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ORIGINAL ARTICLE

Optimization of gelatin extraction from chicken deboner residue using RSM method

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Abstract This study aims to investigate the optimization of gelatin extraction from chicken deboner residue. An optimization procedure using a central composite design with three factors (HCl concentration, extraction temperature, and extraction time) was used in order to investigate the effects of these parameters on extraction yield, g-f, viscosity, and lightness. It was found that the optimum conditions for producing gelatin using response surface methodology (RSM) included an acid concentration of 6.73% and an extraction temperature of 86.8 °C for 1.95 h. The predicted responses for these extraction conditions included a yield of 10.2%, a g-f of 526 g, a viscosity of 5.85 cP, and a lightness of 70.0. Verification experiments were conducted under optimal conditions to compare predicted and actual values of the dependent variables. Both actual and predicted values were found to nearly coincide, confirming that the estimation models were capable of reasonably and accurately predicting the dependent variables.

Keywords Optimization · Response surface methodology · Chicken deboner residue · Gelatin

Introduction

Gelatin is an important biopolymer which has been widely used in the food industry (Gilsenan and Ross-Murphy 2000) as an ingredient for increasing the viscosity of aqueous systems; forming aqueous gels; and improving elasticity, consistency, and stability of food products (Sarabia et al. 2000). It can be used in adsorbent pads and for encapsulation, production of hard and soft capsules, wound dressing, and edible film formation, which make it suitable for pharmaceutical and photographic applications (Jongjareonrak et al. 2006). Gelatin is derived from collagen. It is the principal proteinacious component of the white fibrous connective tissue. Collagen serves as the chief tensile stress bearing elements for animals. This animal protein is isolated in major tissues such as skin tendon and bones, but collagen fibers pervade almost every organ and tissue. Most commercial gelatins are made from the hide of porcines and bovines and to a lesser extent from their bones. Poultry and fish by-products are seldom used as a source of gelatin. Traditional sources of gelatin pose certain problems. For example, Jewish and Muslim communities do not accept pork gelatin (Badii and Nazlin 2006), and beef gelatin is acceptable only if it has been processed according to their religious requirements, which will vary. On the other hand the major defect of fish gelatin is its fishy odor (Cho et al. 2004b). These considerations have encouraged production of gelatin from poultry waste derived by mechanical deboning operations as a replacement for mammalian gelatins.

Mechanically deboning is a unit operation in the poultry processing industry, in which pressure is applied to separate meat from the slurry of ground meat and bones in a mechanical deboner. The separated ground meat is used in the manufacture of comminuted poultry products and the waste material leaving the deboner is a bony residue that has a high content of bone, skin, and connective tissues, depending on the input material. This residue has approximately 20% protein, 30%–40% of which is collagen. The

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