# Modification of pea albumin structure by pulsed electric field (PEF)

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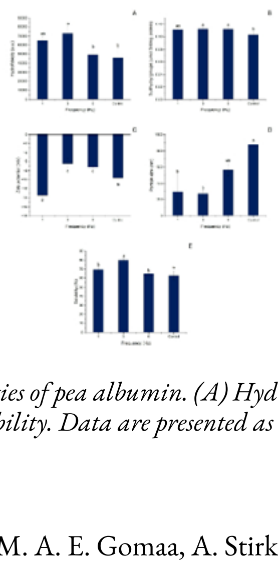
Pulsed electric field (PEF) is a non-thermal technology based on the application of short pulses of high voltage to biomaterials and has been used in several applications, such in the modification of macronutrient structure, for example, in proteins. In the food industry, PEF is used especially for vegetable proteins, due to its capacity to modify the vegetable protein structure and thus enhance its applicability in the food industry, especially plant-based products [1]. Among vegetable proteins, pea proteins have been gaining attention due to their advantages compared to other vegetable proteins, such as low water and land consumption, good amino acid balance, and high productivity [2]. However, most studies related to pea proteins and PEF do not specifically explore how each fraction is affected by PEF. Thus, this study aims to investigate the effect of PEF treatment on the structure of pea albumin and to assess how different PEF frequencies influence its structural behavior. For this purpose, a pea albumin solution (1% w/w, 91.71% protein, purity: 82% of albumin) was exposed to PEF treatment under an electric field strength of 15.6 kV/cm, with a pulse width of 5 µs and 30 pulses. The treatments were performed at frequencies of 1, 3, and 6 Hz in a batch-mode electroporation system developed by [3]. The specific energy input for all three samples was the same, 15.6 J/g. The samples were then subjected to electrophoresis, particle size, zeta potential, intrinsic fluorescence, hydrophobicity, free sulfhydryl groups, and solubility analysis. In SDS-PAGE, no differences were observed between the samples, showing that PEF did not cause alterations in the primary structure. After PEF, the intrinsic fluorescence for all the treatments increased compared to the control, and also a redshift from 337 to 344, 341.5, and 338 for 1 Hz, 3 Hz, and 6 Hz, which may be a reflection of structural alterations in the protein, including conformational rearrangement leading to the unfolding of the protein, until 3 Hz and aggregation at 6Hz. The increase in hydrophobicity is also correlated with protein unfolding. Compared to the control, the highest increase was observed for the frequency of 3 Hz, followed by 1 Hz, probably due to protein unfolding, which exposes hydrophobic residues that were hidden inside the protein. Regarding free SH groups, no difference was observed. Analyzing the particle properties, an increase in zeta potential can be observed at a frequency of 1 Hz and a reduction at other frequencies. A reduction in particle size was also observed, from 876.73 nm (control) to 536.98 nm, 297.47 nm, and 272.48 nm, for frequencies of 6 Hz, 1 Hz, and 3 Hz, respectively. The structural and particle changes allow for an increase in solubility, from 63.07% in the control to 80.07%, 69.37% and 64.65% respectively, for the frequencies 3 Hz, 1 Hz, and 6 Hz. Comparing the frequencies, even with the same energy input, it can be observed that the structural response for PEF is different. Probably the more frequent pulses (6 Hz) prevent the protein from reorganizing, promoting collisions and interactions between partially unfolded molecules, which results in aggregation and decreased solubility. Thus, it is possible to observe that PEF affects the pea albumin structure in a frequency-dependent way, and shows that PEF can be used to modify pea albumin, improving its functional properties and increasing its potential for use in plant-based food systems.



*Effect of PEF treatment frequency on different properties of pea albumin. (A) Hydrophobicity; (B) Free sulfhydryl (SH) content; (C) Zeta potential; (D) Particle size; (E) Solubility. Data are presented as mean ± standard deviation (n = 3).*

**References:**

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