**High temperature thermo-electric treatments as an innovative strategy to improve the techno-functional potential of vegetable proteins.**

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Alternative proteins, particularly those derived from legume such as peas, chickpeas, and fava beans, have gathered significant interest from the food industry and scientific community as substitutes for more established plant proteins like soy or wheat. However, commercial proteins from these sources often exhibit poor solubility and functionality, which limits their broader use in food applications. To address this challenge, various modification techniques aimed at enhancing protein functionality have been explored. Physical modification methods such as electric and ultra-high thermal (UHT) processing methods have shown promise in modifying protein structure and improving functionality. This study investigated the potential use of an emerging thermo-electrical processing technology involving ohmic heating (OH), in UHT conditions. Commercial protein isolate samples - pea, fava and chickpea - were subjected to OH treatment at temperatures ranging from 100 °C to 150 °C, and the effects in structural and functional were assessed. Characterization of the treated proteins revealed that the thermo-electric treatments resulted in shifts in tertiary and secondary structures, consistent with structural rearrangements rather than unfolding. The treatments effectively dissociated insoluble aggregates in the commercial protein samples, significantly reducing particle size and enhancing solubility by 5- to 7-fold. Additionally, the antioxidant capacity of the proteins was markedly improved. Other functional properties, including emulsifying and foaming capacities, remained largely unaffected. The observed changes in protein composition were directly linked to the treatment temperatures, with chickpea protein exhibiting the highest thermal resistance, followed by fava bean and pea proteins. These findings highlight the potential of OH processing under UHT conditions as an innovative and effective approach for enhancing the solubility and functionality of alternative proteins. By improving their properties, thermo-electric processing could facilitate the implementation and application of these proteins in the food industry, driving broader adoption and fostering innovation.