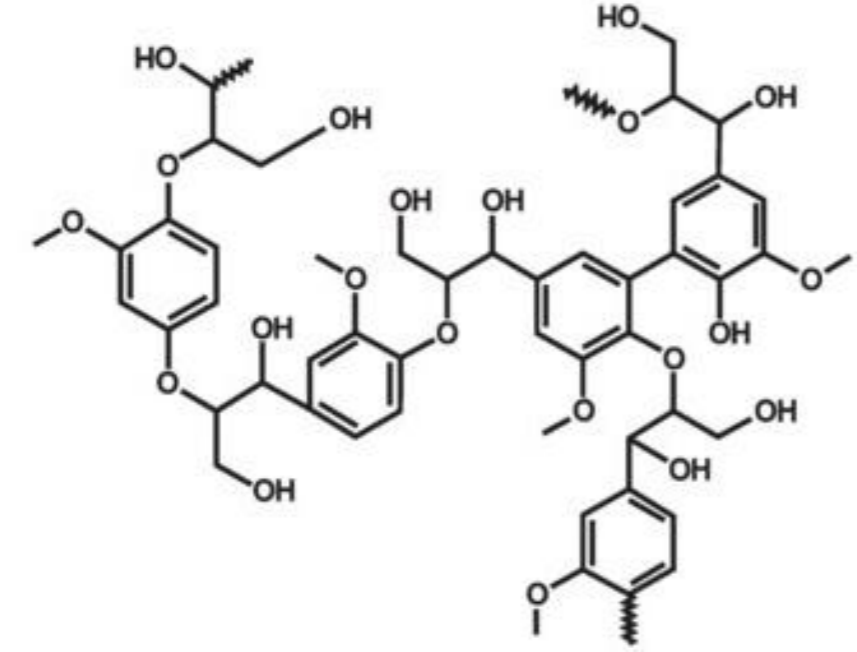


Introduction



▶ OTP is a lignocellulosic waste with a high lignin content, close to 20 %, whose fractionation and comprehensive recovery are key to the development of lignocellulosic biorefineries aligned with circular economy principles.

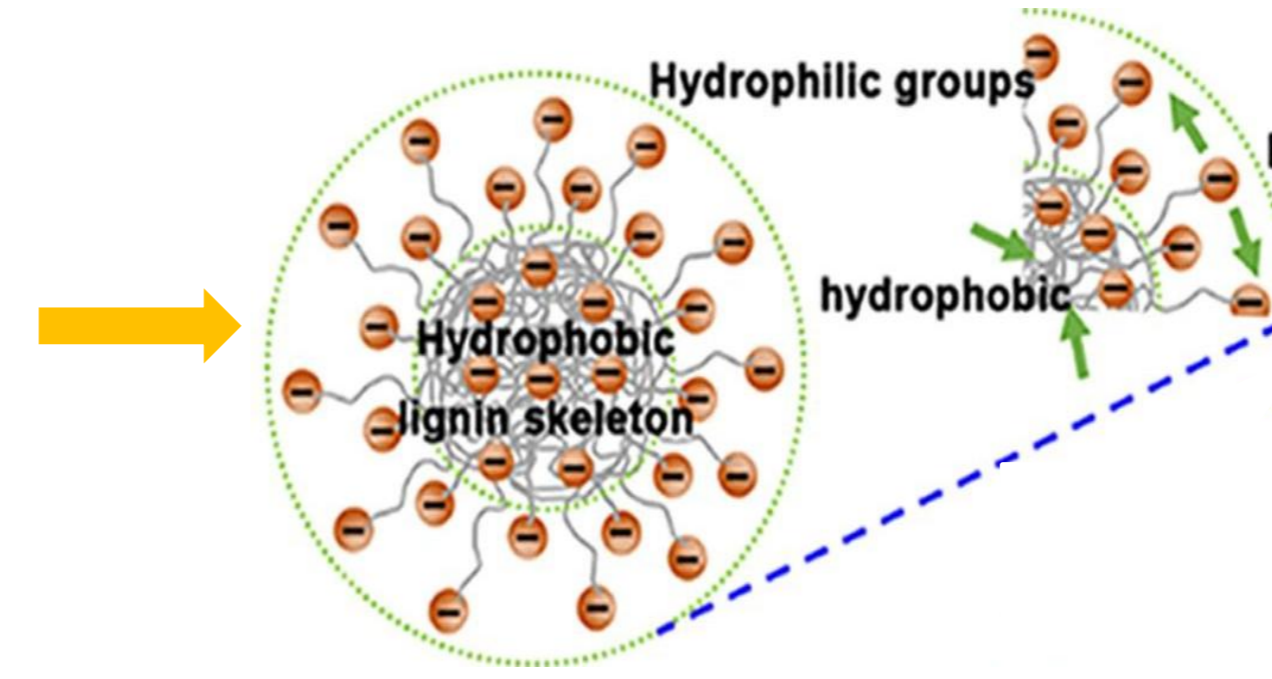


▶ Lignin aromatic nature and specific structural features enable it to self-assemble into lignin nanoparticles (LNPs), characterized by hydrophobic cores and hydrophilic outer layers.

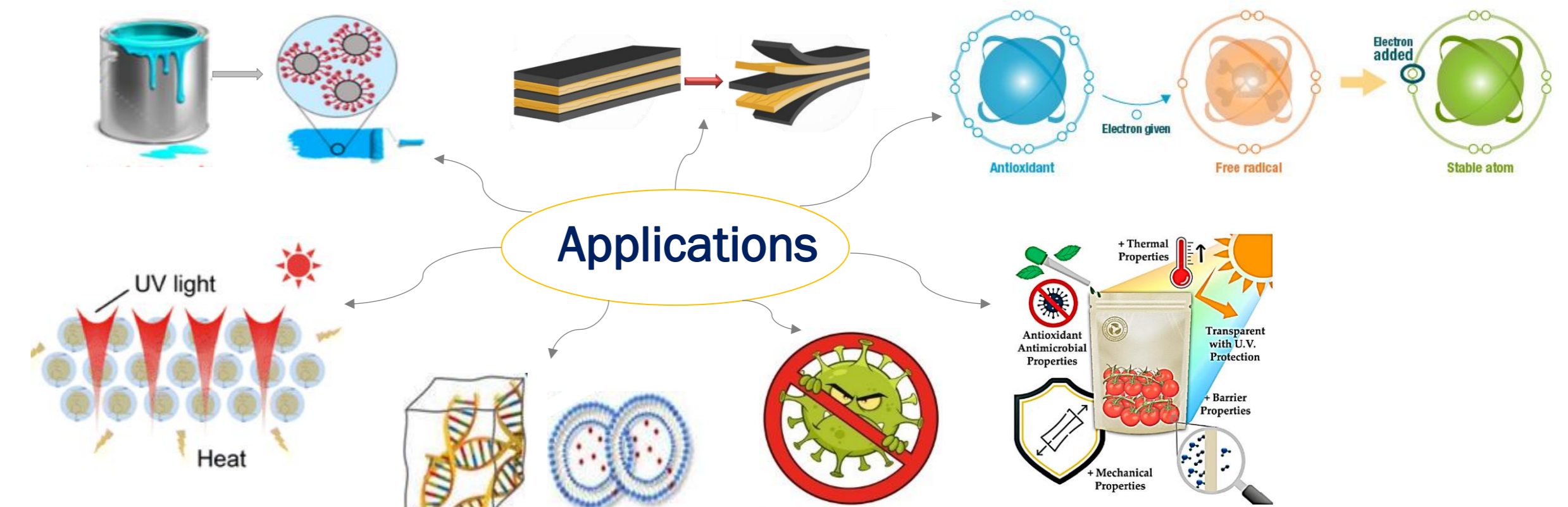
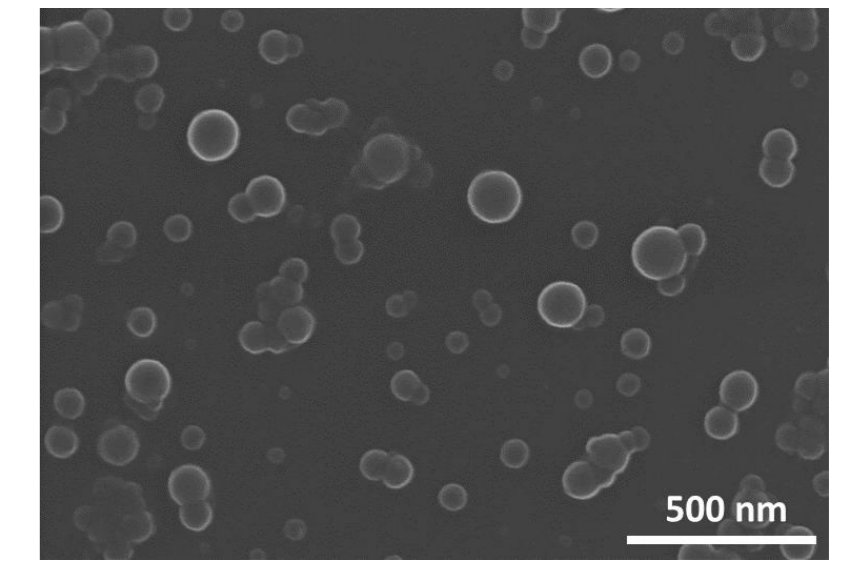
Objective of the present study

- ▶ To develop new strategies for the valorization of lignin from olive tree pruning;
- ▶ Cationization of LNPs using eutectic solvents to expand its scope of application

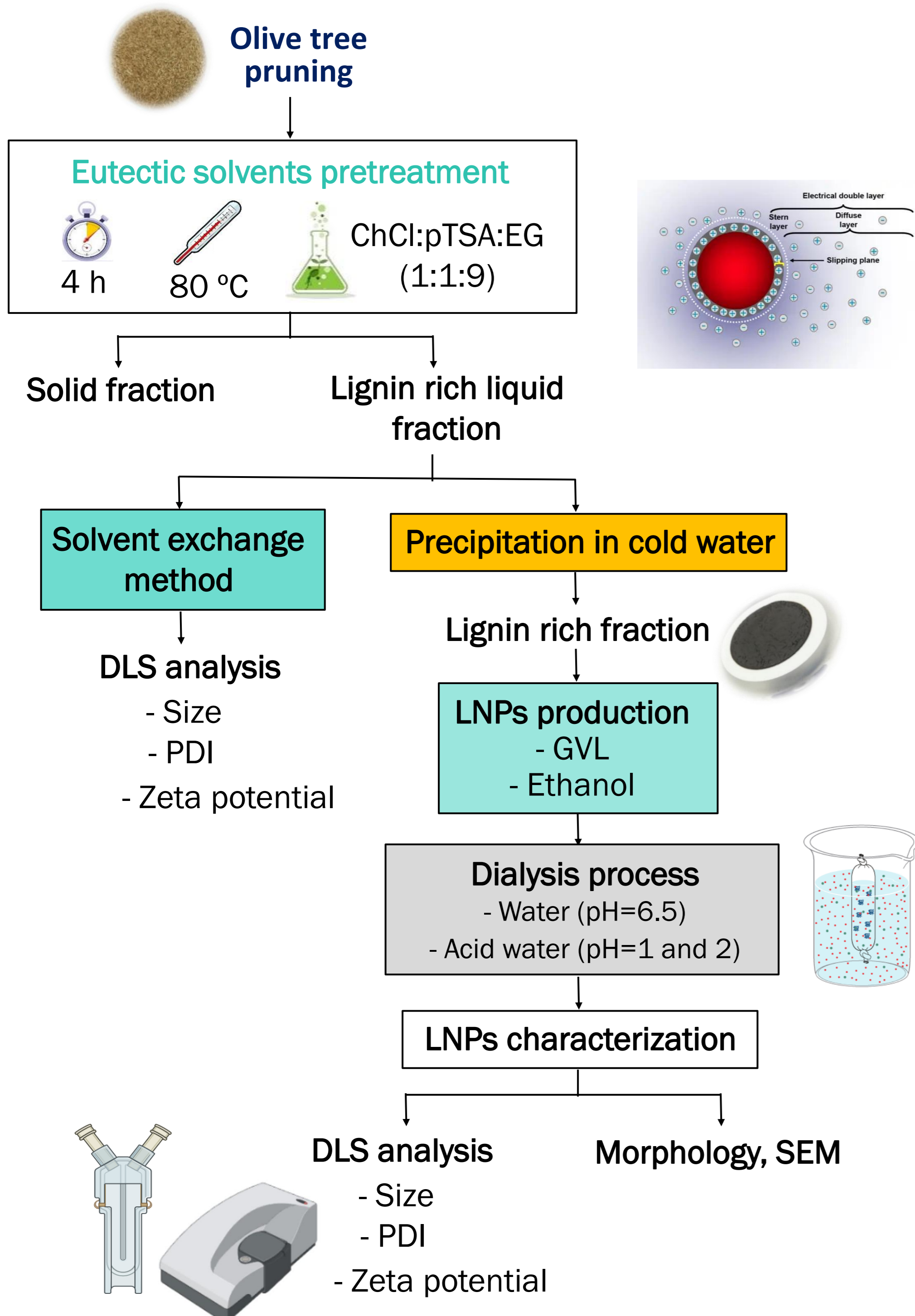
Amphiphilic macromolecule



Production of lignin nanoparticles (LNPs)



Experimental procedure



Results

Isolated lignin are rich is aliphatic and phenolic OH and carboxylic groups

Characteristics of LNPs produced from liquid fraction and organic solvents

	Size (nm)	Zeta potential (mV)	PDI	pH*
Liquid	8270.7 ± 509.5	+ 9.5 ± 0.1	0.746 ± 0.439	1.96 ± 0.01
GVL	118.2 ± 1.4	+ 32.4 ± 0.8	0.099 ± 0.030	3.83 ± 0.12
Ethanol	200.9 ± 2.2	+ 30.4 ± 0.3	0.281 ± 0.037	4.80 ± 0.05

*pH value after formation of nanoparticles. Data represent the mean value and standard deviation (n = 3). PDI: polydispersity index; GVL: γ-Valerolactone.

Liquid Fraction → No LNPs formation

Organic solvents → self-assembly of lignin → particle size ~120 nm with GVL

Zeta potential

particles with Zeta potential distribution higher than +30 mV and lower than -30 mV are considered stable

LNPs from OTP

- ↑ +30 mV → Stable
- + Positively charged

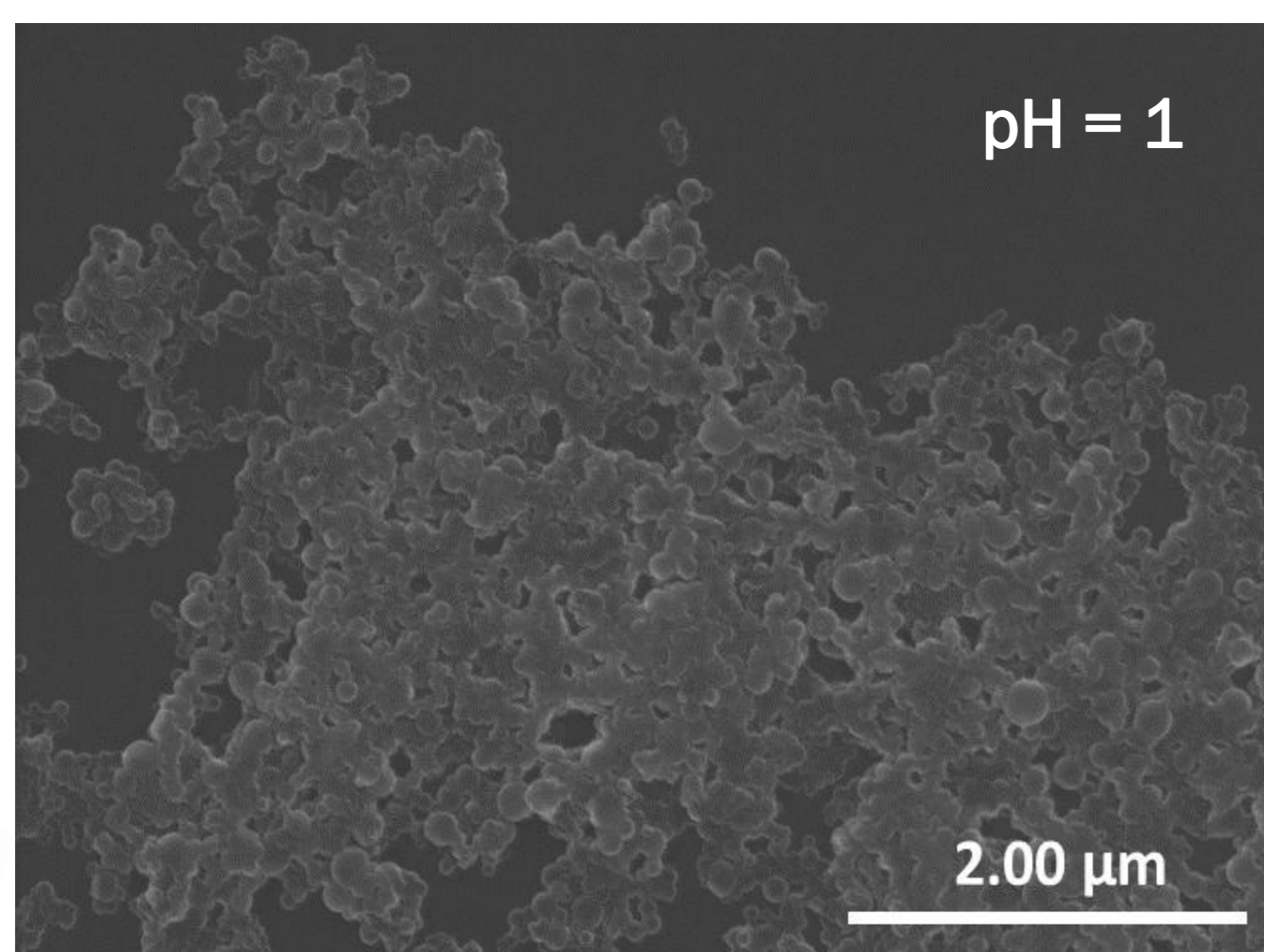
Cationization

Polydispersity index

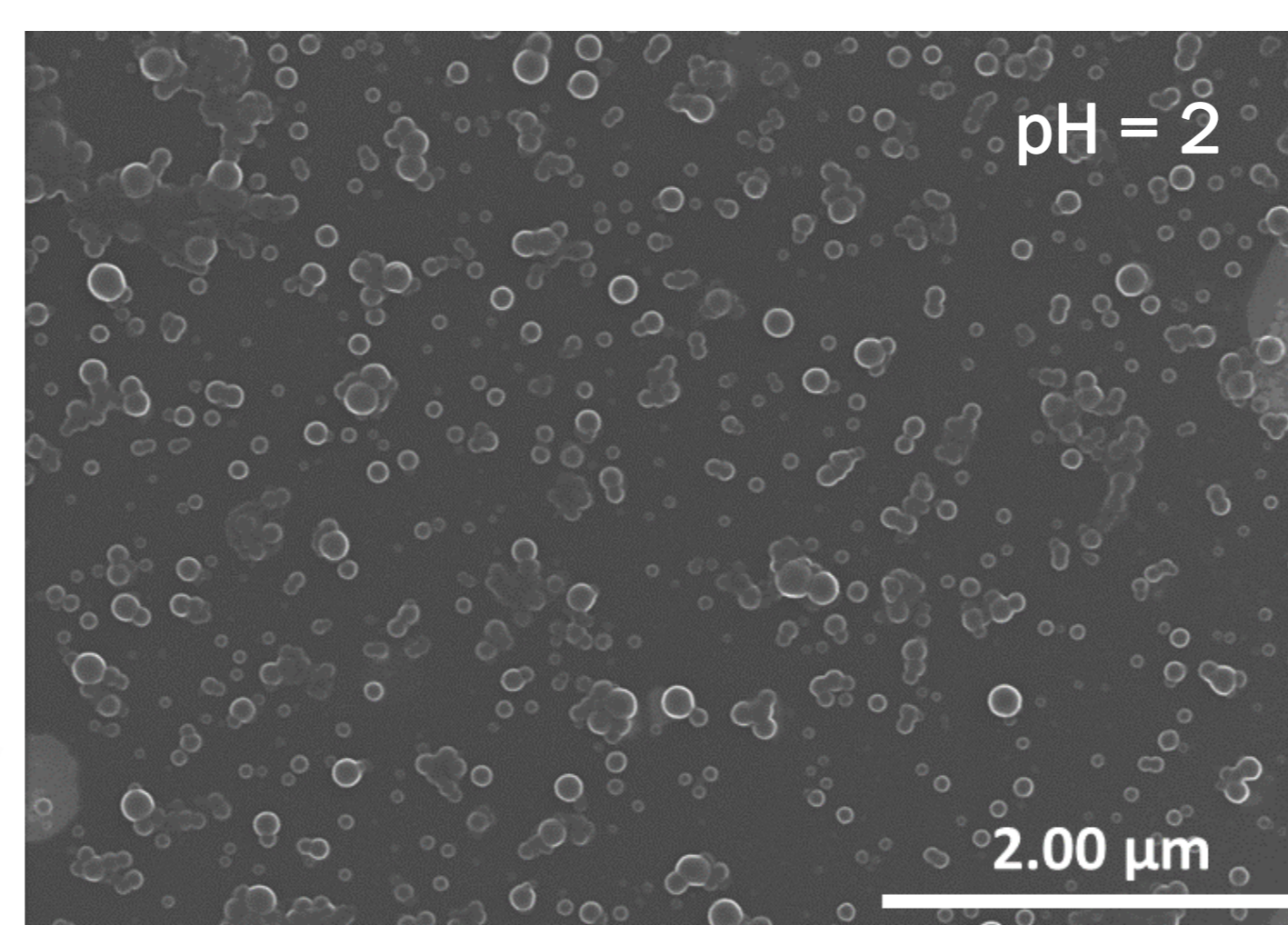
- > 0.2 → heterogeneous nanoparticles
- < 0.2 → homogeneous nanoparticles

Homogeneous LNPs with GVL

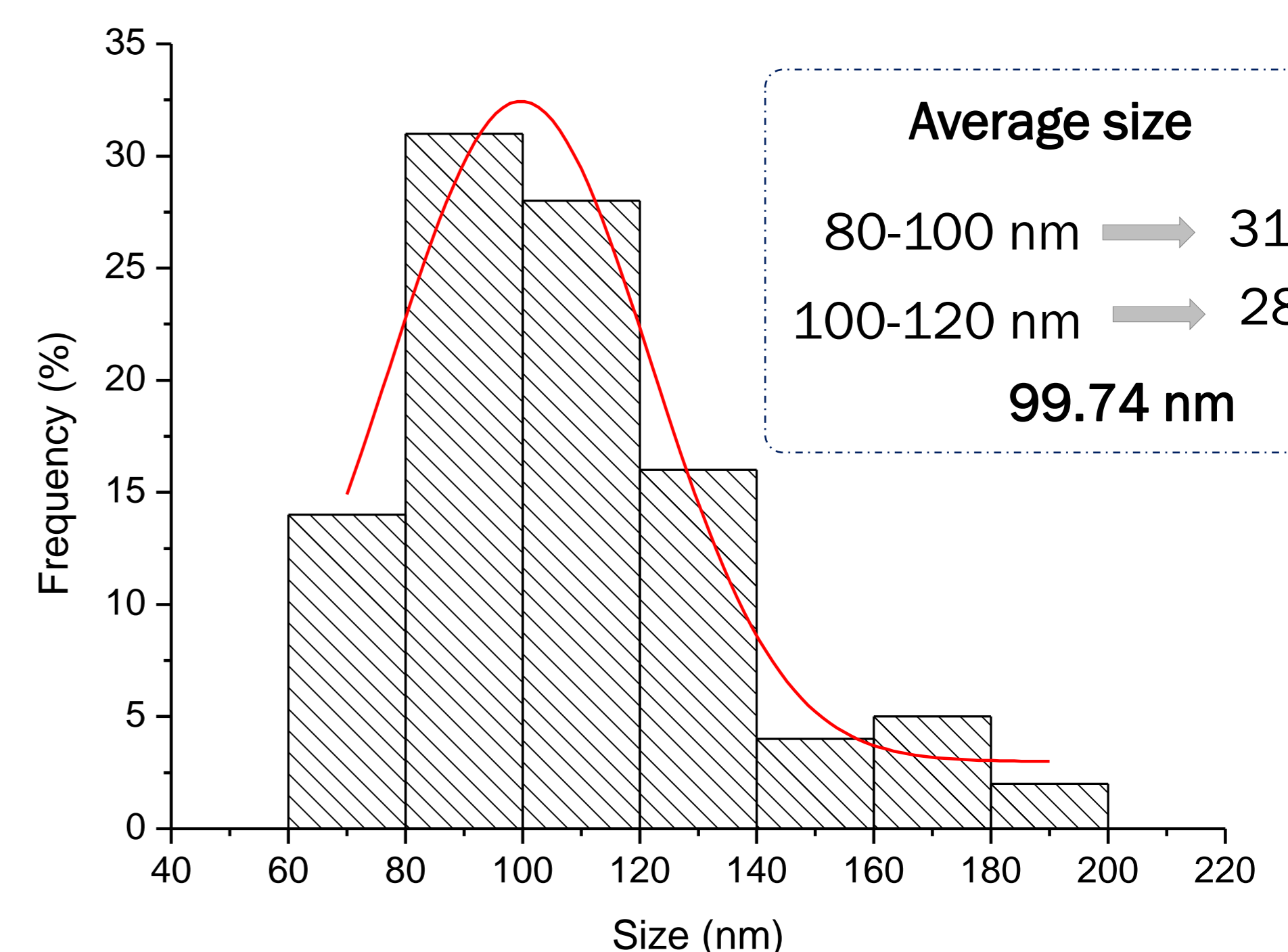
Morphology of LNPs isolated after dialysis process



- Irregular morphologies
- Aggregation of LNPs



Homogeneous and uniform spheres



Conclusions

- ❖ Extraction using ChCl:pTSA:EG ternary ES allows the isolation of a cationized lignin prone to produce positively surface charged LNPs;
- ❖ LNPs are prepared by redissolving lignin in organic solvents such as GVL and ethanol, after which homogeneous and uniform nanoparticles were obtained
- ❖ The best results were achieved after the dialysis process when a pH of 2 (114 nm, + 25 mV and PDI= 0.129) was set;
- ❖ This process represents a substantial improvement in the valorization of lignocellulosic biomass due to the great potential of cationized LNPs in various industrial fields.

Acknowledgements