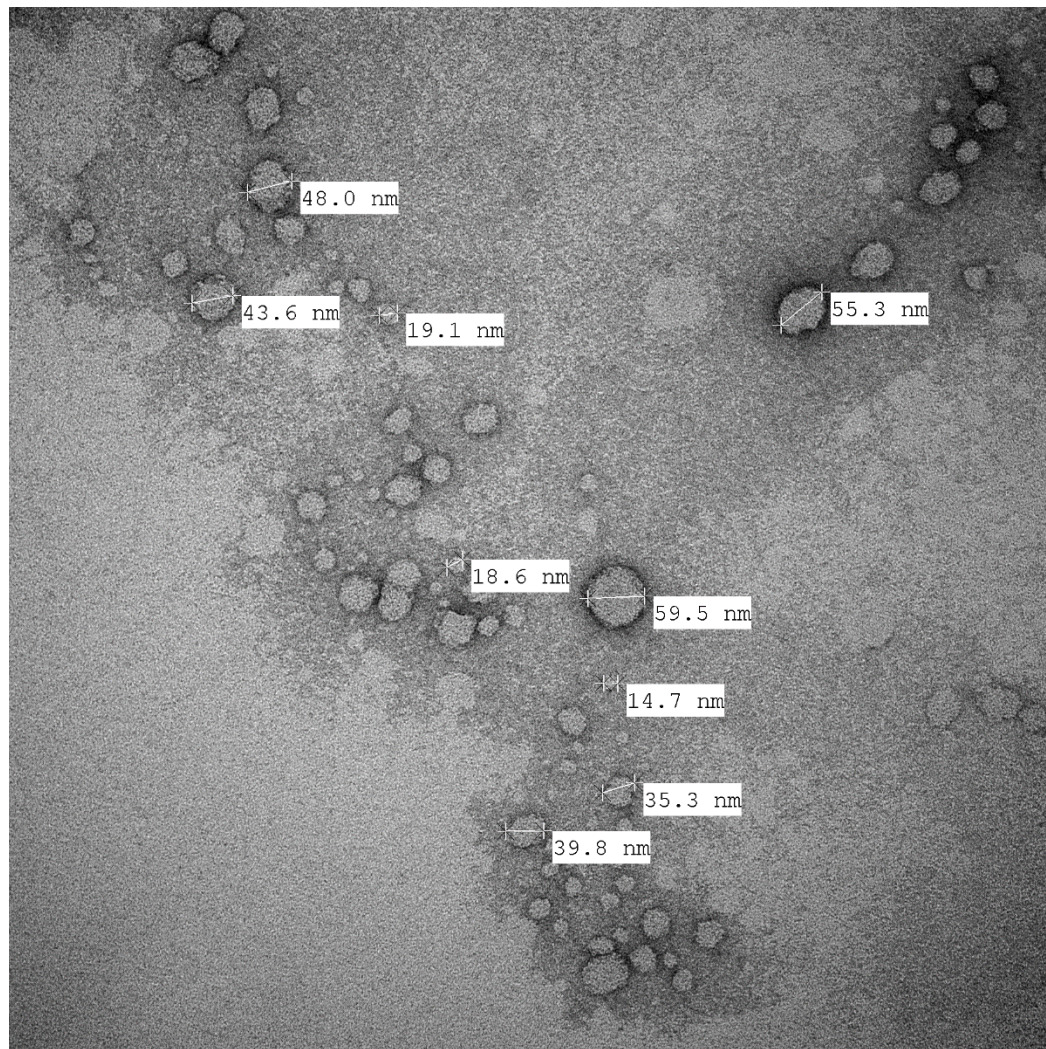
- Characteristics of SDR
 - Creates thin films
 - Intensified micromixing
 - Short residence times
 - Narrow particle size distributions



The spinning disc reactor

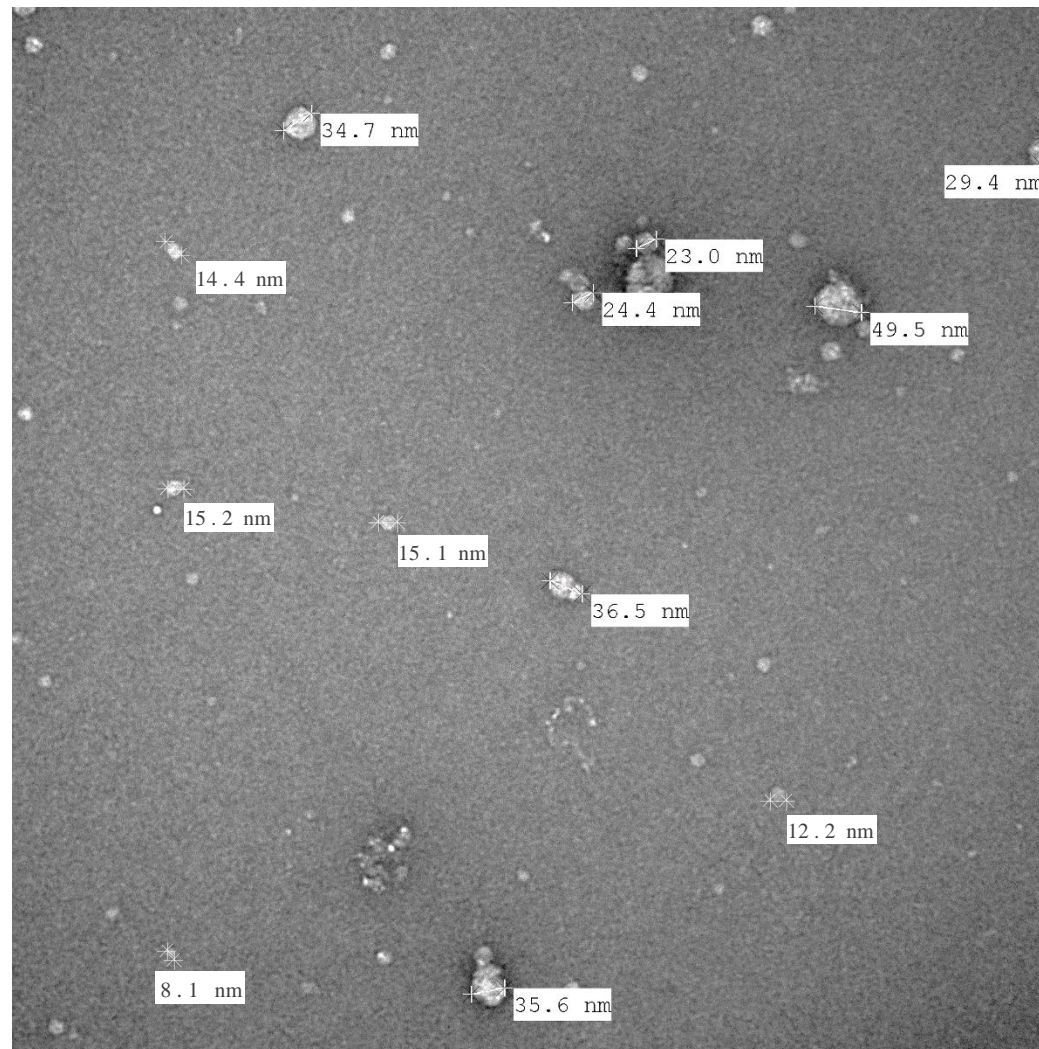


Results: Effect of total flow rate



Run 8 (QT= 6 mL/s, 1:9, 1200 RPM)

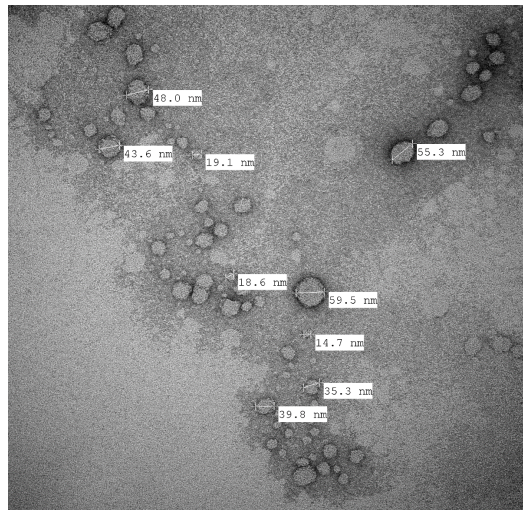
100 nm



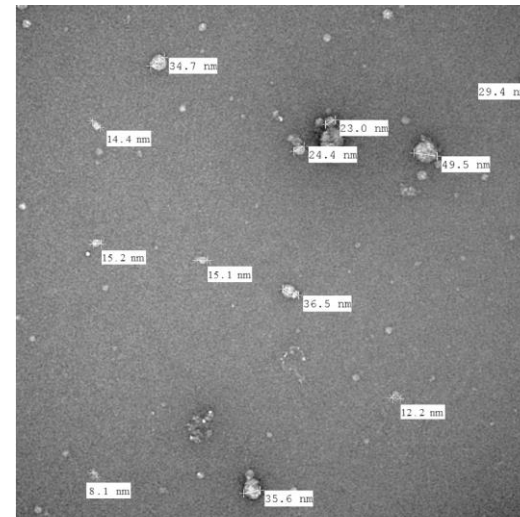
Run 12 (QT= 18 mL/s, 1:9, 1200 RPM)

100 nm

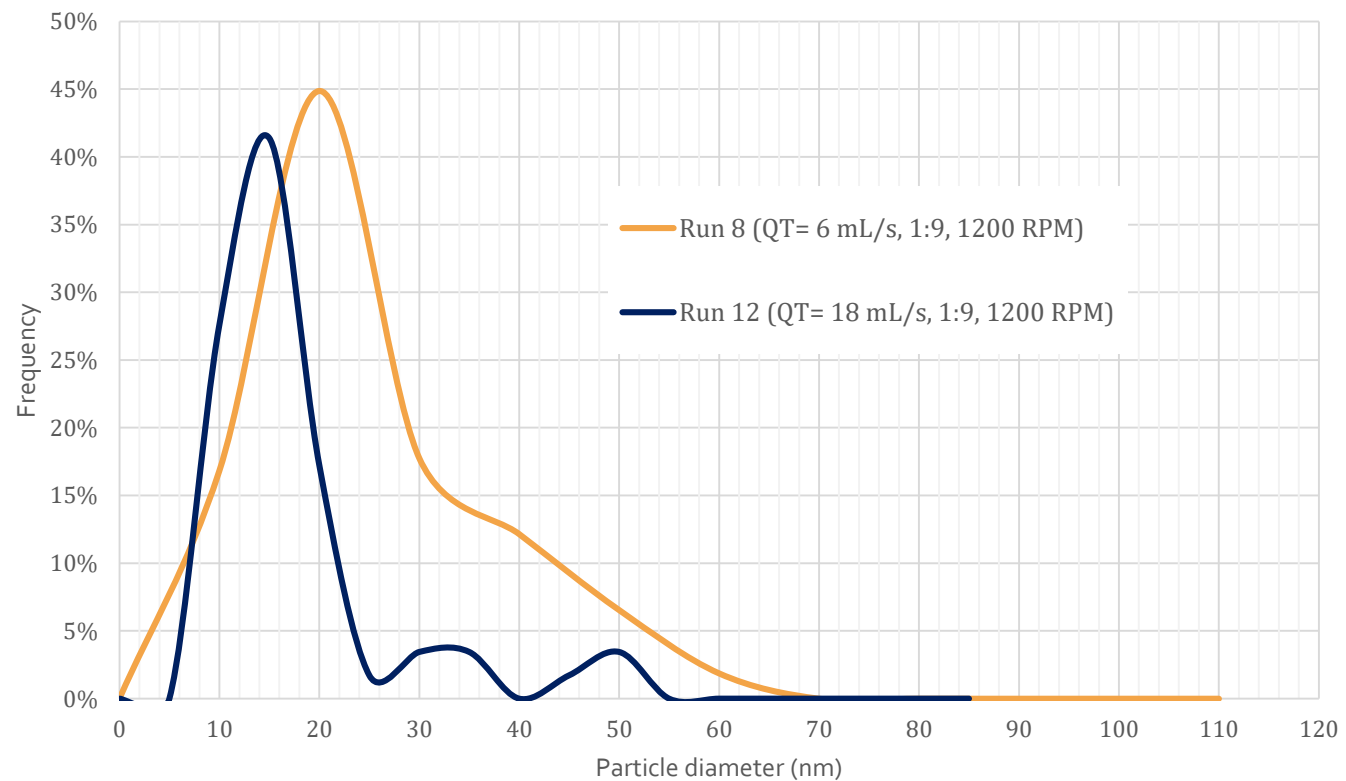
Results: Effect of total flow rate



Run 8 ($Q_T = 6$ mL/s, 1:9, 1200 RPM)



Run 12 ($Q_T = 18$ mL/s, 1:9, 1200 RPM)



Conclusion

- Agglomerated particles produced in semi-batch experiments
- Continuous processing in the SDR has indicated the presence of smaller sized particles with narrower PSDs and reduced agglomeration.