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Communication

Production of Bovine Collagen Hydrolysate with Antioxidant Activity; Optimized by Response Surface Methodology

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Abstract: Antioxidants are widely used in pharmaceutical industries. Gelatin is a byproduct of the meat industry and its hydrolysates showed several functionalities, such as antioxidant activity. The purpose of this study was to describe and optimize the enzymatic hydrolysis conditions including time, temperature, pH, and enzyme/substrate ratio (E/S) to produce protein hydrolysate with antioxidant functionality from bovine gelatin by RSM; the scavenging activity was evaluated using the DPPH method. The model observed was fitted with desirable adequacy and sufficiency. We found that the antioxidant activity increased significantly ($p < 0.05$) with the increase in pH value, E/S ratio, and time of enzymatic process; however, the temperature had no significant ($p < 0.05$) effect on the antioxidant activity of the hydrolysate. The optimum hydrolysis conditions were observed at a temperature of 35.3 °C, pH of 8.0, and E/S ratio at 2.5 after 2 h hydrolysis by trypsin enzyme. The results showed that the hydrolysate under these conditions, optimized by RSM, could be more effective on antioxidant activity. Regarding the antioxidant potential, gelatin hydrolysate can be used as an antioxidant supplement in pharmaceutical industries.

Keywords: bovine gelatin; protein hydrolysate; antioxidant activity; response surface methodology

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1. Introduction

Collagen is the predominant structural protein in vertebrate and invertebrate animals and the principal fibrous protein constituent in skin, bones, and cartilages. Gelatin is a soluble protein derived from collagen and obtained by a partial hydrolysis process [1]. Gelatin is widely used for its functional and nutritional properties in the food and pharmaceutical industries. Currently, collagen is mainly extracted from the skin and bones of cows and pigs. It is worthwhile to note that collagen and gelatin are the main proteinaceous byproducts of meat industries. However, the disposal and utilization of these byproducts can reduce the cost of production and generate income for producers [1,2]. Gelatin-derived peptides and hydrolysates showed several functional activities and potential biological benefits, including antioxidant, anticancer, cholesterol lowering, and antihypertensive effects [3]. More than half of the amino acid residues in collagen α-chain contain glycine, proline, and hydroxyproline amino acids. The presence of both proline and glycine amino acids are associated with radical scavenging and antioxidant activity of gelatin hydrolysate as a bioactive peptide [4].

Bioactive peptides, namely biopeptides, have been characterized as specific fragments of native proteins that have positive effects on human body conditions, which eventually promote health and well-being. Several studies showed the biological functionalities of