

Can Thermodynamic Studies and Thermal Analysis Be of a Help for Safe Keeping of Biological Germplasm When Exposed to Cryopreservation?

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In some cases the unfavorable environmental conditions lead to the serious depression, and in limit extinction, of the population density of plant specimens on our planet. There are many plant species close to the edge of their disappearance under the currently deterioration effect of environment. Even in the presence of great progress in genomics there is still the exigency to store plants with their total genetic information but it is not necessary to store a whole plant. The plant cells are totipotent; therefore it is possible to store only a small part of plants, mostly a part of meristematic tissues of vegetatively propagated plants [1] or a seed axis of generatively propagated plants. The plant storage at low or even cryopreservation at ultra low temperatures is one of the appropriate ways how to keep their viability in long term prospect. Intracellular ice crystal formation during low temperature plant exposure is in every case lethal for plant due to its volume increase regarding that of liquid. One way how plants can withstand the low temperatures in the nature is their tolerance to movement of intracellular water to extra-cellular domains and in consequence to this high tolerance to cell dehydration [1,2]. The supercooling states thus possess no dehydration effects neither ice crystal formation, but this state is yet unstable with somehow unpredictable ice formation. Thermal analysis is of a favorite use in the study of thermal behavior of both phenomena under repeated cooling and re-heating, (particularly curious about the determination and concentration-temperature dependences of glass transition) as well as in the examination of phase relations in the simulated system of the mixture of saccharose with water. This study was supported by grant 522/04/0384 of the Grant Agency of Czech Republic.

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- [2] Bilavcik, A. Zamecnik J., J. Sestak: “Cryopresevation and thermodynamics of water in plants” Proceedings of: 8th ESTAC, Barcelona, 25 - 29 August, p. 56, 2002.