

Bioactive Double Network Hydrogel and Foam Composites from Lignocellulosic Building Blocks

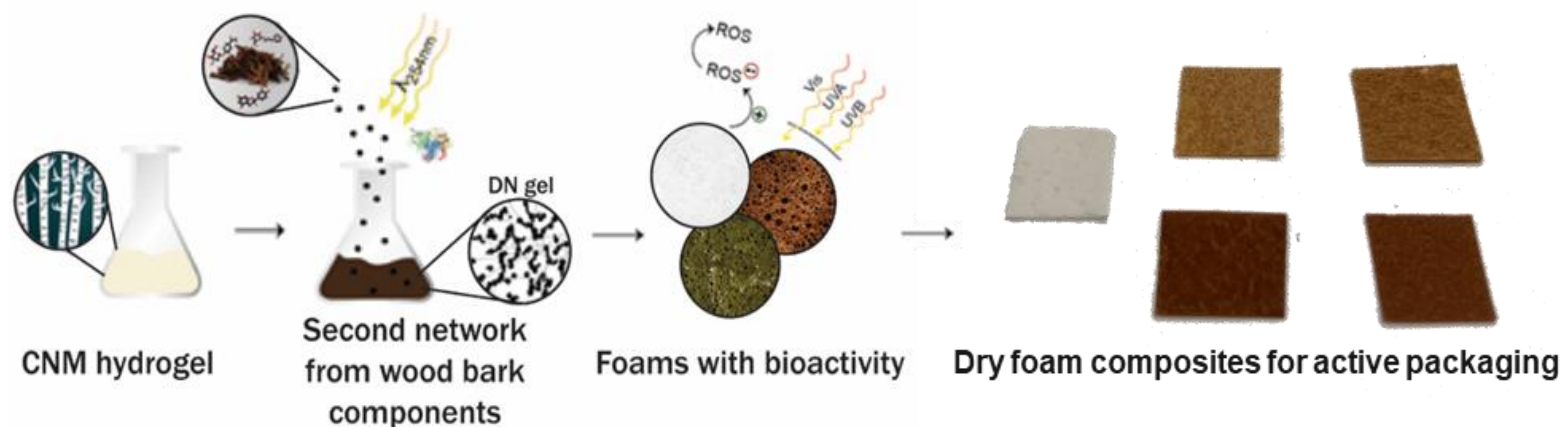
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INTRODUCTION

- Willow bark - a potential reservoir of several bioactive phenolic compounds
- Combination of willow bark extract (WBE) and cellulosic materials to form double network (DN) hydrogels – a new class of functional and high performance materials using enzymatic approach
- Aalto and VTT's joint force under BioNETS project

OBJECTIVES

- Develop purely bio-based and biodegradable composites from WBE and CNF
- Add value and functions to cellulosic foam with willow bark
- Explore the application prospects of DN hydrogels and dry foam composites in biomedical products or as bio-based functional packaging

RESULTS – DN HYDROGELS

- Significant increase in the strength of the hydrogel upon WBE introduction into CNF network and a slight increase after polymerization
- WBE addition has stronger effect on native CNF than TEMPO CNF

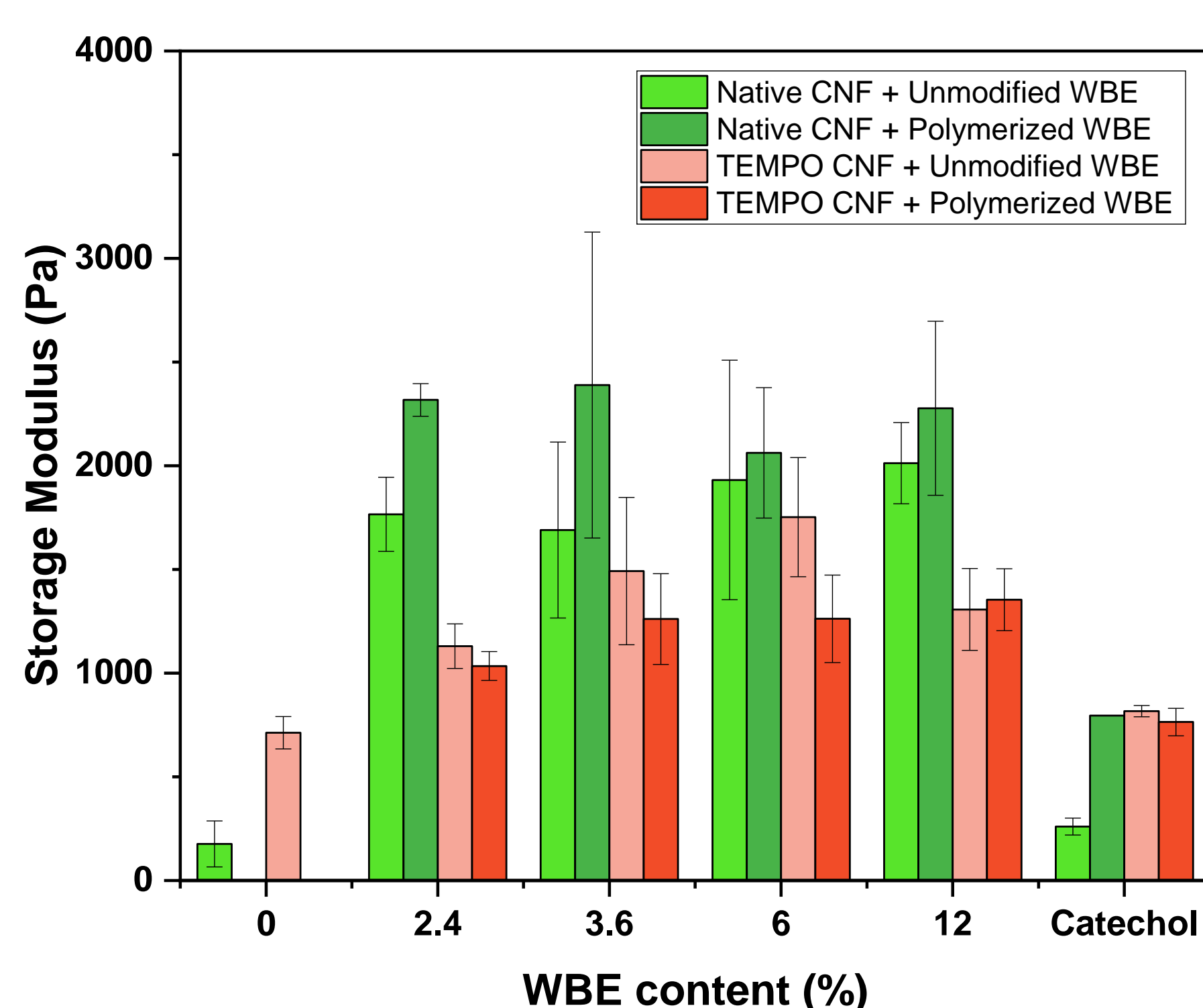


Figure 1. Storage modulus at 0.48 rad/s of samples of different WBE content.

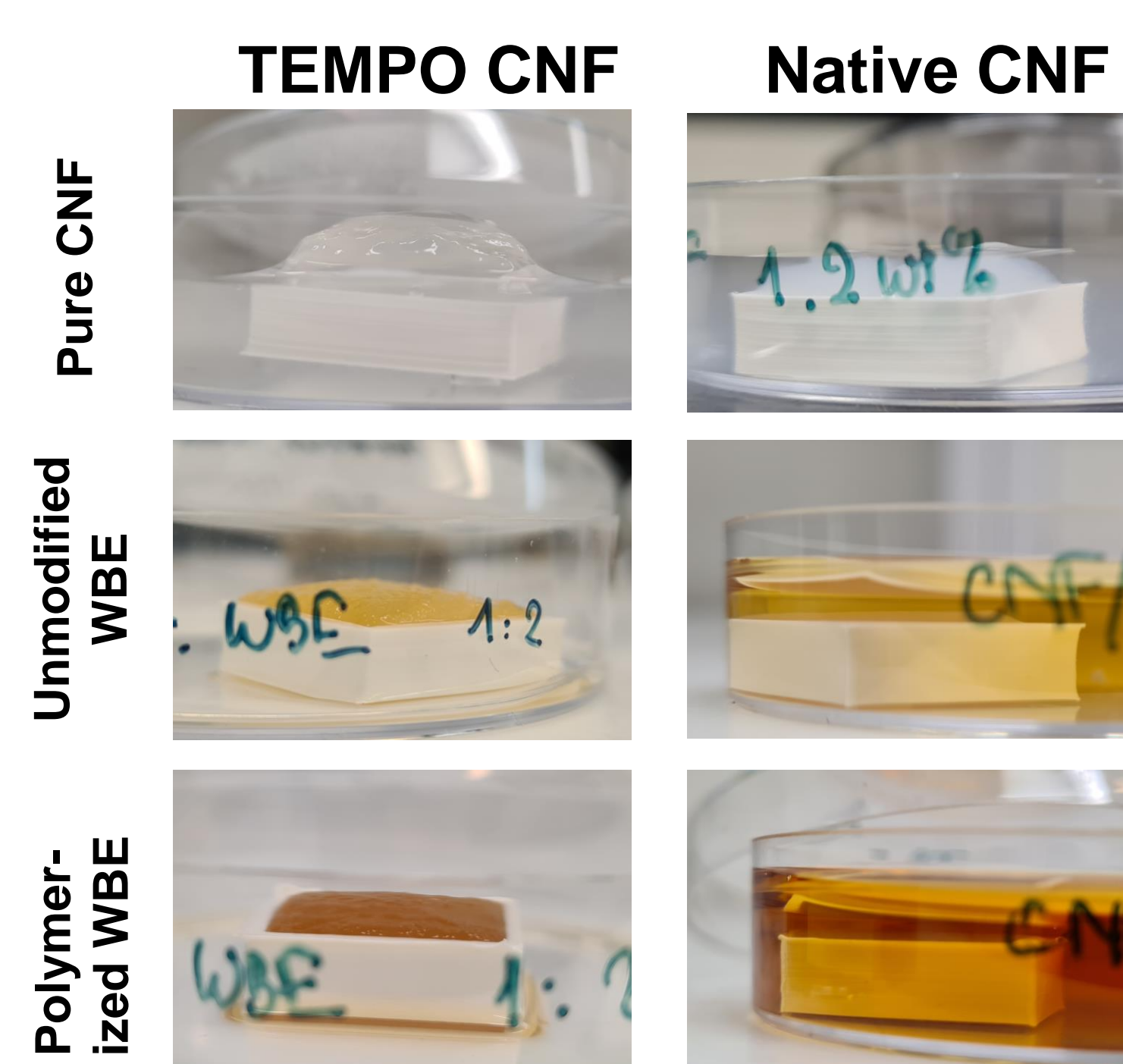


Figure 2. Water immersion test. WBE reduces the swelling of TEMPO CNF and native CNF, even without polymerization with enzyme.

RESULTS – DRY FOAM STUDY

- Foam composition: HefCel, methylcellulose, and carboxymethyl cellulose (CMC)
- Incorporation of WBE improves the mechanical properties of the dry foam and increases density slightly

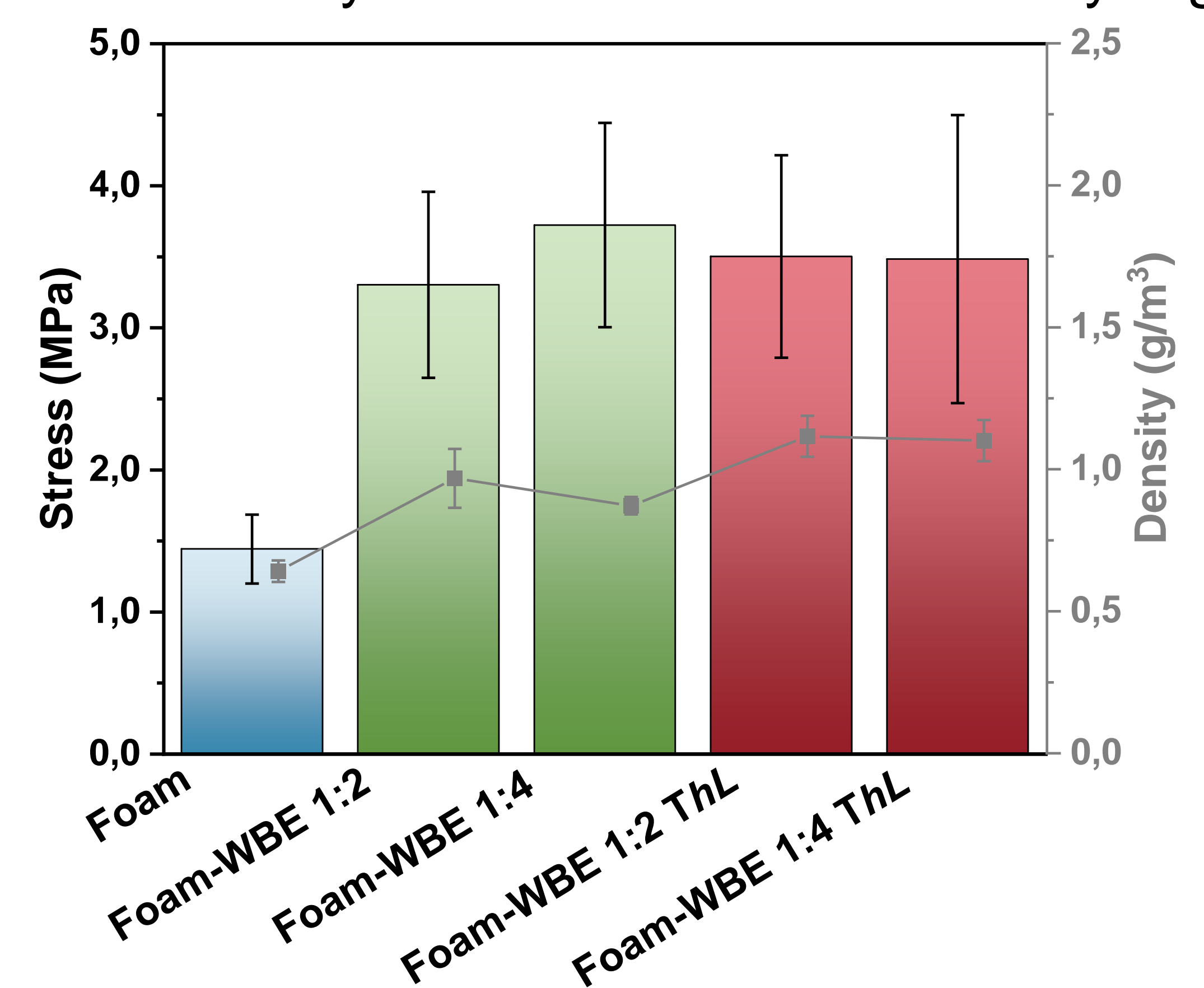


Figure 3. The tensile strength and density of dry composite foams.

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SUMMARY

- WBE increases the strength of CNF hydrogels and dried foam structures
- WBE inhibits swelling of nanocellulose in water
- WBE interacts differently with native CNF and with TEMPO CNF
- WBE shows great potential as a functionalization agent for foam packaging applications

