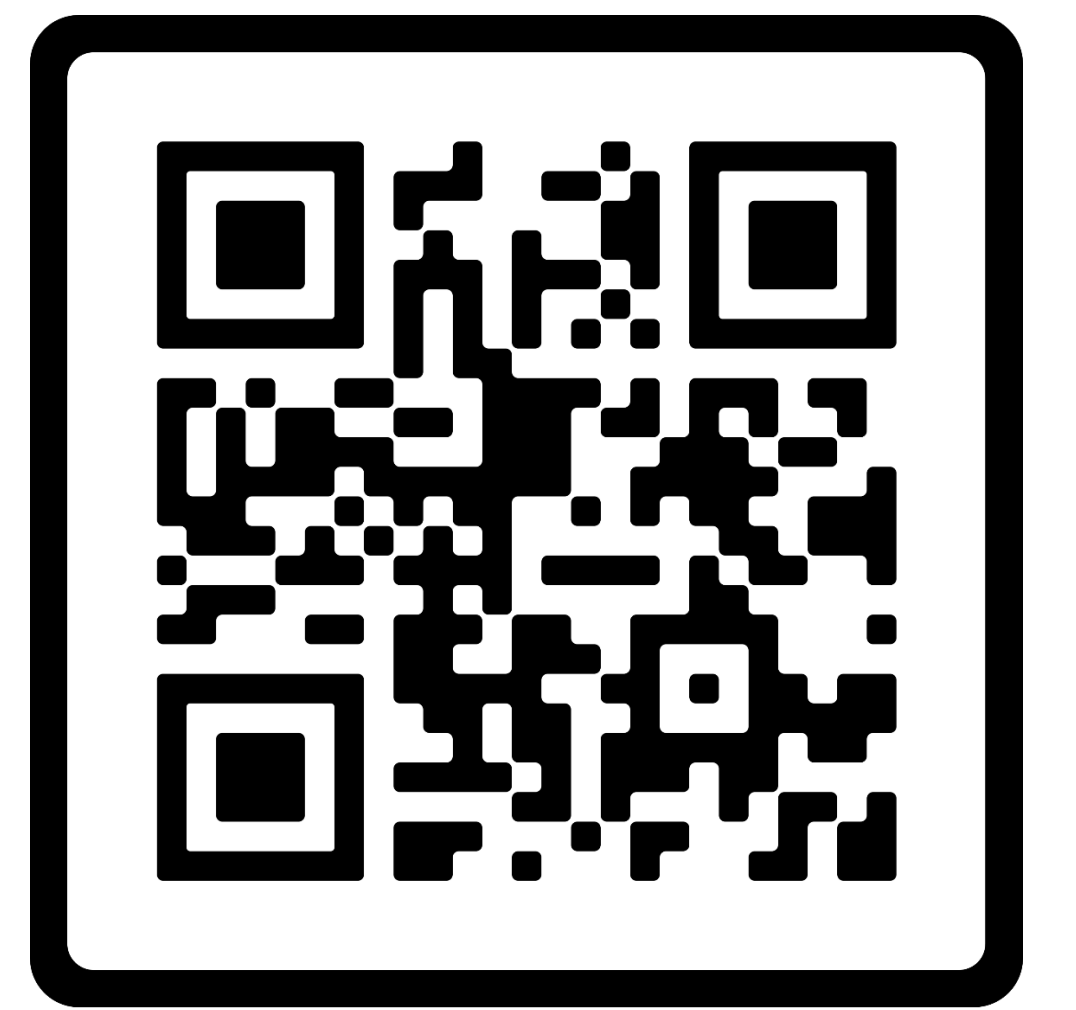
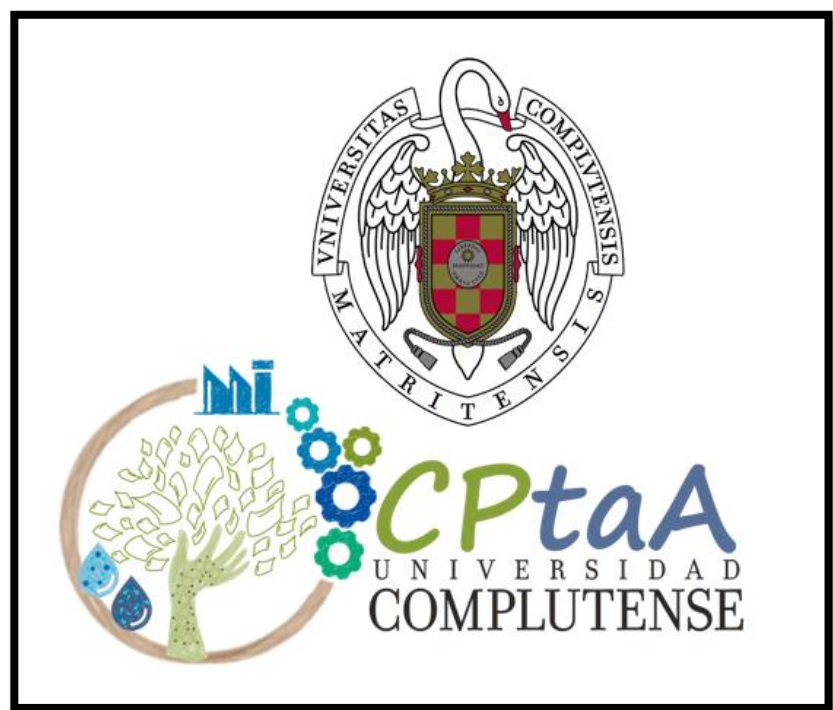


Pilot-Plant Twin-Screw Extruder to Produce TEMPO-Oxidated CNFs

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MORE INFO



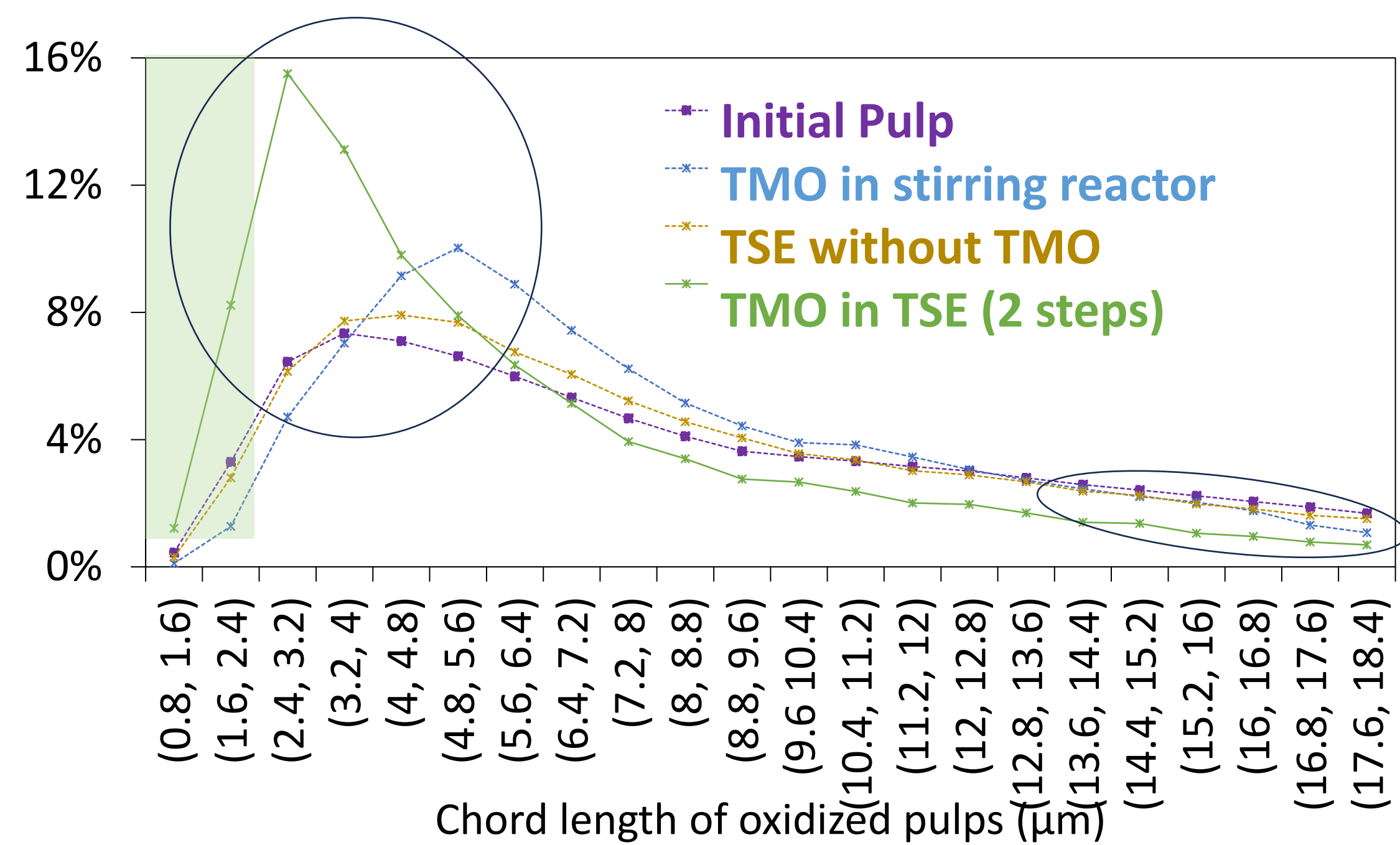
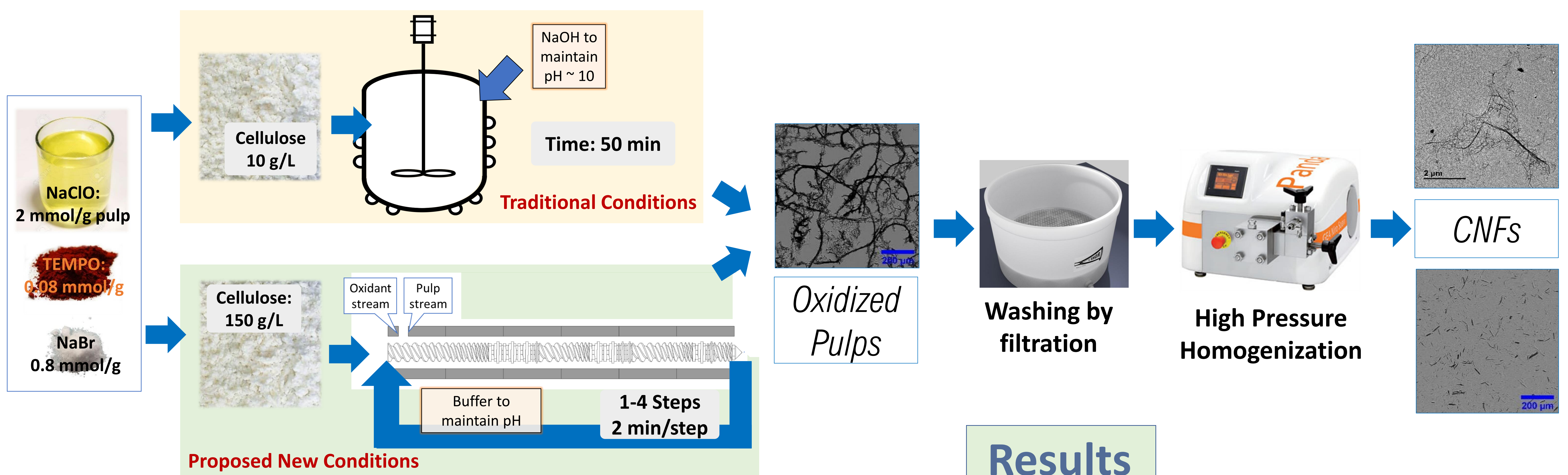
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CNFs produced by TEMPO-mediated oxidation (TMO) are widely recognized because of its efficiency and selectivity. However, the challenges of scaling up this process is limiting its implementation.

The feasibility of producing TMO pulps with a soft mechanical fibrillation in a twin-screw extruder (TSE) is studied. Proof of concept to increase the production of CNFs.



TMO in TSE produce a decrease of fibrils size, with more shorter fibrils, part of them not seen in the FBRM.

	Initial pulp	TMO Stirring Reactor	TSE 2 steps (Only Mechanical)	TMO in 1 TSE	TMO in 2 TSE	TMO in 4 TSE
Oxidized Pulps						
Not pass through HPH						
Carboxyl groups (mmol/g)	< 0.05	0.9-1.0	< 0.05	0.81	0.74	0.69
Polym. degree (monomers)	> 1500	294	946	202	198	139
Production (g/h)	-	9.3	434	527 (Yellowish CNFs)	294	154

Conclusions

- TMO reaction in pilot-plant TSE is feasible → High production of oxidized pulps and CNFs.
- Synergies TMO – TSE: allow CNF oxidation at high concentration and a soft fibrillation during oxidation.
- CNFs and OPs shows good properties with higher fibrillation than TMO or TSE separately. Several TSE passes decreases the polymerization degree with a lower proportion of remain fibers. The more extruder steps, the fewer remaining fibers. Although, an excess of TSE steps could produce the lost of fibrils after washing. 2-4 steps in the TSE is enough.
- This approach aims to oxidize large volumes of cellulose at high concentrations while simultaneously applying a soft mechanical fibrillation, making the upscaling process more sustainable and feasible.

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