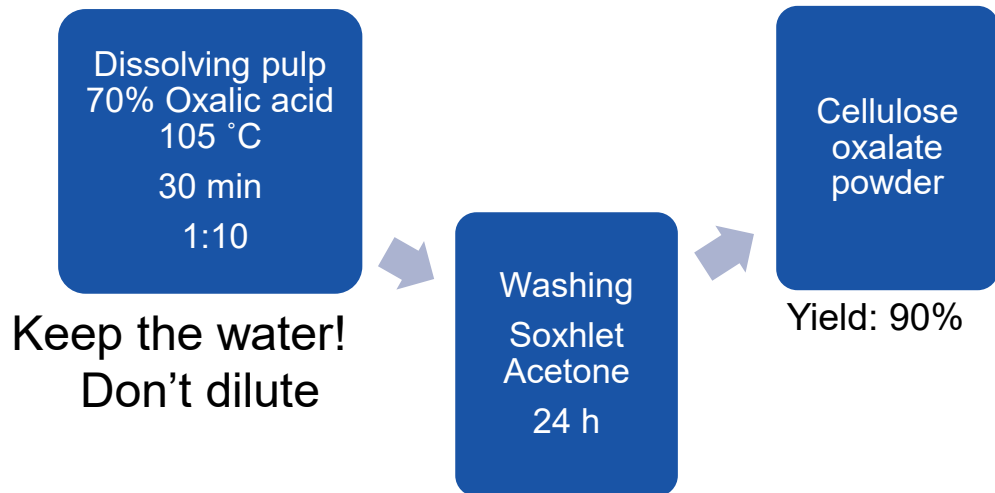
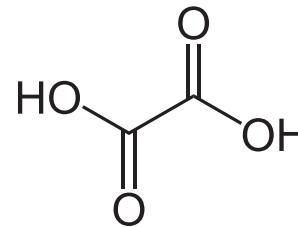


CNC from an oxalic acid process

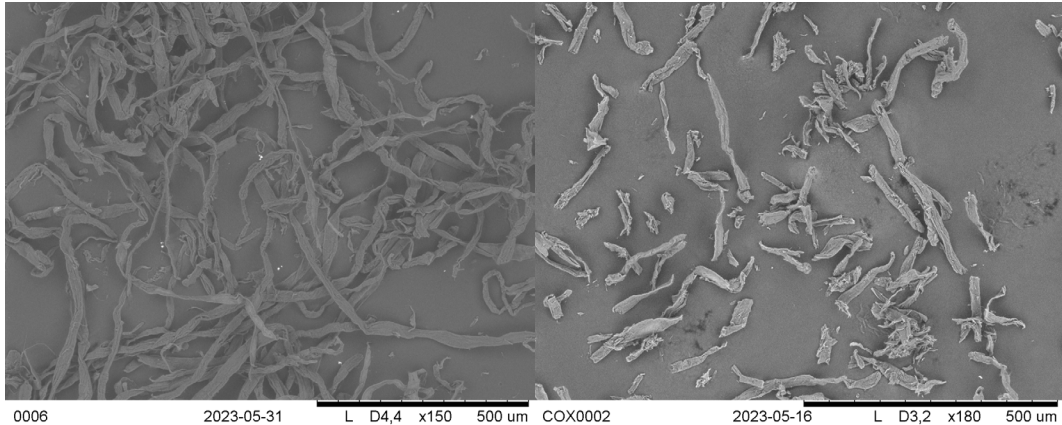
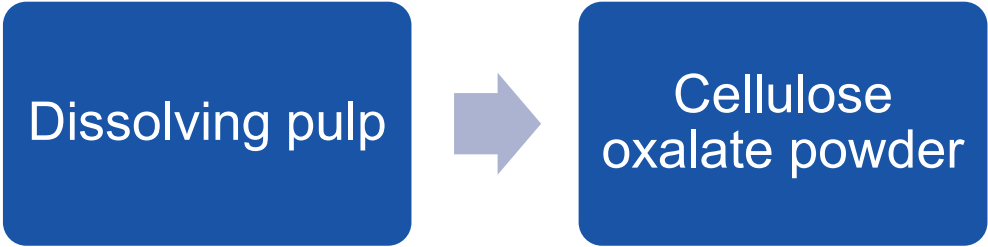
**Beatrice Swensson
KTH, Sweden**



Process of making OA-CNC



Process of making OA-CNC



Cellulose oxalate powder

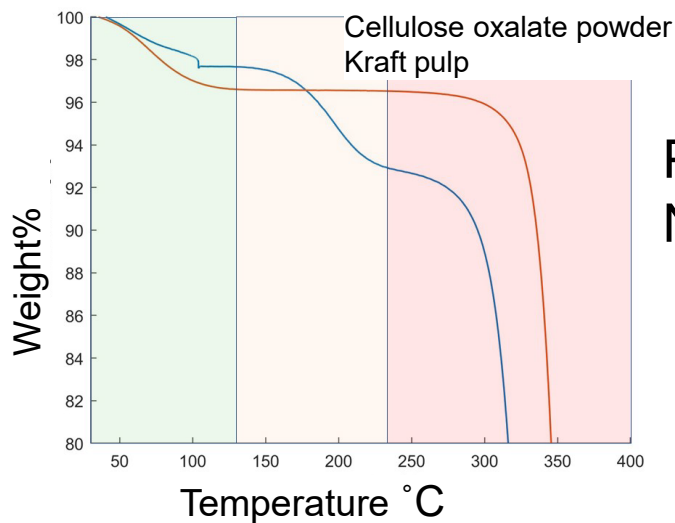
Extrusion with thermoplastics in twin-screw extruder



Sample	Fiber content	Tensile modulus (MPa)	Tensile strength (MPa)	Elongation at break
Reference only PP	0%	1450	31	300%
PP 2% MAPP	20%	2020	32	11%
PP 3% MAPP	30%	2500	33	8%
PP 4% MAPP	40%	3000	37	6%

Cellulose oxalate powder

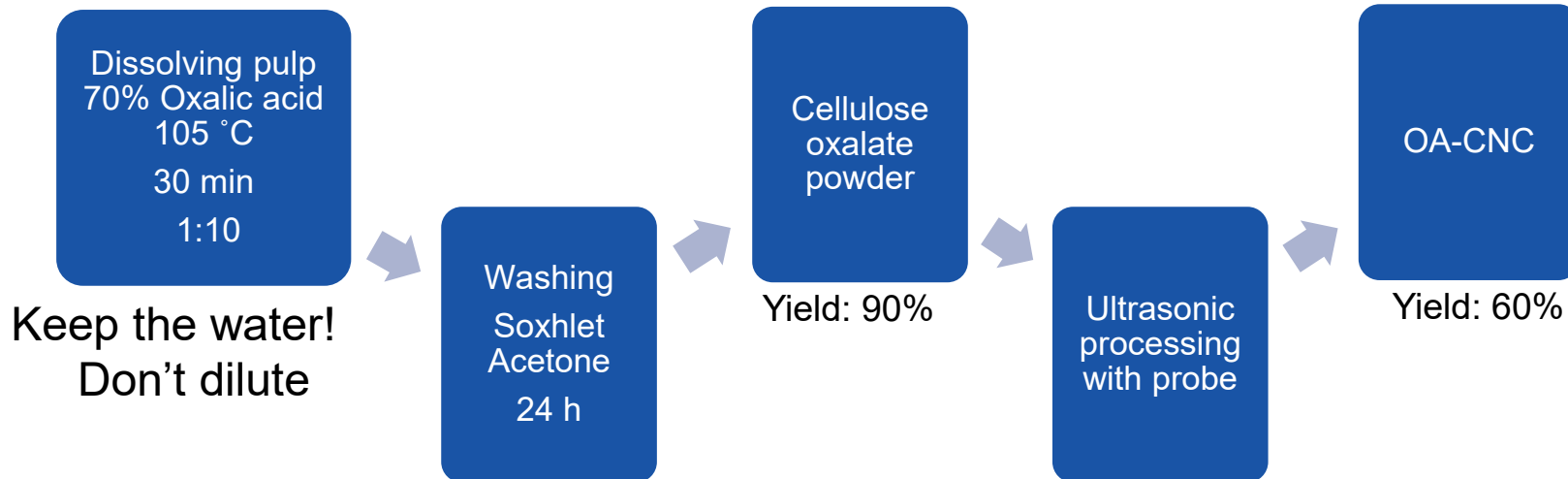
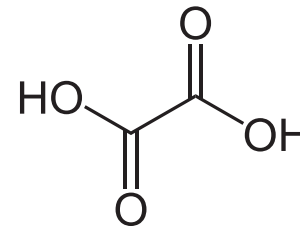
Extrusion with thermoplastics in twin-screw extruder



Protonated 175 °C
Na/Li/K 205 °C

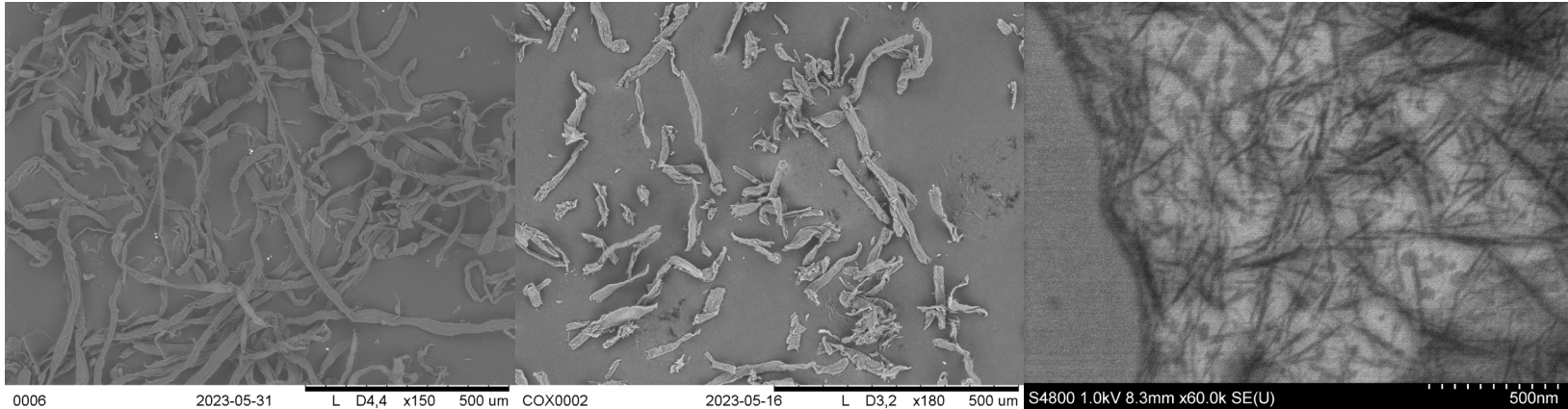
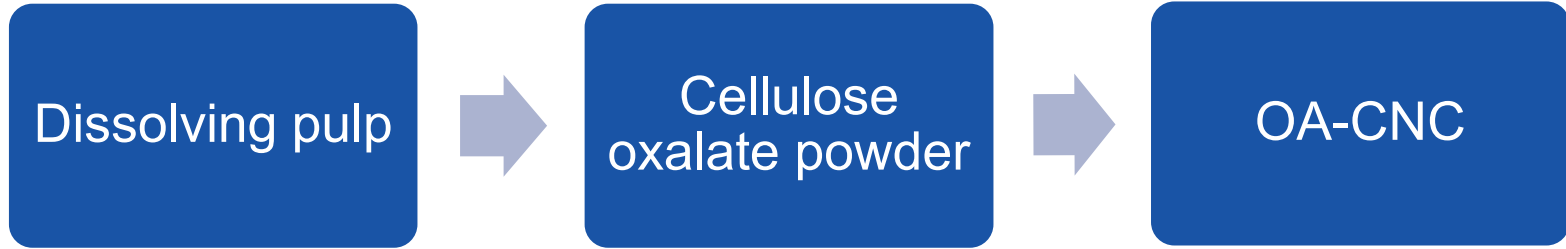


Process of making OA-CNC



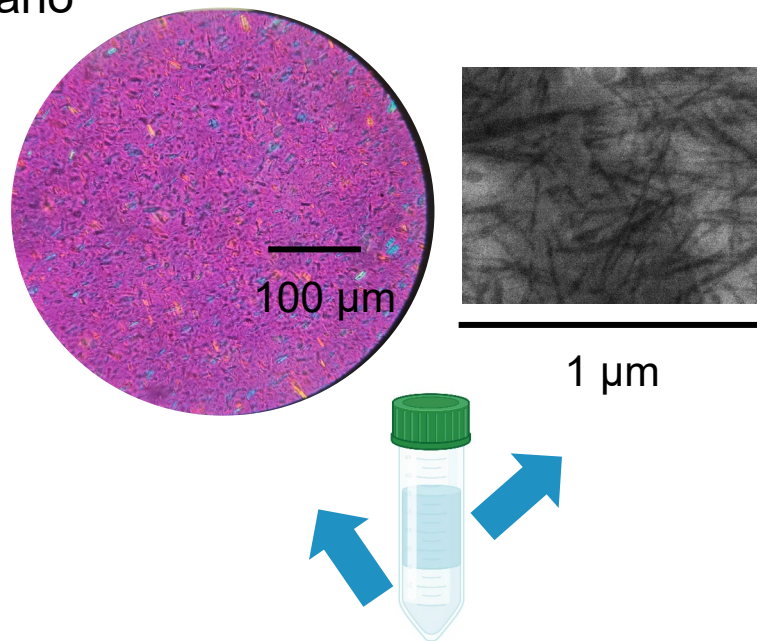
Total yield: 54%

Process of making OA-CNC

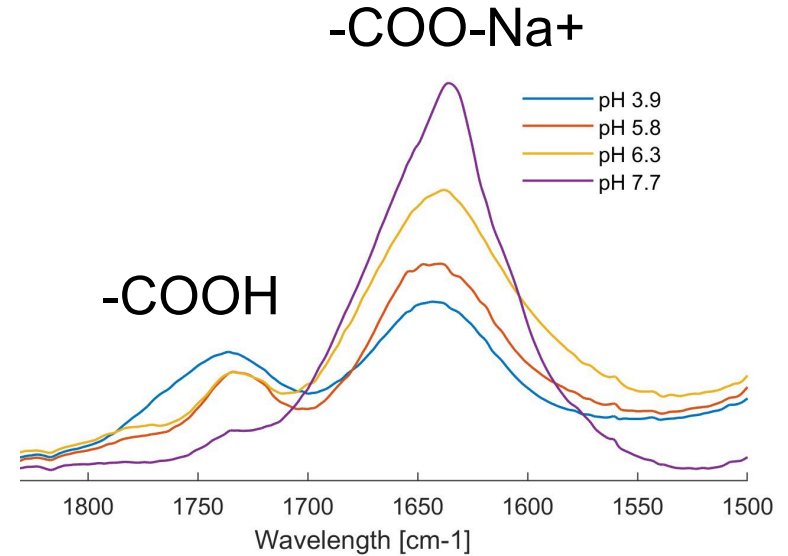
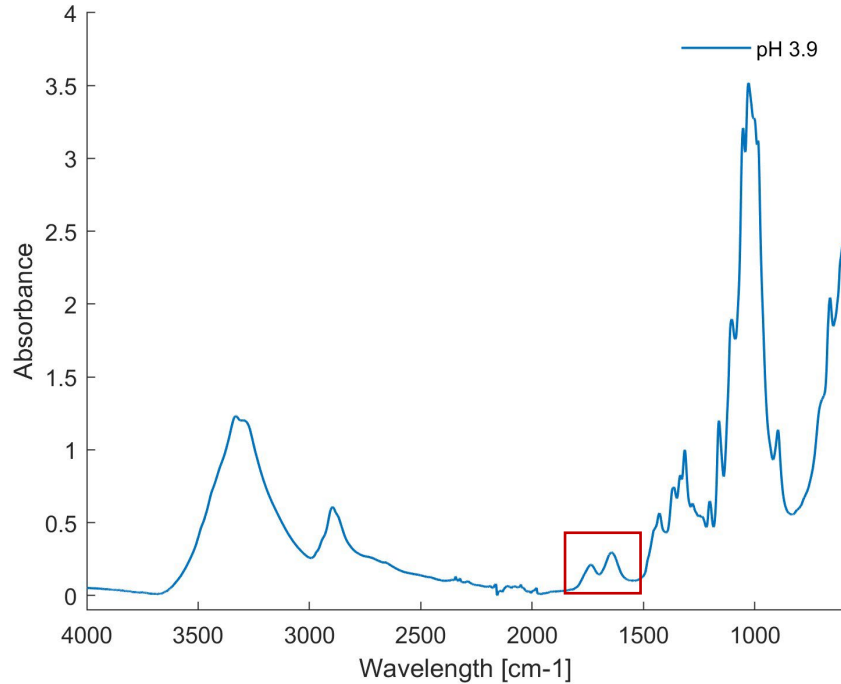


Characterization of product after ultrasonication

- Size: Two possible fractions, micro and nano
- Stable colloidal suspension after ultrasonication and centrifugation
- Rod-like OA-CNC
 - Width 10-20 nm, Length 240 - 490 nm
 - Z-ave 200-300 nm
- Charge 0.20 mmol/g SS-ISO 21400
 - Intermediate product and nanocellulose
 - Acetone Soxhlet does not remove all acid



Identifying the sodium form?





Drying and redispersing the CNC

Previous research on CNC

NaCl: good & bad (Beck et al. 2012, Missoum et al. 2012)

Remaining water content (Beck et al. 2012)

Additives: CMC, glycerol, lignin...

Sodium form (Beck et al. 2012)

“...a change in pH value equals a change in salt concentration, following $cs=10-pH$ so that a pH of 2 or 12 corresponds to 10 mm salt”

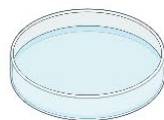
(Bensselfelt et al. 2023)

Strategy: low ionic strength, no NaCl, sodium form but low NaOH,
not completely dry

Drying and redispersing the CNC: Method



OA-CNC



48 H
85% DC



Stirring
with
magnet
overnight





Drying and redispersing the CNC: ambient drying

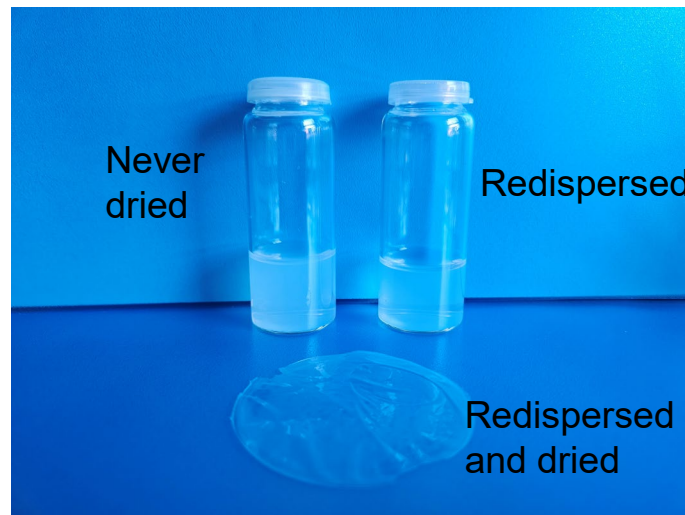
Results so far:

60-80% redispersable without further treatment if dried to 85% DC after ultrasonication

Dialysis

Dialysis on OA-CNC + NaOH

Urea CMC



Sample	Conduct. [μS/cm]	pH	Redisp.
1	335	8.4	Yes, 80%
2	53	4.5	No
3	120	5.8	Yes, 40%
4	88	6.3	Yes, 20%
5	148	7.7	Yes, 15%



Acknowledgements

- FineCell, start-up company
- FORMAS Swedish funding agency
- Anastasia Riazanova for the SEM images
- Professor Monica Ek, my supervisor

- Questions?