Solubility and Degree of Hydrolysis of Rice Endosperm Protein in Relation to Functional Properties

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Introduction and the aim

The special interest in rice proteins lies in its hypoallergenicity, ease of digestion and relatively good amount of nutritionally essential amino acids. However, rice endosperm proteins are mainly insoluble in water, due to the protein profile consisting mostly high molecular weight rice glutelin, which hinders their applicability in food systems. The objective of this study was to improve water solubility of rice endosperm protein isolate by enzymatic means and to find the optimum extent of degree of hydrolysis for improved functional properties by using different proteolytic enzymes; acidic and neutral endoproteases.

Results

The highest studied degree of hydrolysis was 5.4% corresponding to a solubility value of 55.2% (Figure 1A). Solubility values increased as a function of degree of hydrolysis with an efficiency rate higher with acid endoprotease. Colloidal stability followed the same trend, however, colloidal stability was higher when the proteins were treated by neutral endoprotease (Figure 1B).

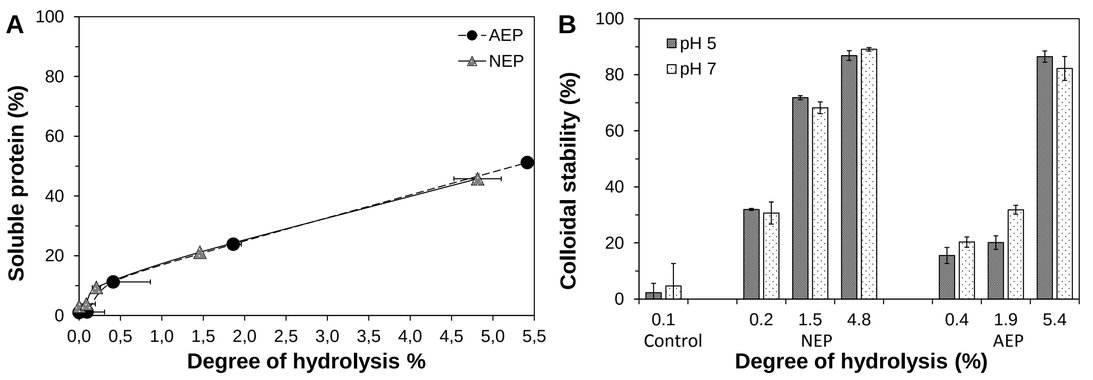

Figure 1. *A: Solubility of rice endosperm protein isolate as a function of degree of hydrolysis with three different enzyme dosages (0.2, 2, 20 U/g) treated 3h by acid (AEP) and neutral (NEP) endoproteases. B: Colloidal stability of the modified proteins at pH 5 and 7 as a function of degree of hydrolysis.*

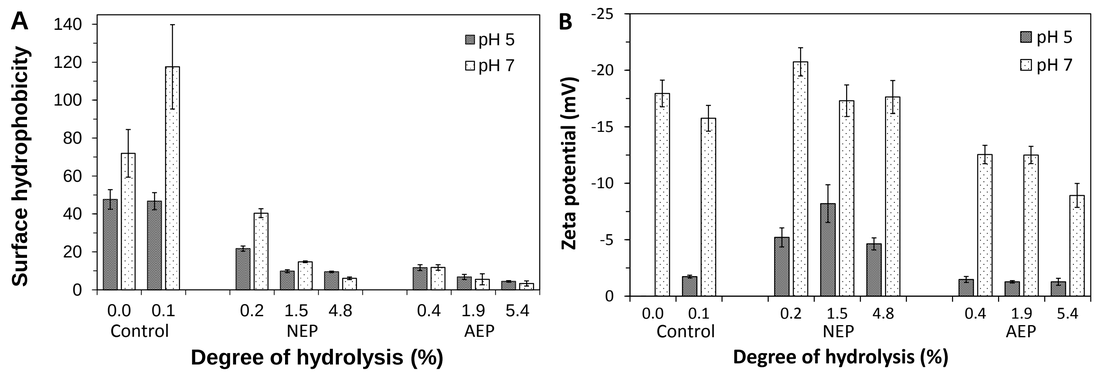

Figure 2. A: *Surface hydrophobicity and B: zeta potential of the modified rice endosperm protein isolate at pH 5 and 7 treated with acid (AEP) and neutral (NEP) endoproteases. Analysed from the soluble fraction.*

Surface hydrophobicity decreased as a function of degree of hydrolysis at both pH values (Figure 2A) . Higher values were achieved with neutral endoprotease compared to that with acid endoprotease. Similarly, the absolute zeta potential value of the hydrolysates was higher after treatments with neutral endoprotease (Figure 2B). The foaming capacity and stability increased after protease treatment until the degree of hydrolysis values of 1.5% (neutral endoprotease) and 1.9% (acid endoprotease) at pH 7. No stable foams were achieved at pH 5. Foam stability was higher with acid endoprotease treatment; however, the appearance of the 1.5% foam was more appealing when treated by neutral endoprotease.

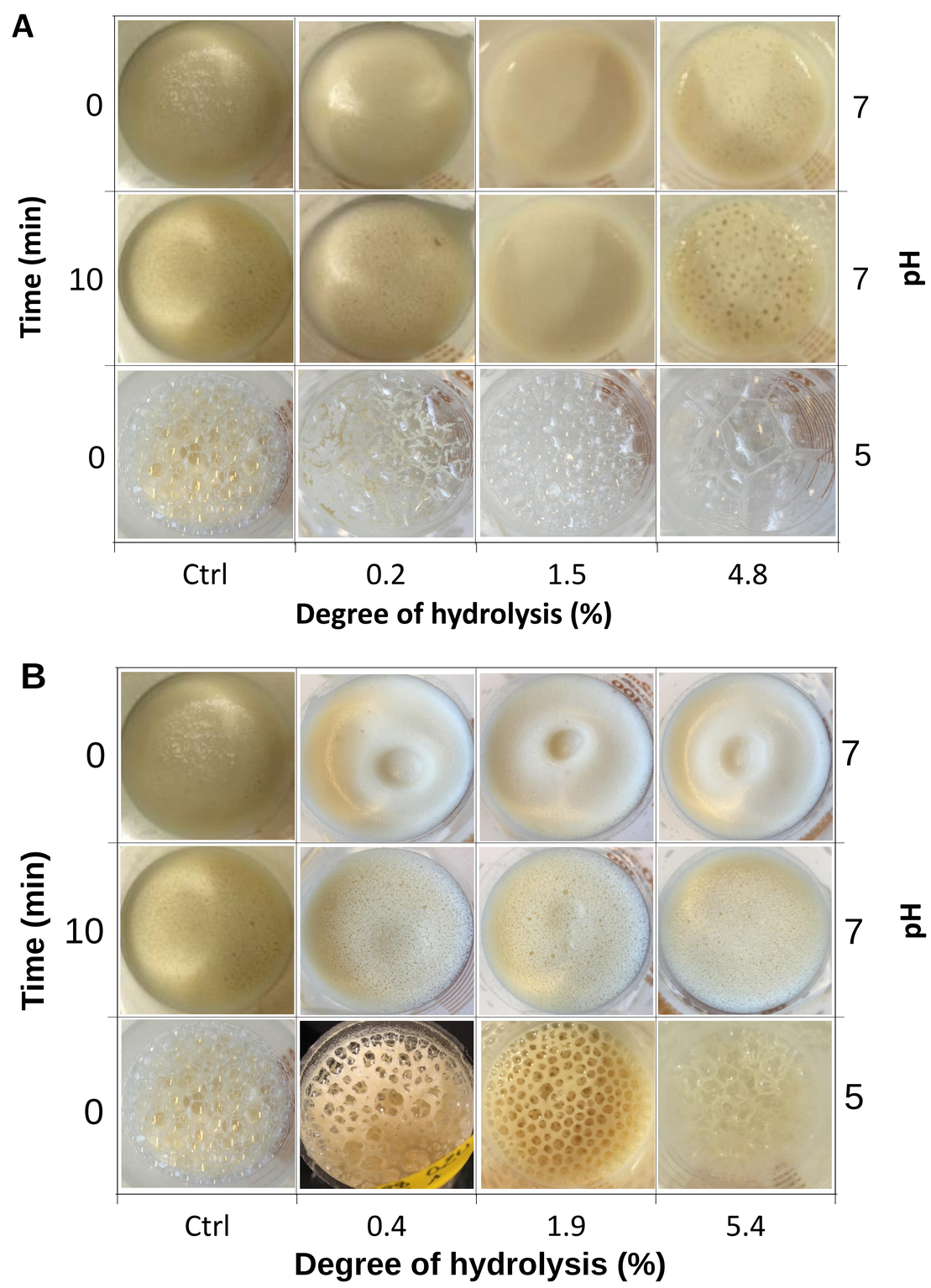

Figure 3. *Foam images of the modified and unmodified (Ctrl) rice endosperm protein isolate as a function of degree of hydrolysis at pH 5 and 7 after 0-10 min sedimentation treated with. A: neutral and B: acid endoprotease.*

Conclusions

- **Controlled enzymatic hydrolysis was a promising tool for improving functional properties of rice endosperm proteins**
- **Functional outcomes depended on enzyme type and its specificity towards the substrate**
- **Colloidal stability increased with increasing degree of hydrolysis, whereas surface hydrophobicity decreased**
- **Zeta potential of the soluble fraction was not adequate on defining the functional properties of the suspensions that contained proteins with a large molecular weight distribution**
- **Foaming properties improved until degree of hydrolysis at around 2% after which the properties started to degrade**

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