Revealing the potential of Brewers Spent Grains In Human Nutrition: Exploration of Protein Extraction Performance and Functional Properties

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One of the main ways of reducing the environmental costs of the brewing industry is to find new ways to increase the value of brewer's spent grain (BSG), the main organic waste associated with beer production. Currently, most of this by-product is relegated to animal feed or landfills but it could have other potential uses with higher economical value such as human consumption. Of the two main constituents of BSG (protein and fiber), its protein content is of particular interest for human consumption. To investigate BSG proteins and identify potential food applications, native BSG, alkaline extract and alkaline extract with L-cysteine as a reducing agent were compared for a wide range of functional properties.

BSG proteins were extracted using NaOH with and without L-cysteine as a reducing agent. Composition (protein, lipid, moisture, carbohydrate, and ash content) of extracts and native BSG was determined. Protein content was further investigated and characterized using SDS-Page and circular dichroism. Emulsifying power, stability, and capacity, foaming capacity and stability, viscosity and solubility were investigated for each extract and native BSG at pH 2, 4, 6 and 8. Water holding capacity, gelling properties and hygroscopicity were also investigated.

Both methods of protein extraction yielded extracts with higher protein content and improved functional properties when compared with native BSG in all tested parameters. Extractions with reducing agent (L-Cysteine) doubled protein content (from 20 to 40 %). Native BSG showed almost no emulsifying and foaming properties while both types of extracts yielded results on par with similar data from other studies on casein and pea proteins. In all cases, functional properties were improved in higher pH conditions (pH 6 and 8) and were lowest at pH 4 where isoelectric precipitation of proteins was observed.
BSG proteins have interesting potential applications in human consumption especially regarding their emulsifying and foaming properties however, future food applications should focus on low acid foods to maximise BSG protein solubility and other functional properties.