



Biobased Hydrogels from Native Cellulose and Natural Dicarboxylic Acids: Toward Green Alternatives to Polyacrylates

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Biobased Hydrogels from Native Cellulose and Natural Dicarboxylic Acids: Toward Green Alternatives to Polyacrylates

INTRODUCTION

- BIOMASS
- HYDROGELS
- USAGE OF HYDROGELS IN PAPER INDUSTRY

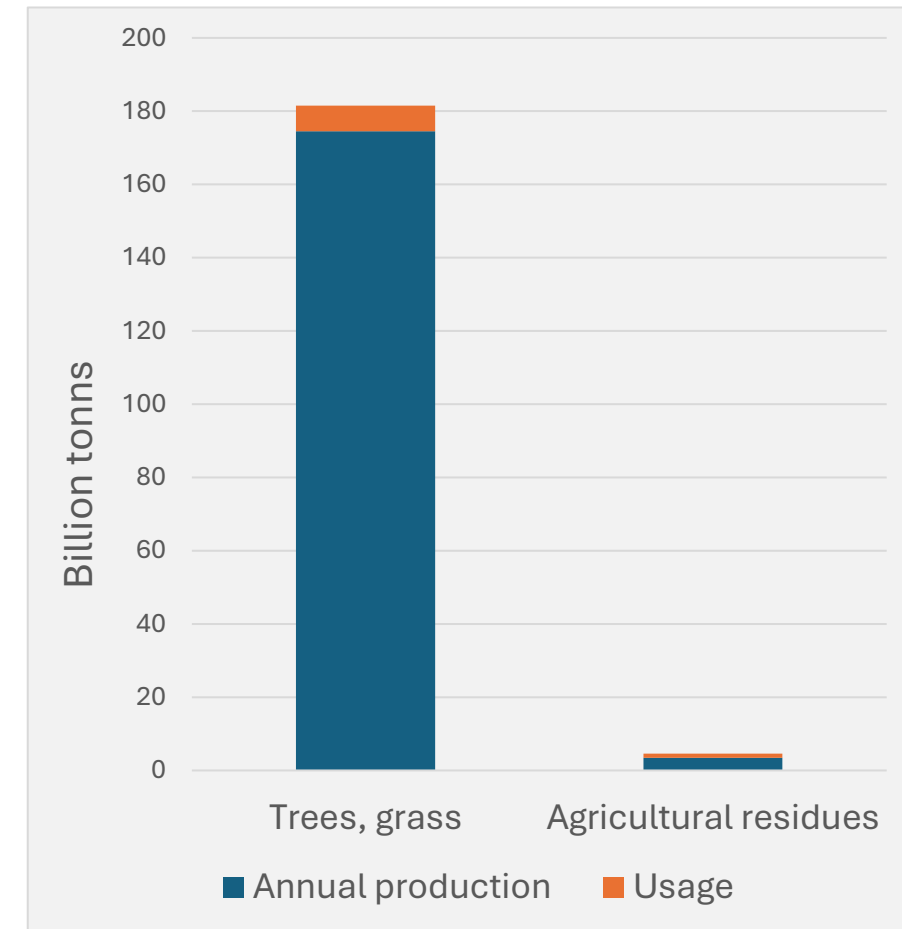
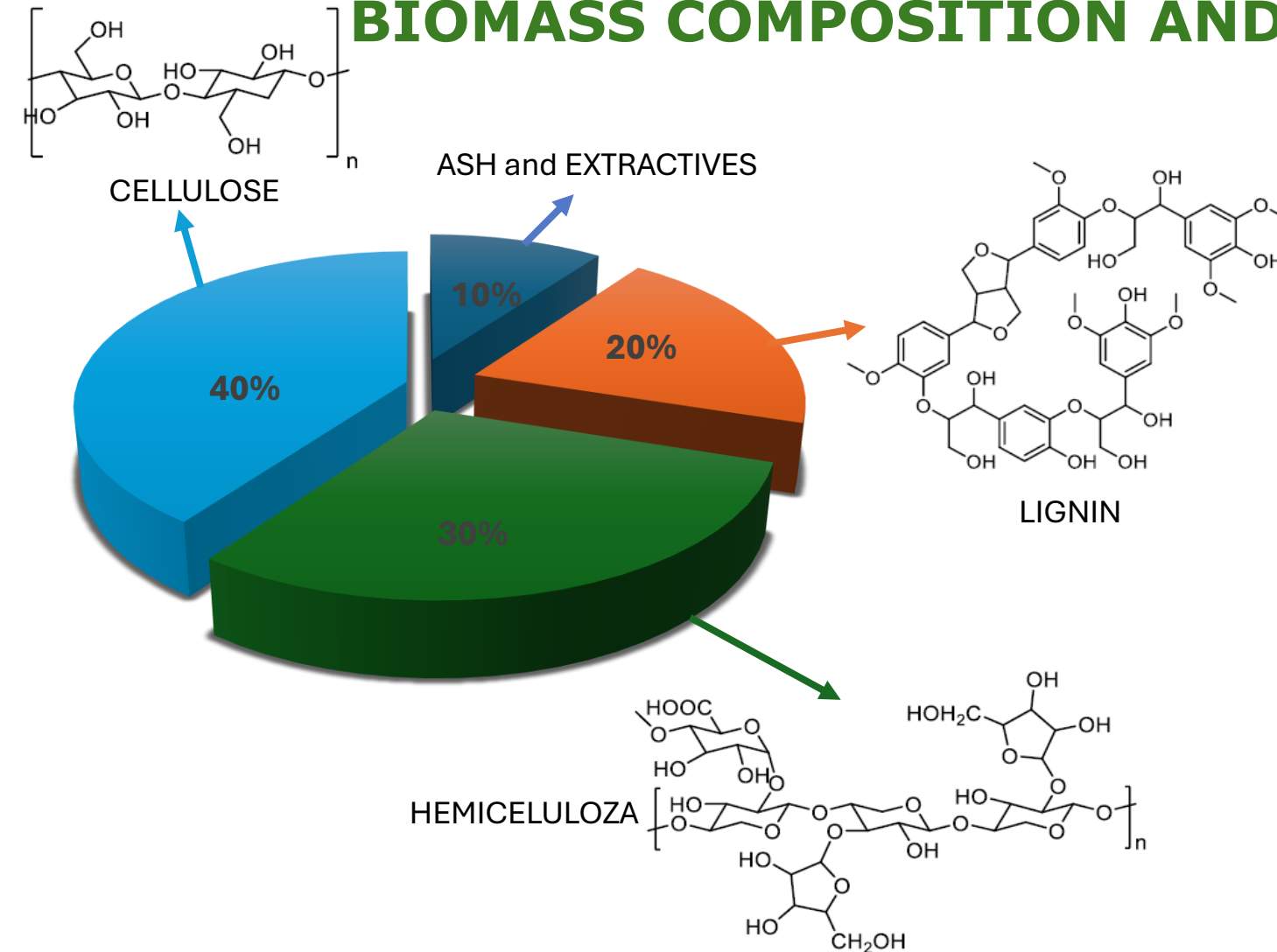
PURPOSE OF RESEARCH WORK

RESULTS

- NaCMC BASED HYDROGELS
- NATIVE CELLULOSE BASED HYDROGELS

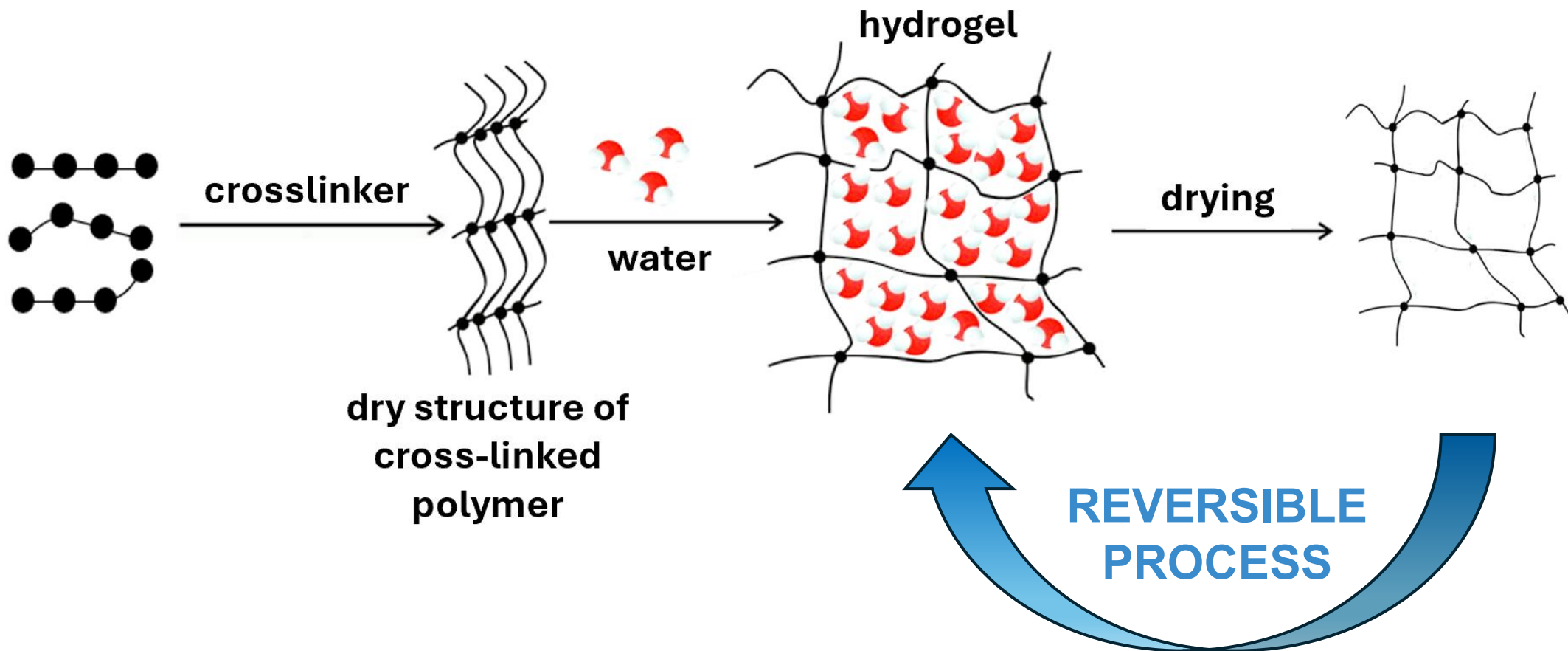
CONCLUSION

BIOMASS COMPOSITION AND ITS POTENTIALS

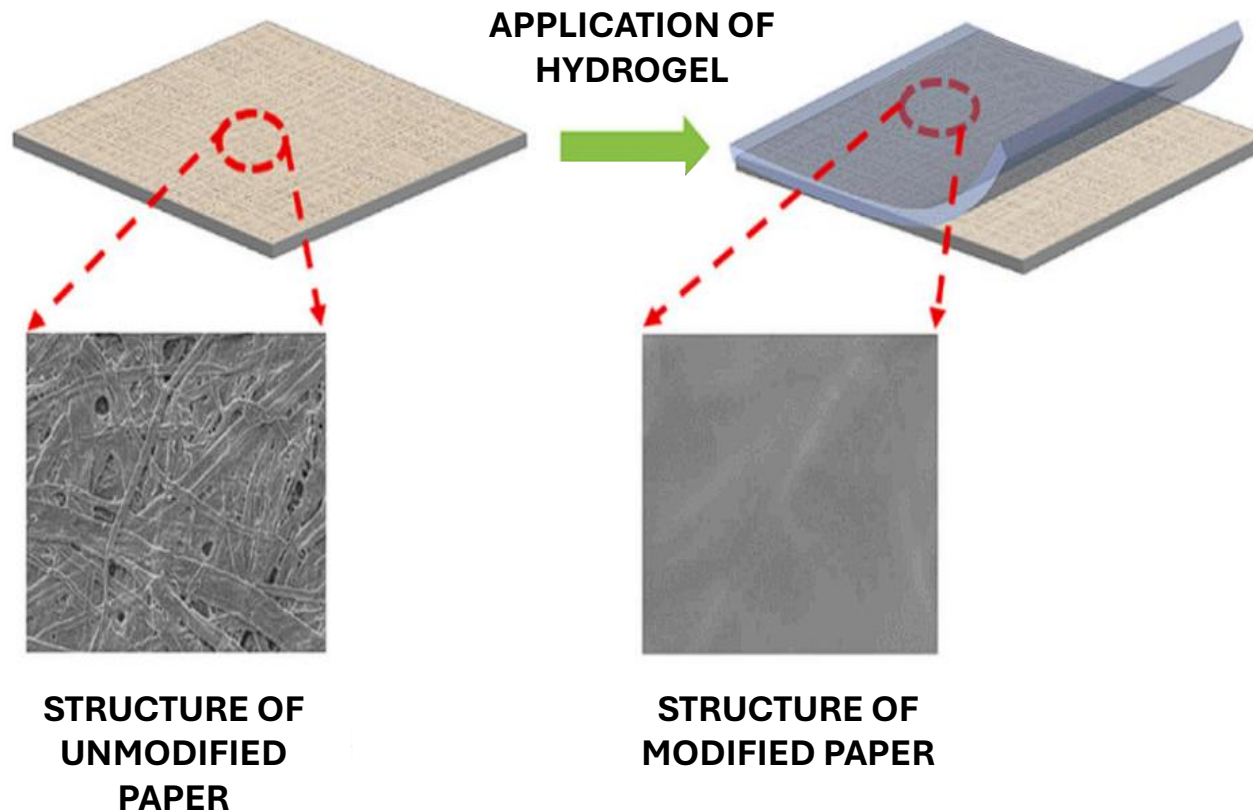


N. Dahmen, et al.: Integrated lignocellulosic value chains in a growing bioeconomy: Status quo and perspectives.

HYDROGELS

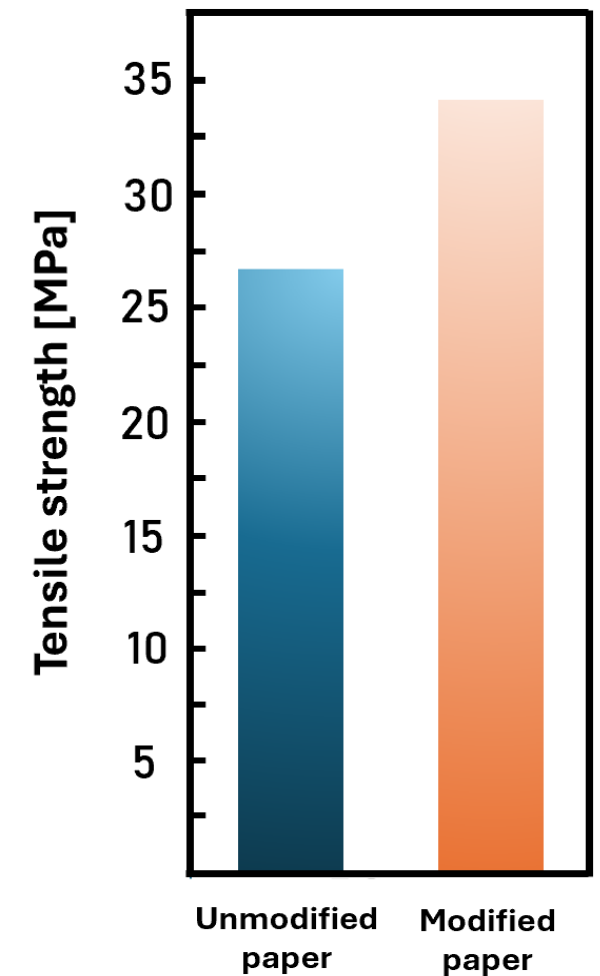
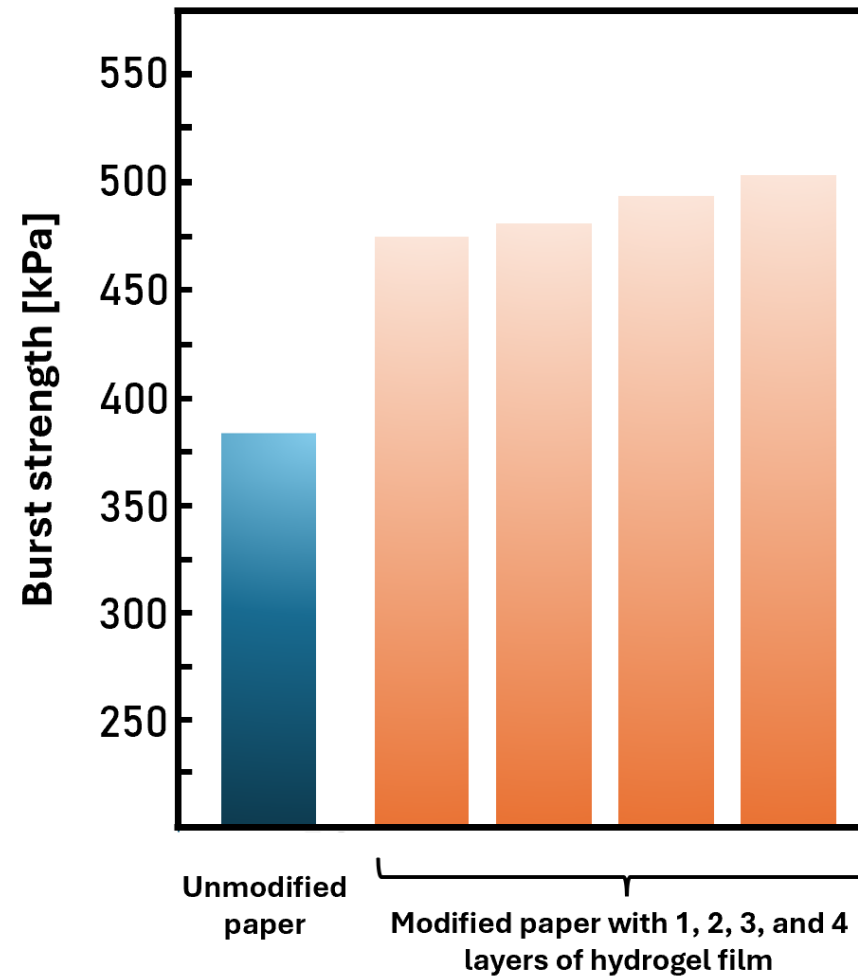
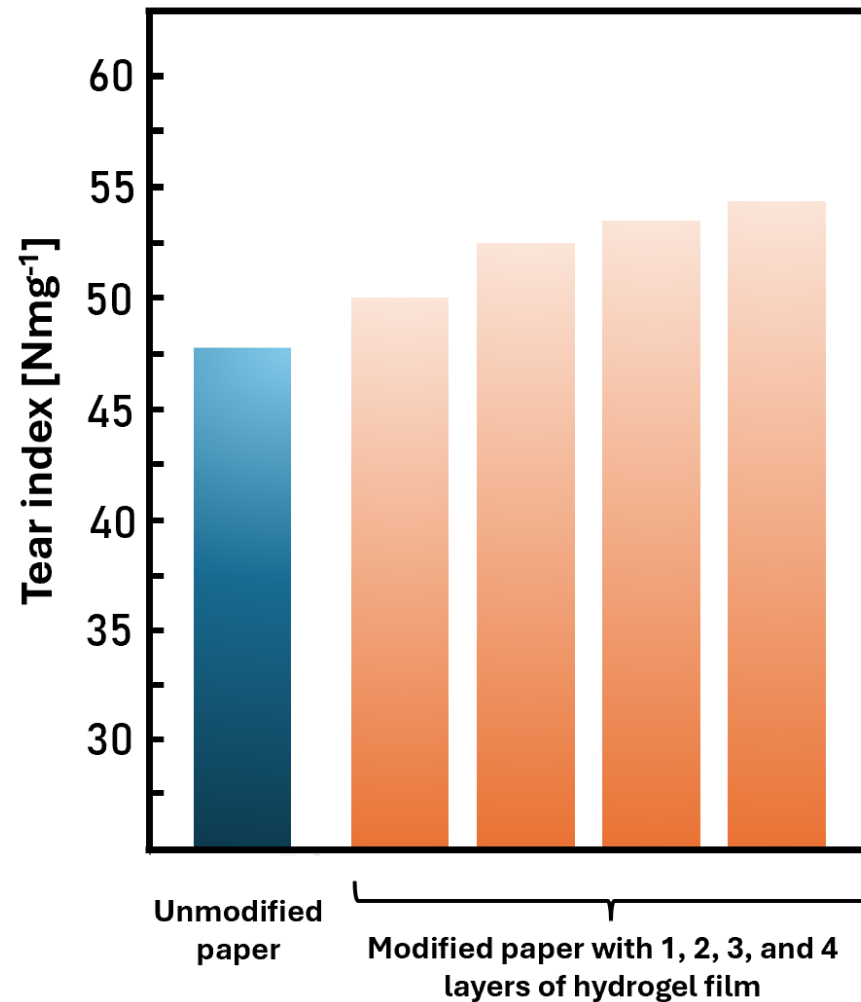


HYDROGELS IN PAPER INDUSTRY

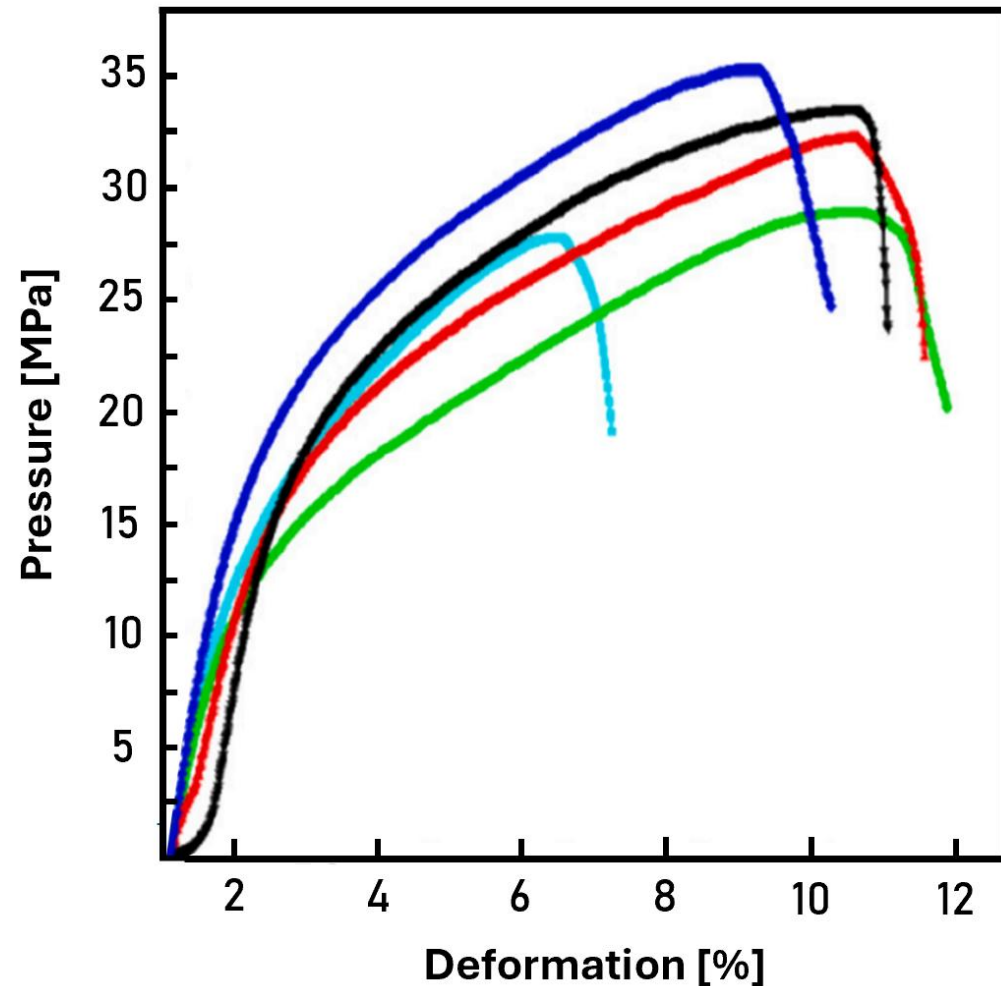


L. Dai, et al.: Self-assembled all-polysaccharide hydrogel film for versatile paper-based food packaging.

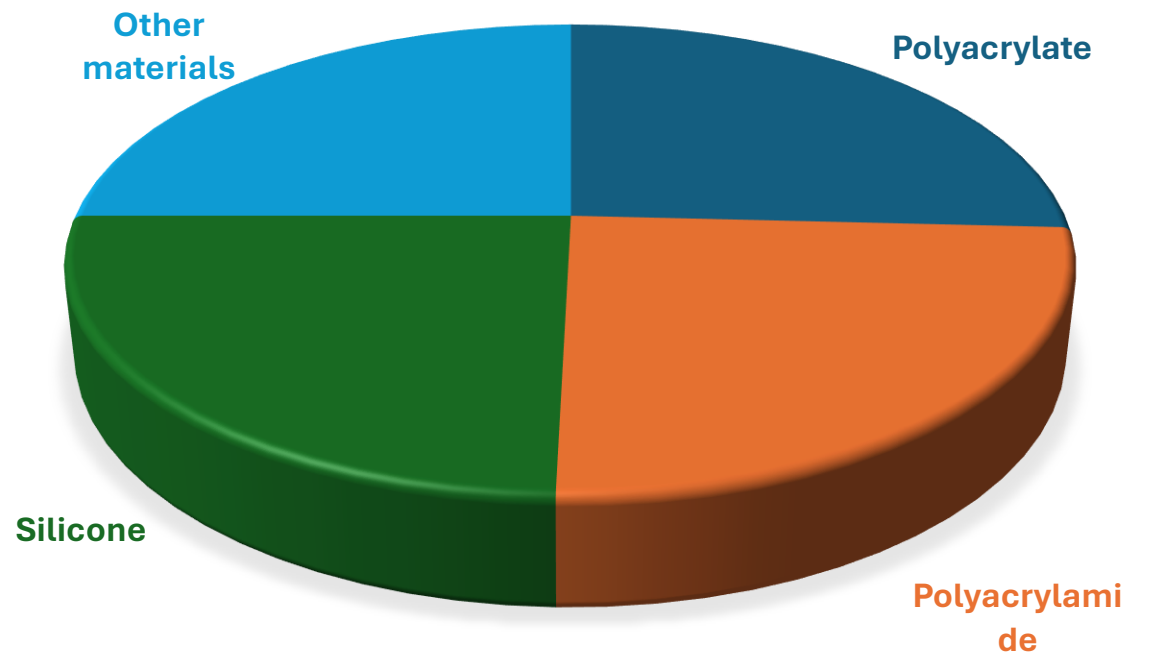
HYDROGELS IN PAPER INDUSTRY



HYDROGELS IN PAPER INDUSTRY

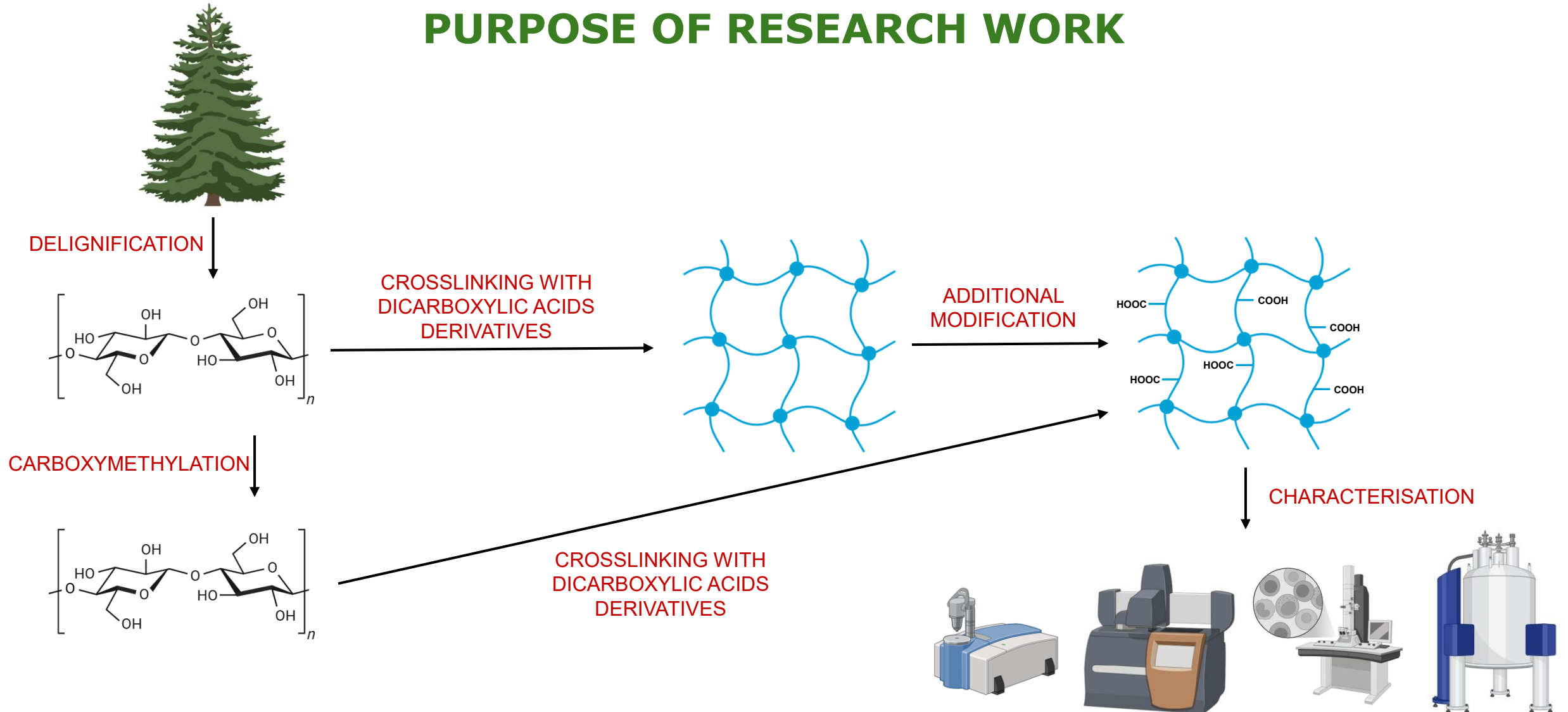


HYDROGEL MARKET BY MATERIAL (2024)



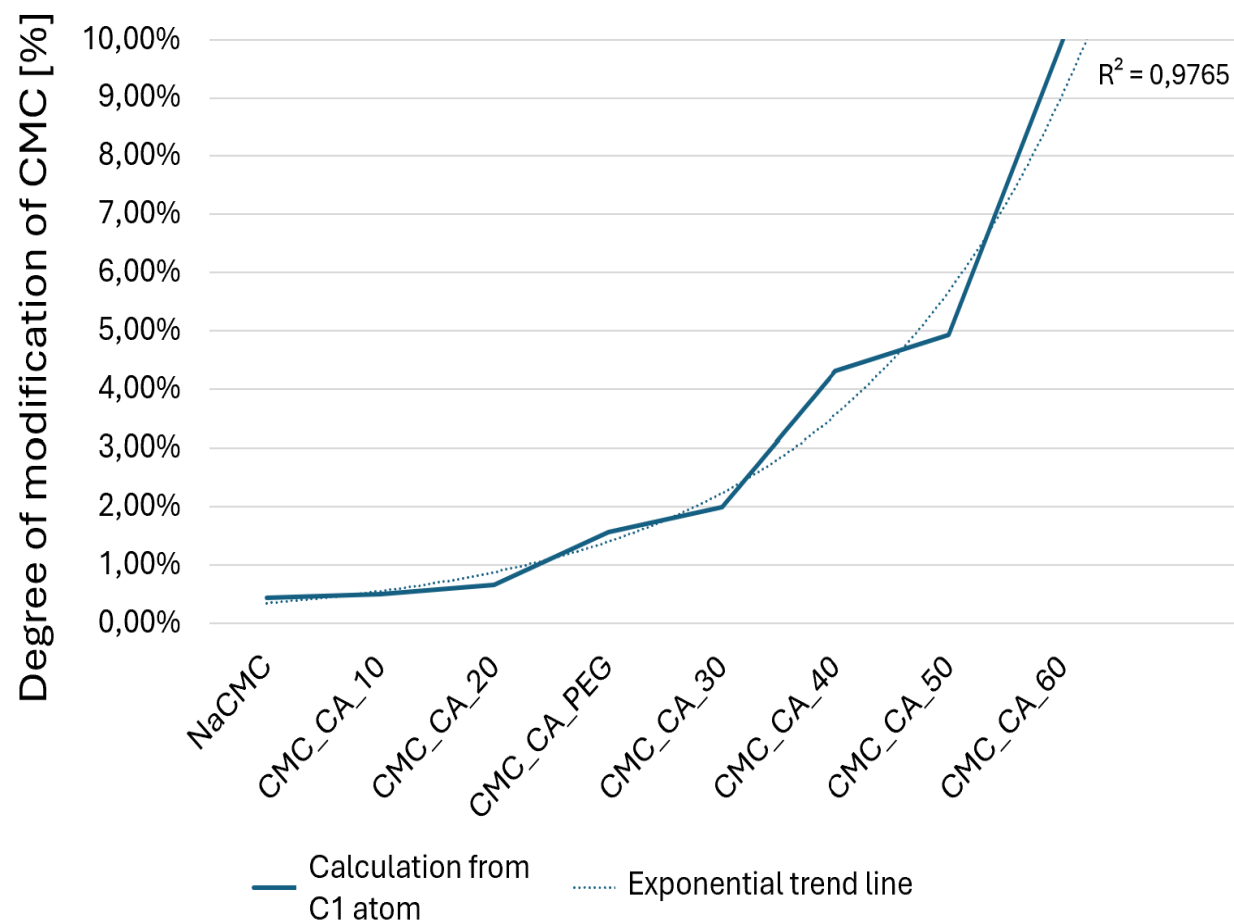
<https://www.grandviewresearch.com/industry-analysis/hydrogel-market-report>,
used on 13 October 2025.

PURPOSE OF RESEARCH WORK

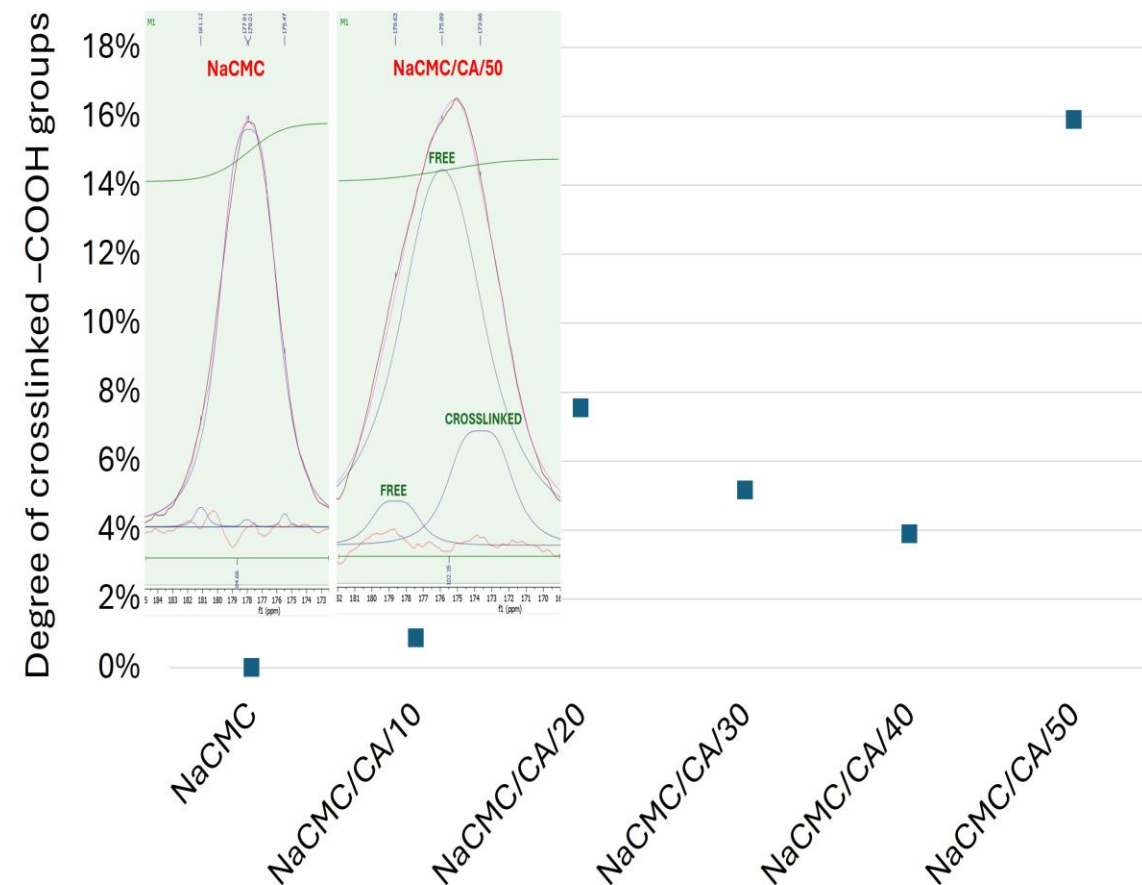


NaCMC HYDROGELS

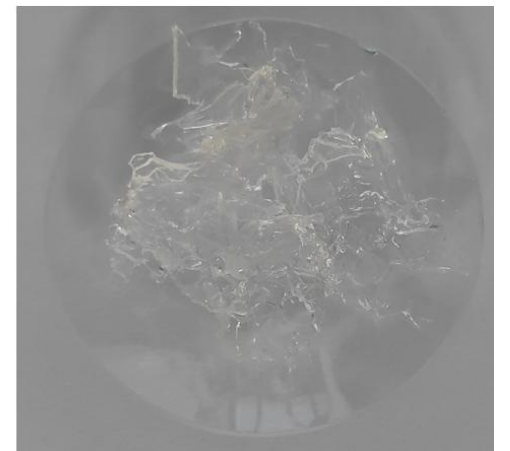
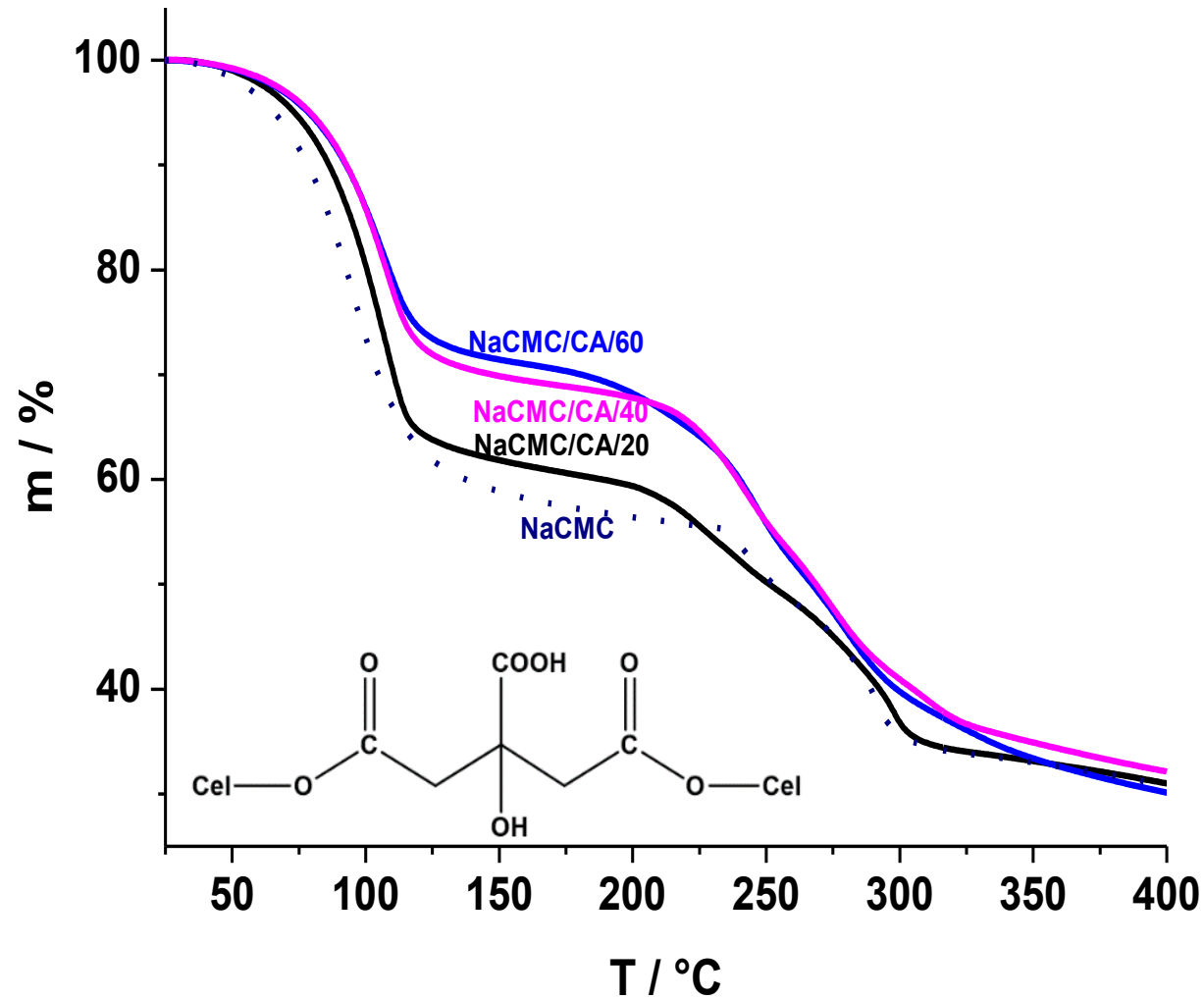
DEGREE OF MODIFICATION



DEGREE OF CROSSLINKING

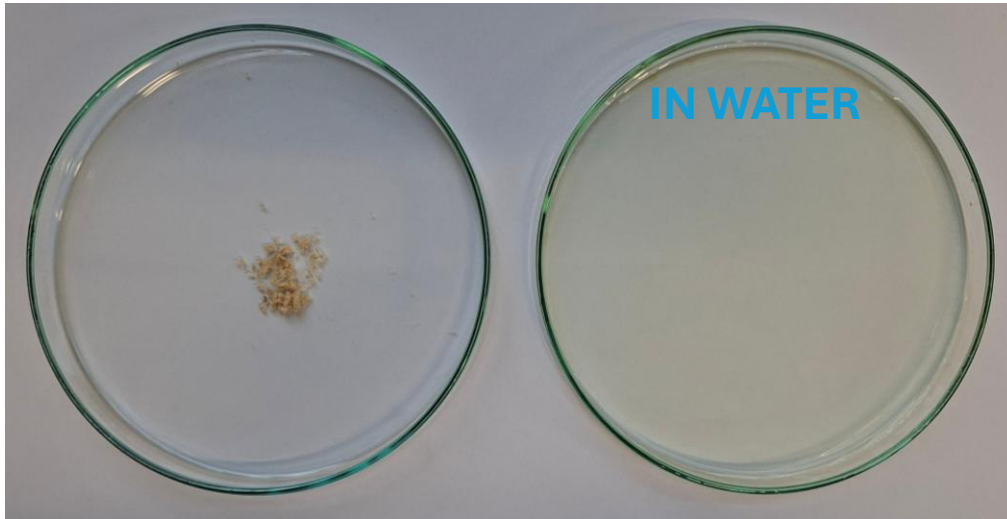


NaCMC HYDROGELS



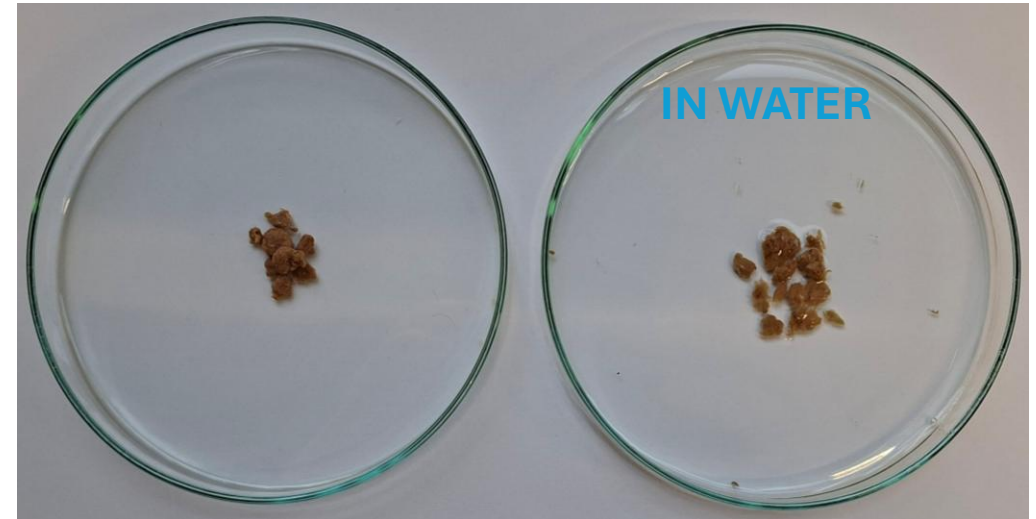
HYDROGELS

NaCMC



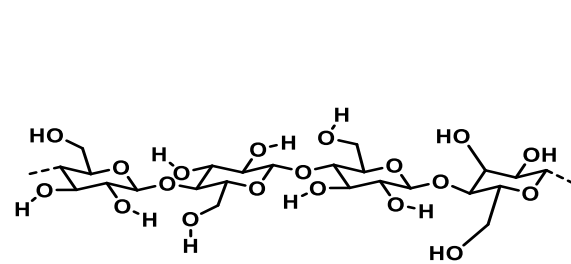
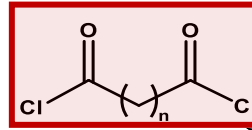
Water absorption: 45%
Swelling degree: 0%

Native
cellulose



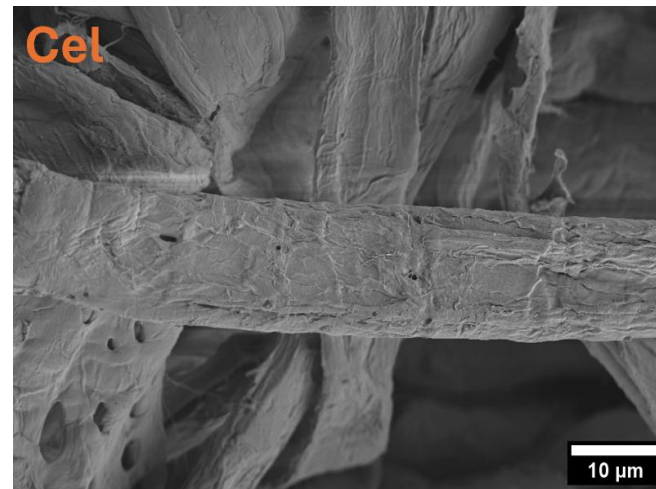
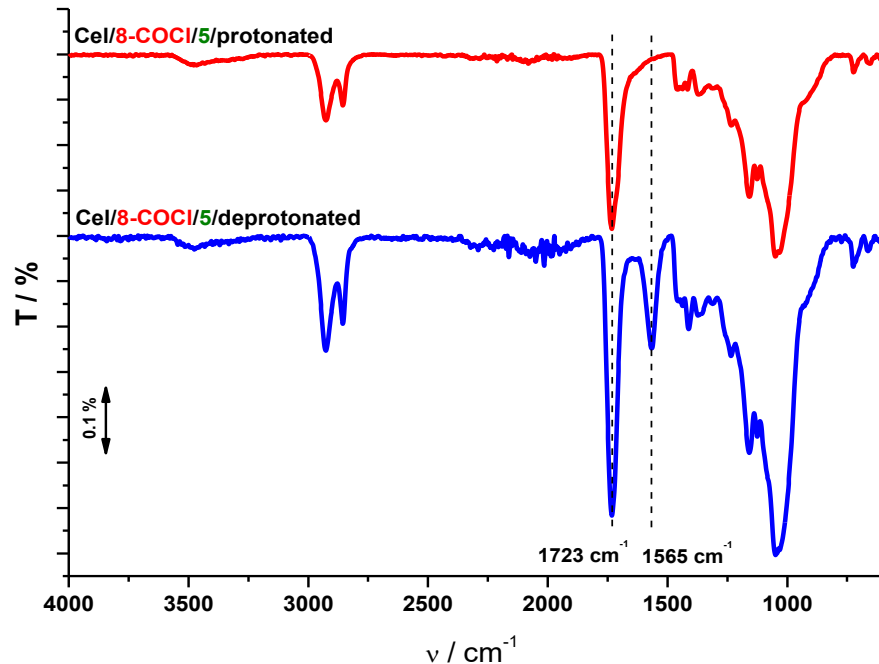
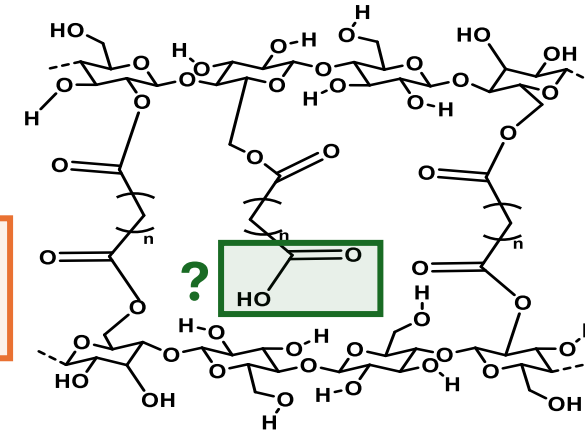
Water absorption: 4%
Swelling degree: 0%

NATIVE CELLULOSE - CROSSLINKING WITH ACID DICHLORIDES

 $c = ?$ 

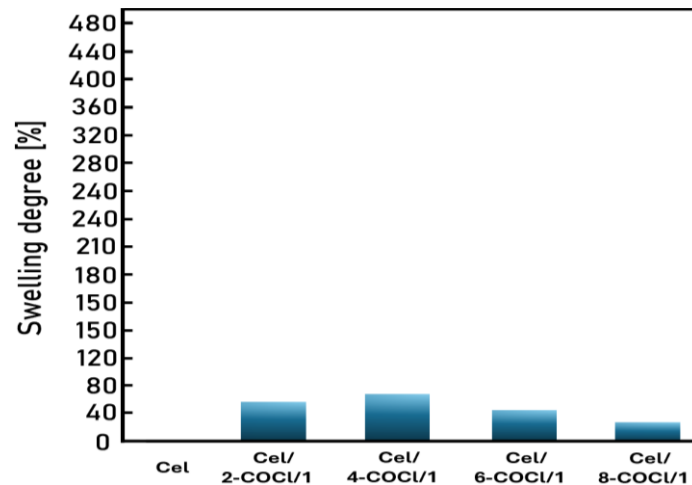
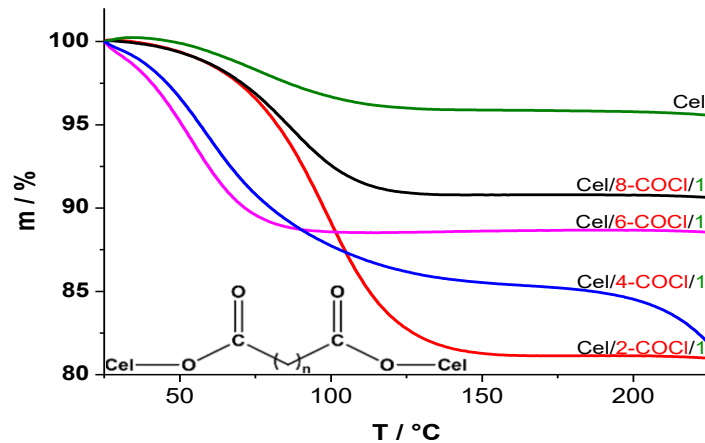
n = 2 (succinyl dichloride)
n = 4 (adipoyl dichloride)
n = 6 (suberyl dichloride)
n = 8 (sebacoyl dichloride)

?

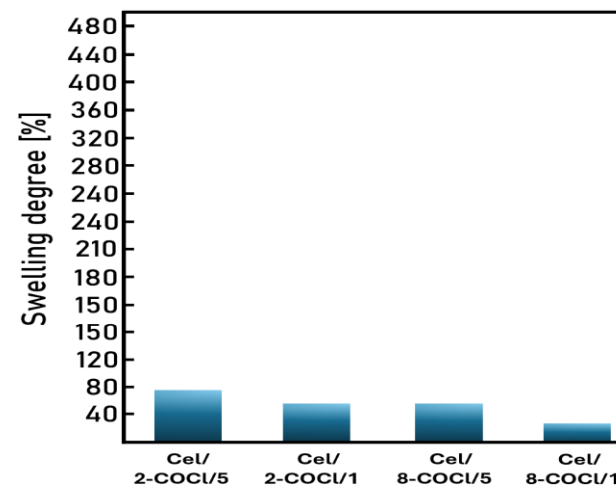
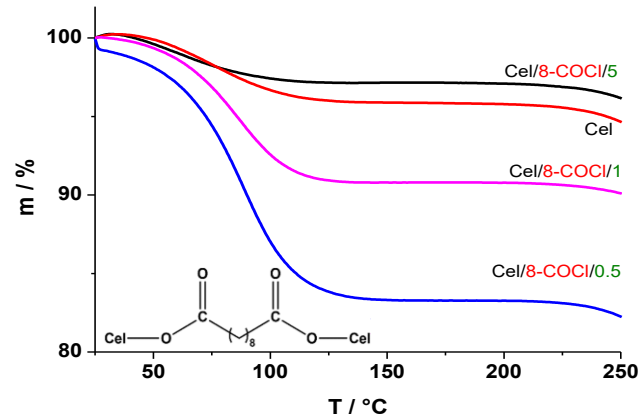


NATIVE CELLULOSE - CROSSLINKING WITH ACID DICHLORIDES

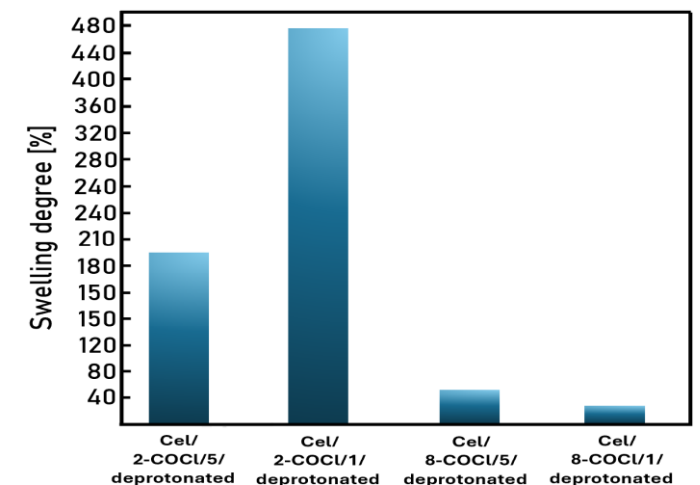
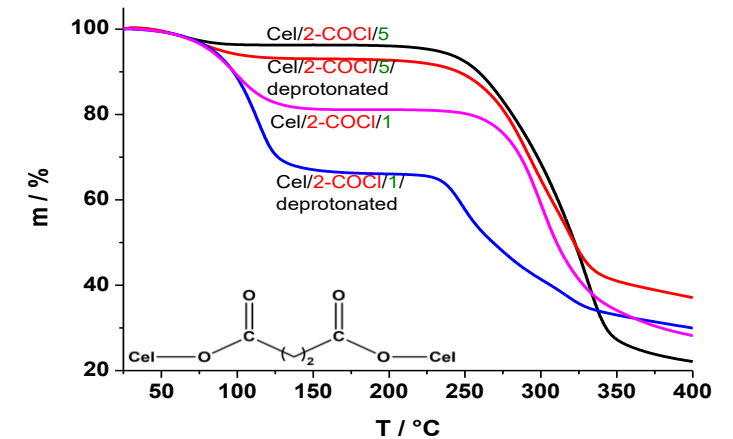
ALKYL CHAIN LENGTH



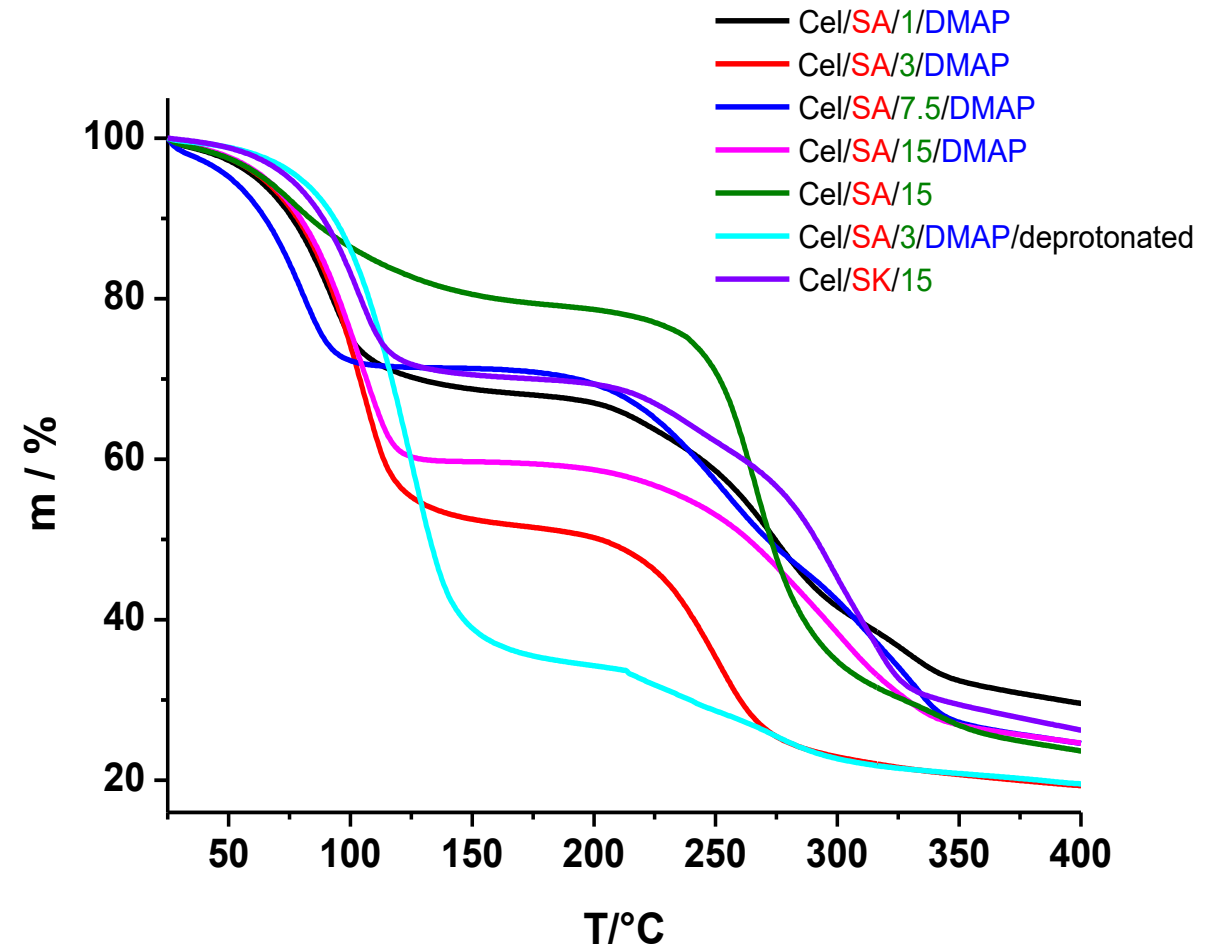
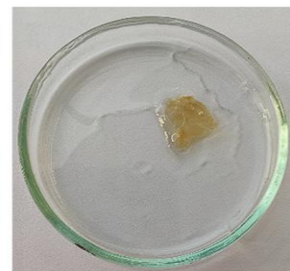
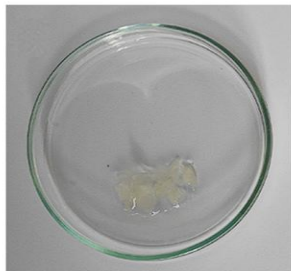
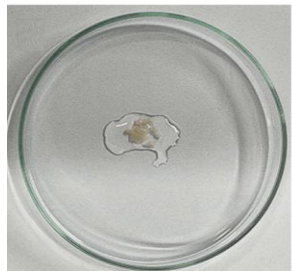
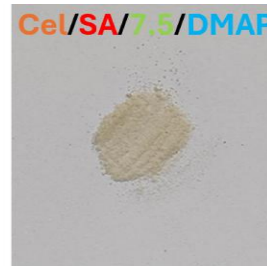
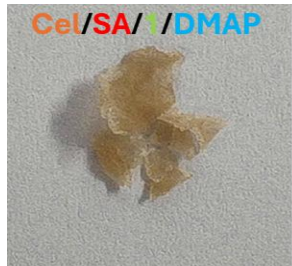
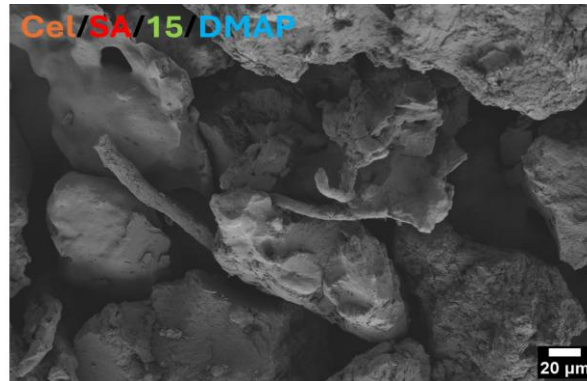
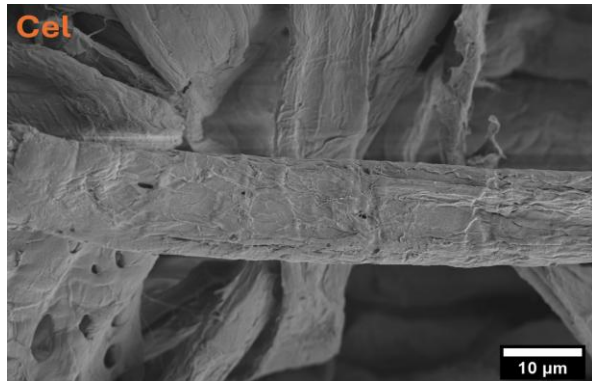
CROSSLINKER / CELLULOSE MOLAR RATIO



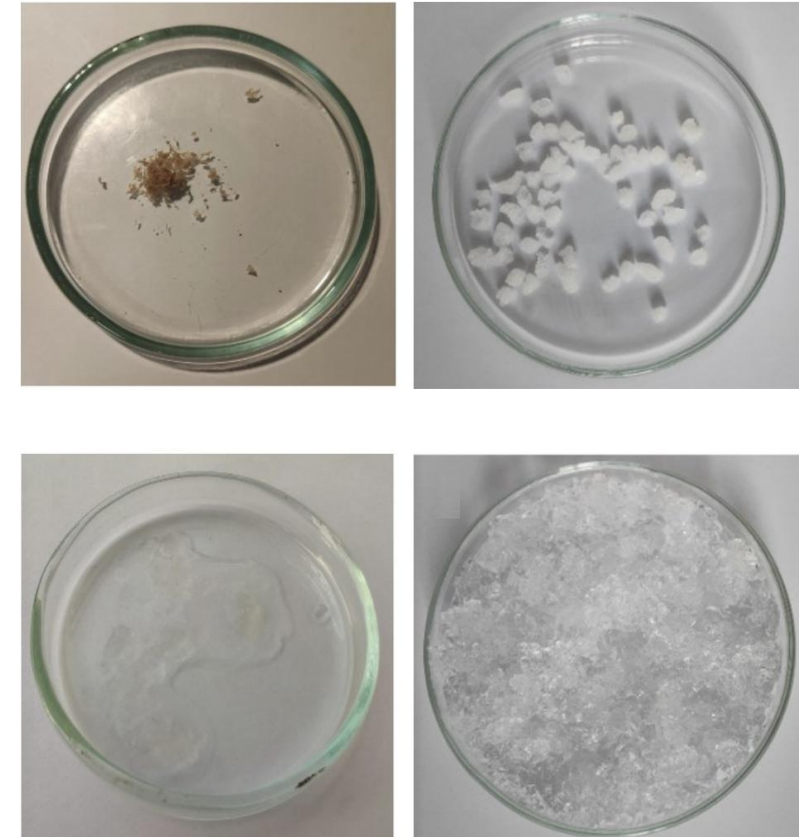
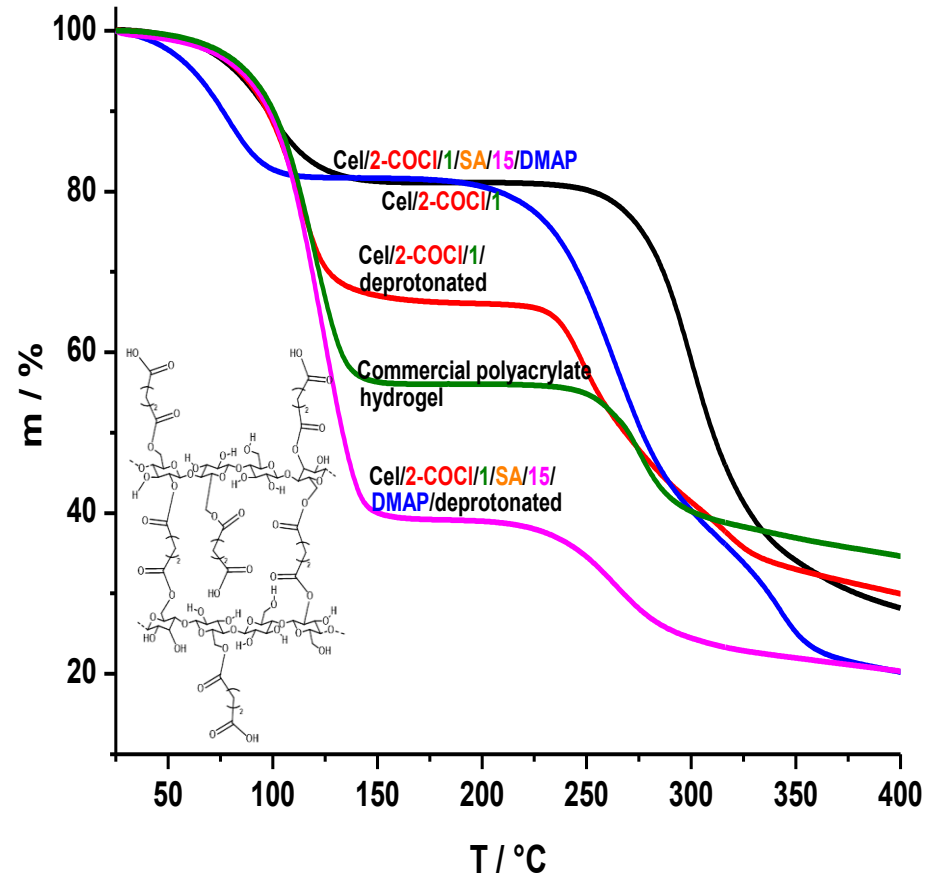
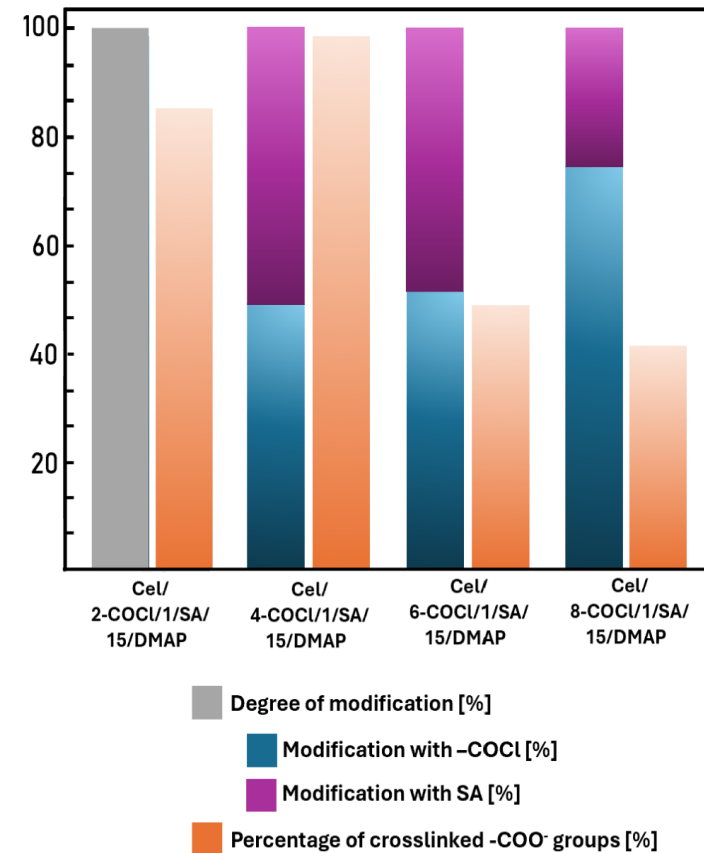
FREE CARBOXYL GROUPS



NATIVE CELLULOSE - MODIFICATION WITH SUCCINIC ANHYDRIDE / SUCCINIC ACID



NATIVE CELLULOSE - CROSSLINKING WITH ACID DICHLORIDES AND MODIFYING WITH SUCCINIC ANHYDRIDE



CONCLUSION

- NaCMC HYDROGELS HAVE A 40% WATER ABSORPTION RATE AND A LOW SWELLING DEGREE
- THE TYPE OF CROSS-LINKING REAGENT, ITS CONCENTRATION AND THE SYNTHESIS CONDITIONS HAVE A STRONG INFLUENCE ON THE PROPERTIES OF THE CELLULOSE HYDROGELS
- SUCCINIC ANHYDRIDE ACTS AS A MODIFIER RATHER THAN A CROSSLINKER LIKE ACID CHLORIDES
- SYNTHESIZED HYDROGELS ARE THERMALLY STABLE
- THE BEST CELLULOSE HYDROGEL IS CEL/2-COCL/100/DMAP/SA/1500 (A LOW CONCENTRATION OF CROSS-LINKING REAGENT AND MODIFICATION WITH SUCCINIC ANHYDRIDE WAS USED) (61% WATER ABSORPTION RATE)
- THE SYNTHESIZED HYDROGELS ABSORB LARGE AMOUNTS OF WATER AND HAVE A LOW SWELLING RATE



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Faculty of Chemistry
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**THANK YOU VERY MUCH FOR
YOUR ATTENTION!**