

Title Change in Diffusional Water Permeability of Spinach Leaf Cell Membrane determined by Nuclear Magnetic Resonance Relaxation Time

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### Abstract

The nuclear magnetic resonance spin–lattice relaxation times of spinach leaf protoplasts suspended in 0.6 M mannitol solution were measured in the presence ( $T_{1s}$ ) and absence ( $T_{1p}$ ) of  $Mn^{2+}$  ions to determine the water exchange time  $\lambda$  and water permeability coefficient  $P_d$  of membrane. For the spinach stored for 1 d at 2 °C,  $\lambda$  was determined to be 76.4 ms and  $P_d$  was  $49 \mu\text{m s}^{-1}$ . As to the spinach stored for 6 d,  $\lambda$  was 52.7 ms and  $P_d$  was  $71 \mu\text{m s}^{-1}$ . Values of  $P_d$  obtained in this study had the same order of magnitude as literature values. Both the decrease in  $\lambda$  and the increase in  $P_d$  with storage time showed that cell membrane became freely permeable state with storage duration. It was thought that the aquaporin of PM28A, a major intrinsic protein of the spinach leaf plasma membrane, was not a major cause of the increase in water permeability of cell membrane after harvest because the decrease in the expression of PM28A was observed in 1 d.