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RESPONSE OF SECONDARY STRUCTURAL COMPONENTS OF EGG WHITE PROTEINS TO COLD AND THERMAL EXTREMITIES IN WATER/DEUTERIUM OXIDE MIXTURES

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ABSTRACT

Temperature and water influence proteins' stability and function. This study investigated the response of Amid I secondary structural components (SSC) of egg white proteins to cold (-80 °C) and thermal (100 °C) extremities in water and deuterium oxide (D_2O) mixtures by using FT-IR, DSC, and SEM analyses. Notably, D_2O enabled SSCs exhibit similar profiles at temperature extremities. Latent heat of melting (ΔH_m) raised by 9.5% at 100 °C, while it lowered by 106.8% at -80 °C. Heat capacity (C) increased by 0.9% and 42.2% at 100 and -80 °C, whereas melting temperature (T_m) decreased by 1.7% and 80.5% at 100 and -80 °C. SEM imaging showed flaky structures with different shapes, dimensions, and fissures. Statistical evaluation indicated that there was a strong positive correlation among SSC ($p=0.0001$), ΔH_m ($p=0.00008$), and C ($p=0.00001$) changes, except for T_m values (p=.558182). Overall, D_2O contributed to protein stability at 100 and -80 °C by controlling the unfolding process, possibly by an enthalpy-dependent mechanism. Therefore, it can be used as a reference solvent to establish kinetic models with/without enzymatic, physical, or chemical approaches for improved protein stability.