# Keeping Water Supercool: Non-Toxic Substances that Inhibit the Crystallization of Supercooled Water

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Supercooling occurs when a liquid obtains a temperature lower than its freezing point without exhibiting a phase change from liquid to its solid state. The properties of liquids exhibiting this phenomenon have not yet been completely determined. Knowledge of these properties is important due to the potential application of supercooling, specifically in the preservation of living tissues and cells, and being of particular interest for organ donation. Furthermore, supercooling is a promising method for the cryogenic preservation of human bodies. The purpose of this investigation was to identify if solutions of poly-glutamic acid (PGA) and propylene glycol (PG), at different concentrations (1μM, 1nM) and exposed to different temperatures (-10ºC, -15ºC), could prolong the supercooled state of water. To identify their effectiveness, 5mL solutions of the latter substances were exposed to a bath of cooled ethylene glycol. The period of time during which the solutions were supercooled, and the changes in temperature, were measured. The results showed that the solutions were able to affect the length of time during which water was supercooled. When cooled at -10ºC, both the 1nM PGA and 1μM PG solutions increased the supercooling period, remaining at -10ºC without freezing for 300 minutes and 182 minutes respectively. Conversely, both of the other solutions reduced the amount of time water remained supercooled when cooled at -10ºC. Finally, the 1nM PG solution achieved a temperature of -14.6ºC when cooled to -15ºC. This was the lowest metastability limit (temperature the water reaches before crystallization) attained by any of the solutions.

**Awards Won:**