

Cryoprotectivity of polyethylene glycol: dependence on chain length and concentration related to its behaviour in solution

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Abstract

Polyethylene glycol (PEG) is an organic polymer with cryoprotective properties. However, to our knowledge, the dependence of its cryoprotectivity on concentration and chain length haven't been properly described or understood.

Here, we systematically probed these relationships for chain M_r between 100 and 18 000. We showed that in the probed range of concentrations, the optimum of PEG concentration shifted from higher to lower values with increasing chain length.

We also measured and compared parameters of PEG solutions that were possibly relevant to their cryoprotective effectivity in order to elucidate its mechanisms. Among these were clustering behaviour of PEG in solution, phase transition behaviour during freezing and thawing, and the ability to induce ice recrystallization inhibition.

Furthermore, we prepared a fluorescent modification of PEG (denoted dPEG) with a single dansyl- group attached via an ester bond to one end of the chain. This allowed us to monitor interactions between dPEG and cells using an imaging flow cytometer.