INTISARI

Industri gelatin menghadapi tantangan kekhawatiran agama dan kesehatan terkait sumber mamalia. Penelitian ini menggunakan sumber alternatif, kulit ikan tuna sirip kuning, yang merupakan limbah pengolahan ikan di Indonesia. Metode hidrolisis asam dan basa menghasilkan rendemen gelatin yang rendah dan limbah berbahaya. Sehingga digunakan metode ramah lingkungan yang menggabungkan *pre-treatment* ultrasonik dan hidrolisis enzimatik dengan bromelin. Bromelin memiliki kemampuan hidrolisis yang baik, dan *pre-treatment* ultrasonik meningkatkan efektivitas dengan meningkatkan aksesibilitas enzim terhadap kolagen. Metode ini digunakan untuk meningkatkan rendemen, mendukung sirkular ekonomi serta menekan biaya penggunaan enzim. Penelitian ini mengevaluasi *amplitudo* ultrasonik, waktu *pre-treatment*, konsentrasi enzim, dan waktu hidrolisis terhadap rendemen, serta menentukan kondisi optimal untuk rendemen, viskositas, dan kekuatan gel, juga sifat fisiko-kimia dan fungsional gelatin. Penelitian ini terdiri dari tiga tahap yaitu *screening*, optimasi, dan karakterisasi gelatin hasil optimasi. Diperoleh hasil *screening* yaitu 5, 15, dan 25 menit *pre-treatment*, konsentrasi enzim 1, 2 dan 3%, dan 1, 3 dan 5 jam hidrolisis. Kondisi optimal 25 menit *pre-treatment*, konsentrasi enzim 1%, dan 2,17 jam hidrolisis, menghasilkan rendemen 64,08%, viskositas 9,29 cP, dan kekuatan gel 166,28 bloom. Serta menghasilkan gelatin dengan sifat fisiko-kimia yang baik yaitu kadar air, abu, dan protein yang memenuhi standar SNI, derajat hidrolisis 83,58%, kelarutan 73,84 – 98,65% dalam rentang pH 3-11, komposisi asam amino dengan dominan glisin (29,26%) dan prolin (18,26%) serta distribusi berat molekul 17-160 kDa. Sifat fungsional meliputi kapasitas pengikatan minyak-air 192% dan 406%, aktivitas dan stabilitas pengemulsi 50,5 m^2/g dan ESI 23,80 min, aktivitas antioksidan 60,16%, dan gugus fungsional amida I, II, III, A, dan B, serta daya cerna protein 76,95%. Metode ramah lingkungan ini meningkatkan efektivitas hidrolisis gelatin dari kulit tuna sirip kuning dan menghasilkan sifat fisiko-kimia dan fungsional yang baik.

Kata kunci: Metode ramah lingkungan, optimasi, sifat fisiko-kimia, sifat fungsional, sirkular ekonomi

ABSTRACT

The gelatin industry faces challenges related to religious and health concerns regarding mammalian sources. This research utilizes an alternative source, yellowfin tuna skin, which is a byproduct of fish processing in Indonesia. Acid and alkaline hydrolysis methods yield low gelatin extraction and produce hazardous waste. Therefore, an environmental friendly method combining ultrasonic *pre-treatment* and enzymatic hydrolysis with bromelain is employed. Bromelain demonstrates effective hydrolysis capabilities, and ultrasonic *pre-treatment* enhances its effectiveness by increasing enzyme accessibility to collagen. This method aims to improve yield, support circular economy principles, and reduce enzyme usage costs. The study evaluates the effects of ultrasonic amplitude, *pre-treatment* time, enzyme concentration, and hydrolysis time on yield, and determines optimal conditions for yield, viscosity, and gel strength, as well as the physicochemical and functional properties of gelatin. The research comprises three phases: screening, optimization, and characterization of optimized gelatin. Screening results yielded *pre-treatment* times of 5, 15, and 25 minutes, enzyme concentrations of 1, 2, and 3%, and hydrolysis times of 1, 3, and 5 hours. Optimal conditions were determined to be 25 minutes of *pre-treatment*, 1% enzyme concentration, and 2.17 hours of hydrolysis, resulting in a yield of 64.08%, viscosity of 9.29 cP, and gel strength of 166.28 bloom. The optimized gelatin exhibited favorable physicochemical properties, including moisture, ash, and protein content meeting SNI standards, a degree of hydrolysis of 83.58%, solubility ranging from 73.84% to 98.65% across pH 3-11, amino acid composition dominated by glycine (29.26%) and proline (18.26%), and molecular weight distribution of 17-160 kDa. Functional properties include oil-water binding capacities of 192% and 406%, emulsifying activity and stability of 50.5 m2/g and ESI 23.80 min, antioxidant activity of 60.16%, functional groups including amide I, II, III, A, and B, and protein digestibility of 76.95%. This environmentally friendly method enhances the effectiveness of gelatin hydrolysis from yellowfin tuna skin and produces gelatin with favorable physicochemical and functional properties.

Keywords: Environmental friendly method, optimization, physicochemical properties, functional properties, circular economy