RUBISCO PROTEIN FROM AGRICULTURAL WASTE WITH ENHANCED SOLUBILITY FOR COMPLEXATION WITH GUM ARABIC

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Abstract

Agricultural waste holds significant potential as a source of nutritionally valuable components but remains largely underutilized. Oilseed crop leaves, in particular, are rich in proteins, with the enzyme RuBisCO comprising a major portion of the protein fraction. However, RuBisCO extracted using standard methods often exhibits limited solubility, which can hinder its interaction with other polymers in various applications. This study aimed to extract RuBisCO from pumpkin leaves using a combination of isolation techniques—salting out with ammonium sulfate followed by three cycles of acidic precipitation. The extracted protein was further characterized using the Kjeldahl method, FTIR spectroscopy, and isoelectric point determination. Results showed a protein purity of over 90%, with the FTIR spectrum confirming the presence of characteristic peptide bands and a small amount of residual ammonium sulfate. The extracted protein demonstrated improved solubility compared to fractions obtained using individual methods, with a relatively high isoelectric point of approximately 5.39. The obtained protein was then used to form complexes with gum arabic, an acidic polysaccharide. Various protein-to-polysaccharide ratios were tested (1:2, 1:1, 2:1, 3:1, 5:1, and 10:1) as the ratio is one of the most important parameters affecting complex formation by modifying the charge balance in the complexes. Complex formation was monitored by changes in ζ-potential across different pH levels (8.5 to 2.0), with the highest yield occurring at the isoelectric point of the protein-polysaccharide mixture. The isoelectric points for all tested ratios were determined, showing a neutral ζ-potential between 2.95 and 4.39. Higher gum arabic content resulted in a lower isoelectric point; however, the values remained within an acceptable range, ensuring the complexes' suitability as carriers for vitamins or other sensitive compounds.In conclusion, the successful extraction and enhanced solubility of RuBisCO from pumpkin leaves, combined with the formation of protein-polysaccharide complexes, demonstrates the potential of agricultural waste as a valuable source of functional biomaterials for various applications.

Keywords: *protein, RuBisCO, agricultural waste, gum arabic, complexation, ζ-potential*

Acknowledgment: *This research was supported by the Science Fund of the Republic of Serbia, #GRANT No 7751519, MultiPromis.*