Ice-binding with nano-tube forming cyclic peptides

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ABSTRACT:

While most native ice-binding proteins are rigid, artificial (macro)molecular ice-binders are usually flexible. Realizing a regular array with precisely positioned ice-binding motifs on synthetic proteins, (macro)molecular ice-binders are thus challenging. Here, we exploit the predictable assembly of cyclic peptides into nanotubes as a starting point to prepare (tunable) large, rigid ice-binders bearing an ice-binding site that is found in hyperactive ice-binding proteins in insects. Upon dissolution in aqueous solutions, this peptide was observed to assemble in a pH- and concentration-dependent manner into objects with nanoscopic dimensions. LS revealed the presence of small (pH 3) and large aggregates (pH 11), held together through a network of intermolecular antiparallel β-sheets. Interestingly, the pH-dependent self-assembly behavior translates into a marked pH dependence of IRI activity, but it is not what we initially expected.

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