

Intisari

PENGARUH FORTIFIKASI NANOKALSIUM TEPUNG TULANG LELE TERHADAP KARAKTERISTIK FISIK, KIMIA, DAN SENSORIS OTAK-OTAK

Peningkatan produksi dan konsumsi lele menghasilkan limbah tulang yang memiliki kandungan mineral seperti kalsium, fosfor, dan karbonat, sehingga berpotensi dimanfaatkan menjadi sumber kalsium. Konsumsi kalsium masyarakat di Indonesia hanya 254 mg jauh dari asupan kalsium yang direkomendasikan yaitu 1000-1200 mg. Untuk itu, diperlukan fortifikasi nanokalsium tepung tulang lele pada produk otak-otak. Tujuan penelitian ini adalah mengetahui metode terbaik pembuatan tepung nanokalsium, mengetahui pengaruh fortifikasi nanokalsium terhadap karakteristik fisik, kimia, dan penerimaan konsumen. Pembuatan nanokalsium dilakukan sebanyak 6 perlakuan dengan perlakuan terbaik yaitu kalsinasi presto pasta, sedangkan produk otak-otak terdapat 5 konsentrasi penambahan nanokalsium yaitu 0%; 0,375%; 0,75%; 1,125%; dan 1,5%. Optimasi pengecilan ukuran partikel terbaik pada perlakuan kalsinasi presto pasta dengan kadar air 0,74%, derajat putih 96,66%, rasio Ca : P sebesar 1,70 : 1, kalsium sebesar 30,82%, fosfor 18,12%, dan ukuran partikel 18,32 nm (60,1%). Kekerasan meningkat seiring penambahan nanokalsium, struktur pori menjadi lebih padat dan tidak berongga, dan warna lebih gelap, kadar pH otak-otak yang berkisar antara 6,70-7,24. Hasil karakteristik kimia menunjukkan fortifikasi nanokalsium berpengaruh terhadap kadar abu sebesar 1,90-3,55%, kalsium 0,04-0,76%, fosfor 0,06-0,33%, kadar air 53,93-55,99%, kadar lemak 7,74-10,79%, dan kadar protein 7,13-8,76%. Hasil analisis sensori *Quantitative Descriptive Analysis (QDA)* dan *Time Intensity (TI)* menunjukkan penambahan nanokalsium meningkatkan *grittiness*, aroma smoky, dan rasa gurih, serta mengurangi tekstur kenyal, sensasi pedas dan *aftertaste* pedas. Penerimaan konsumen (hedonik) menunjukkan penambahan nanokalsium berpengaruh terhadap kenampakan, warna, aroma, rasa, tekstur, dan penilaian keseluruhan. Formula optimum yaitu penambahan 0,75% (P2) dengan indeks penerimaan konsumen (AI) $\geq 70\%$, memiliki rasio Ca : P dengan perbandingan 2 : 1, memenuhi regulasi BPOM (2019) mengenai syarat produk sumber kalsium dan tinggi kalsium.

Kata kunci : nanokalsium, tepung tulang, otak-otak, kalsinasi, sensoris

Abstract

Effect of Nano-Calcium Fortification from Catfish Bone Powder on the Physical, Chemical, and Sensory Characteristics of Otak-Otak

The increasing production and consumption of catfish generate bone waste containing minerals such as calcium, phosphorus, and carbonates, which have the potential to be utilized as a calcium source. Calcium intake among the Indonesian population is only 254 mg, far below the recommended daily intake of 1000–1200 mg. Therefore, fortification of catfish bone nano-calcium into *otak-otak* products is required. This study aimed to determine the best method for producing nano-calcium powder and to evaluate the effect of nano-calcium fortification on the physical, chemical, and consumer acceptance characteristics of *otak-otak*. Nano-calcium was produced using six treatments, with the best treatment being calcination of pressure-cooked paste. The *otak-otak* products were formulated with five levels of nano-calcium addition: 0%, 0.375%, 0.75%, 1.125%, and 1.5%. The optimal particle size reduction was achieved using the calcined pressure-cooked paste treatment, resulting in a moisture content of 0.74%, whiteness degree of 96.66%, Ca:P ratio of 1.70:1, calcium content of 30.82%, phosphorus content of 18.12%, and particle size of 18.32 nm (60.1%). Hardness increased with increasing nano-calcium addition, pore structure became denser and less porous, and color became darker, with *otak-otak* pH values ranging from 6.70 to 7.24. Chemical characterization showed that nano-calcium fortification affected ash content (1.90–3.55%), calcium (0.04–0.76%), and phosphorus (0.06–0.33%). Moisture content ranged from 53.93–55.99%, fat content from 7.74–10.79%, and protein content from 7.13–8.76%. Sensory analysis using Quantitative Descriptive Analysis (QDA) and Time Intensity (TI) indicated that nano-calcium addition increased grittiness, smoky aroma, and savory taste, while reducing chewiness, spicy sensation, and spicy aftertaste. Consumer acceptance (hedonic test) showed that nano-calcium addition significantly affected appearance, color, aroma, taste, texture, and overall acceptance. The optimum formulation was obtained with 0.75% nano-calcium addition (P2), achieving a consumer acceptance index (AI) > 70%, a Ca:P ratio of 2:1, and meeting BPOM (2019) regulations for calcium source and high-calcium food products.

Keywords: nano-calcium, bone powder, *otak-otak*, calcination, sensory analysis