

We explored metabolic responses of potato tissue induced by the application of pulsed electric fields (PEF) at different pulse widths and strengths

MATERIALS AND METHODS

- 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. Metabolic responses were monitored using isothermal calorimetry. Changes on electrical resistance during the delivery of the pulse were also measured.
- Potato tissue was pre-treated with metabolic inhibitors (KCN, KCN + SHAM) before PEF and the proportion of cyanide-sensitive metabolic heat produced after the pulse was determined.

RESULTS

- The metabolic response is strongly dependent on pulsing conditions (Fig. 1C, D) and is independent of the total degree of permeabilization (Fig 2A, B).
- The metabolic response involves oxygen consuming pathways as well as other unidentified events that are shown to be insensitive to metabolic inhibitors such as KCN and SHAM (Fig 3).
- Evidence is provided showing that calorimetry is a simple and powerful method for exploring conditions for metabolic stimulation.

Significance. Plant stress is a key issue in postharvest treatments. Stress can be used to induce certain responses in the tissue, for example, the utilization of stresses has been proposed as a means of increasing the plant tissue antioxidant levels in both preharvest and postharvest. We here have done a first exploration study on the consequences of PEF induced stress.

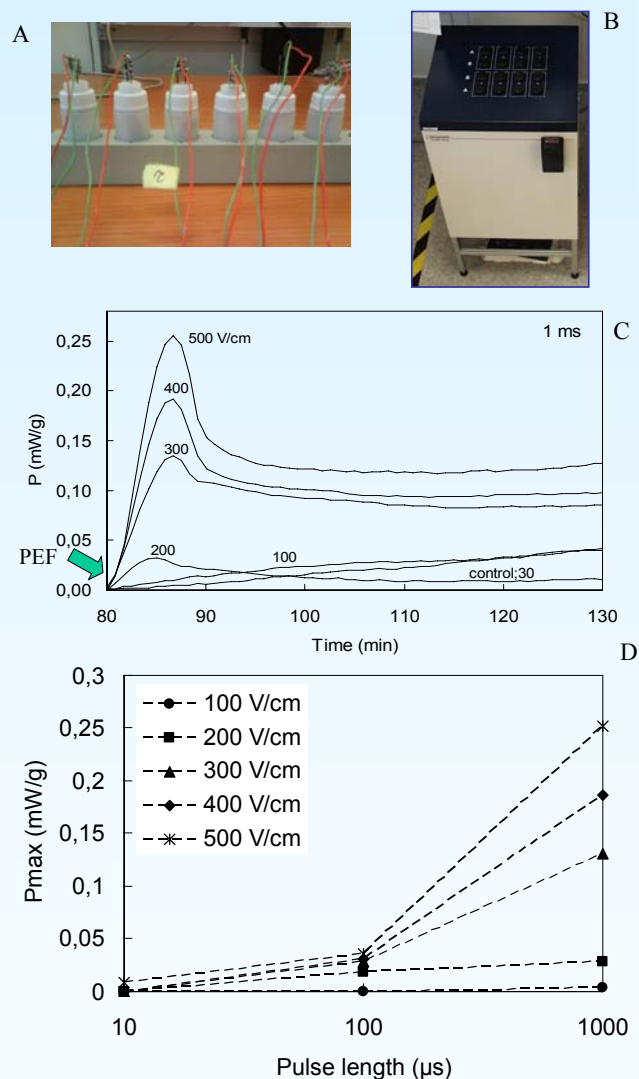


Figure 1. Calorimetric measurements of metabolic heat. (A) Ampoules containing samples (B) Isothermal calorimeter (C) Effect of pulse strength on thermal power (D) Effect of pulse strength and width on the maximum thermal power (Pmax), measured as the maximum value of the peak of the thermal power curves showed in Figure 1C.

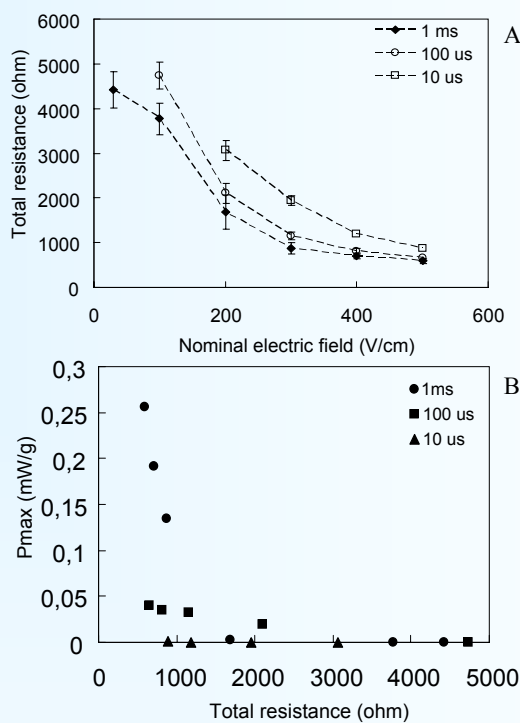


Figure 2. Factors affecting the metabolic response. (A) Total resistance of potato samples during the application of unipolar, rectangular pulses at different field strengths and widths (B) Pmax as a function of total resistance of the potato samples during the application of the pulse.

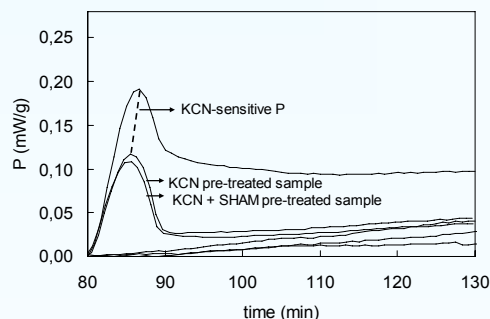


Figure 3. Effect of metabolic inhibitors on thermal power. An example of the effect of pre-treating the samples with KCN alone or in combination with SHAM is shown for the case of 400 V/cm, 1 ms. The maximum thermal power that was shown to be KCN insensitive is depicted by the dashed line.