ABSTRACT

The current inclination towards the popularity of plant-based protein and increasing cost of animal-derived protein has indicated an escalating demand of new sources of 'sustainable protein-rich biomass' that can be used as alternative protein sources. To address this crucial issue the researchers are engaged to develop a sustainable technology by exploring alternative food resources which can successfully eliminate world food crisis. Wastes obtained from distillery industries are gaining importance because of its high protein content. In India, about 38000 million L distillery sludge is generated causing adverse effect on ecosystem.

An innovative, sustainable, cost-effective, 'green technology-based' approach has been proposed in this study for the production, purification and characterization of protein in order to formulate nutritionally enriched food. A good synergistic effect is recorded by applying ultrasonication assisted-enzymatic hydrolysis (UAEH) of protein from rice distillers dried grain with solubles (DDGS). To evaluate the optimal conditions for ultrasonic extraction, optimization studies i.e. Box-Behnken Design (BBD) based Response Surface Methodology (RSM) was studied. Under the optimum conditions viz. amplitude 97 %, 10 % (w/v) of solid loading and extraction time of 18 min resulted in maximum protein extraction and degree of hydrolysis (DH) i.e., 66.12 % and 6.32 %, respectively. The highest protein yield and DH % were recorded at a protease concentration of 1.5:50 g/g. A significant amount of glutelin (49.03 %) and prolamin (19.04 %) were fractionated by Osborne procedure. Sodium dodecyl sulphate–polyacrylamide gel electrophoresis (SDS-PAGE) demonstrated 2 distinctive bands of molecular weight of 32.2 and 80.7 kDa, which is matching very close to the bands present in the prolamin and glutelin fraction. Based on the purification study, it can be inferred that the extracted DDGS protein isolates (DDGSPI) has a glutelin component. The nutritional and functional properties of DDGS was evaluated which was found at par with commercial proteins, suggesting its utilization in food/feed formulation. Thus, a feeding trial was conducted to investigate the effects of replacing commercial fish feed (CFF) with DDGS protein in Nile tilapia (*Oreochromis niloticus*) diets. Overall, the results indicates that rice DDGS is a potent replacement of CFF without compromising growth performance and haemato-biochemistry of fish.

Keywords: Distillery byproducts, DDGS, Amino acid, Glutelin, Optimization, Functional property