

Effect of Pulsed Electric Fields and Osmotic Dehydration on the shelf life of fresh-cut spinach leaves

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Fresh-cut spinach is commonly distributed in chilled storage, but due to its extremely rapid microbial spoilage it cannot be readily incorporated into ready-to-eat products (RTE). Conventional dehydration techniques are effective in tissue preservation, but the final product quality is far inferior from that of the initial fresh vegetable. Osmotic Dehydration (OD) provides a gentle dehydration to delicate plant tissues by immersion in a hypertonic solution. Pulsed Electric Fields (PEF) increase cell's permeabilization by exposing them to a high strength electric field and are suitable for enhancing mass transfer during OD. The aim of this work was to study the effect of PEF prior to OD on cut spinach shelf-life extension.

Fresh-cut spinach leaves were PEF treated (0.6 kV/cm, 20 pulses, 15 μ s width). Samples were osmotically dehydrated (25°C, 60 min, 1:20 solid to liquid ratio) in solutions with 60% glycerol. Samples were stored at different storage temperatures from 4°C to 20°C and microbial and sensorial analyses were carried out. The kinetics of microbial growth in terms of total microbial count was mathematically described through Baranyi's model.

At all storage temperatures the microbial growth rate of OD and PEF-OD samples was significantly reduced compared to untreated samples. At 4°C OD reduced microbial growth rate from 0.236 d⁻¹ to 0.091 d⁻¹, while no significant microbial growth was observed for PEF-OD samples for up to 15 days with simultaneous retention of sensory quality. This resulted in at least three-fold increase of shelf life which for untreated spinach leaves was limited to 6 days (at 4°C). This significant increase in the shelf life of minimally treated spinach leaves allows for its incorporation into composite spinach based RTE chilled products that previously could not be commercialized due the perishability of untreated leaves. Such products are currently being tested as case studies based on the results of this work.

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