

Effects of pulsed electrical fields on the texture of potato tissue

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The application of pulsed electric fields (PEF) to cellular tissue is known to affect permanently or transiently the state of cell membranes, this is reflected in the electric properties of the tissue. Permanent permeabilization is known to affect the texture of the tissue. We have investigated whether low intensities of PEF would give rise to transient or permanent changes in texture. In this study, changes on the viscoelastic properties of potato tissues exposed to PEF during small-amplitude oscillatory dynamic rheological measurements were monitored. Potato tissue was subjected to field strengths ranging from 30 to 500 V/cm, with a single rectangular pulse of 10 μ s, 100 μ s or 1 ms. The elastic (G') and viscous (G'') moduli were measured every 30 s after the delivery of the pulse and the $\tan \delta$ change calculated. The results were correlated with measurements of changes on electrical resistance during the delivery of the pulse. Interestingly, there is a drastic increase of $\tan \delta$ 30 s after the application of the pulse, followed by a decrease 1 min after pulsation. This response is strongly influenced by the intensity and width of the pulse. Moreover, at high field strengths, the observed electroporation of the tissue reached similar levels when pulse widths of 1 ms and 100 μ s were applied. Our results, supported by similar measurements on osmotically dehydrated control samples, clearly show that PEF causes a rapid change of the viscoelastic properties of the tissue that could be attributed to a partial loss in turgor pressure. This would be an expected consequence of electroporation. The recovery of the $\tan \delta$ to values similar to those before pulsation, strongly suggests recovery of plasma membrane properties and turgor. These viscoelastic changes were shown to be independent of the total degree of permeabilization.