Biohybrid Nanocellulose – Lysozyme Amyloid Aerogels via Electrostatic Complexation

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Mankind gets inspiration from nature to design sustainable biomaterials with specific helpful features to solve everyday problems in a smart and effective way. Herein we describe biohybrid aerogels obtained from self-assembled lysozyme amyloid fibrils (AMY-FL: full-length and AMY-S: sonicated) and nanocellulose (TO-CNF: TEMPO-oxidized cellulose nanofibers and CNC: cellulose nanocrystals).[1] These starting building blocks differ in length and flexibility (Figure 1A). In the amyloid form, lysozyme has broader antibacterial/antimicrobial activity compared to its native one,[2] but it is unable to produce materials with satisfying mechanical performance; therefore the combination with nanocellulose, which increases system's strength, is required.[3] The electrostatic interaction between these two charged items allows to produce colloidal aggregates, with different features (Figure 1B). Keeping constant the ratio between these two components at 1:1, with final concentration of 2 wt %, it is possible to obtain lightweight aerogels, by means of simple freeze-drying, with homogeneous porous structure and satisfying mechanical properties depending on freezing procedure used (Figure 1C, D). Despite the high potential of these materials, literature is poor in examples; for this reason, these results represent a first step towards larger and more detailed studies in this field.

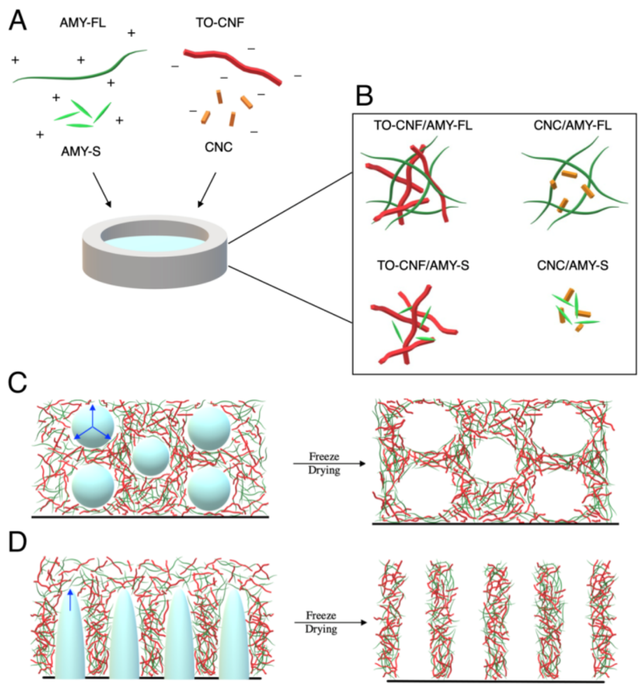

Figure 1. Upper panel: (A) schematic representation of single components and (B) relative combination mixtures. Lower panel: schematic illustration of ice templating of combination mixture dispersion; liquid nitrogen (C) isotropic and (D) gradient freezing, respectively. The blue arrow denotes predominant ice crystal growth direction.

References

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