

AKTIVITAS ANTIOKSIDAN HIDROLISAT PROTEIN OKARA MENGUNAKAN PAPAIN SECARA *IN SILICO* DAN *IN VITRO*

INTISARI

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Berbagai permasalahan kesehatan yang diderita manusia semakin kompleks. Namun, sebagian besar penyakit disebabkan oleh keberadaan radikal bebas yang berasal dari berbagai sumber bahan pangan. Apabila radikal bebas menjadi berlebihan akan menyebabkan stres oksidatif yang memberikan dampak buruk untuk kesehatan manusia. Maka diperlukan mekanisme yang mampu melawan radikal bebas, yakni antioksidan. Penelitian ini bertujuan untuk mengetahui aktivitas antioksidan dan sifat fungsional dari salah satu bahan alternatif, yakni okara yang dihidrolisis menggunakan enzim papain secara *in silico* dan *in vitro*.

Penelitian ini dilaksanakan dengan 3 tahapan utama, yakni 1) analisis prediksi aktivitas antioksidan secara *in silico*; 2) analisis aktivitas antioksidan secara *in vitro*; dan 3) analisis sifat fungsional WHC (*Water holding capacity*) dan OHC (*Oil holding capacity*). Penelitian dirancang dengan Rancangan Acak Lengkap Faktorial dengan dua variabel bebas, yakni konsentrasi enzim (3, 4, dan 5%) dan lama waktu hidrolisis (120, 150, dan 180 menit). Okara ditepungkan terlebih dahulu kemudian dihidrolisis menggunakan enzim papain, selanjutnya diidentifikasi derajat hidrolisis dan aktivitas antioksidan menggunakan metode DPPH dan FRAP. Kemudian, dari hasil dengan derajat hidrolisis paling tinggi akan dianalisis lanjut WHC, OHC, dan kadar air. Untuk analisis *in silico* terlebih dahulu menentukan *parent protein*, kemudian didapat sekuen dengan bentuk FASTA menggunakan UniProt selanjutnya dianalisis dengan *database* BIOPEP, Protparam, PeptideRanker, dan Toxinpred.

Dari analisis *in silico*, diketahui bahwa hasil proteolisis okara menggunakan enzim papain mampu menghasilkan peptida-peptida dengan berat molekul lebih kecil yang memiliki aktivitas antioksidan. Dari hasil penelitian, derajat hidrolisis tertinggi yakni sebesar 27,94%, antioksidan DPPH tertinggi sebesar 57,53% (%RSA), dan antioksidan FRAP tertinggi sebesar 8,6955 mg/ml asam askorbat. Untuk sifat fungsional WHC hidrolisat protein okara sebesar 1,4787 ml air/mg sampel dan OHC hidrolisat protein okara sebesar 2,52 ml minyak/mg sampel.

Kata kunci: Okara, hidrolisat protein, enzim papain, antioksidan, *in silico*, *in vitro*

ANTIOXIDANT ACTIVITY OF OKARA PROTEIN HYDROLYSATE USING PAPAIN BY *IN SILICO* AND *IN VITRO* METHODS

ABSTRACT

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Various health problems suffered by humans are increasingly complex. However, most diseases are caused by the presence of free radicals that come from various food sources. If free radicals become excessive, they will cause oxidative stress which has a negative impact on human health. So we need a mechanism that can fight free radicals, namely antioxidants. This study aims to determine the antioxidant activity and functional properties of an alternative ingredient, namely okara which is hydrolyzed using the enzyme papain in silico and in vitro.

This research was carried out in 3 main stages, namely 1) *in silico* prediction analysis of antioxidant activity; 2) analysis of antioxidant activity in vitro; and 3) analysis of functional properties of WHC (Water holding capacity) and OHC (Oil holding capacity). The study was designed in a completely randomized factorial design with two independent variables, namely enzyme concentration (3, 4, and 5%) and hydrolysis time (120, 150, and 180 minutes). Okara was floured first and then hydrolyzed using the enzyme papain, then the degree of hydrolysis and antioxidant activity were identified using the DPPH and FRAP methods. Then, the results with the highest degree of hydrolysis will be further analyzed for WHC, OHC, and water content. For in silico analysis, first determine the parent protein, then obtain sequences in the FASTA form using UniProt then analyzed with the BIOPEP, Protparam, PeptideRanker, and Toxinpred databases.

From in silico analysis, it is known that the results of okara proteolysis using papain enzymes are capable of producing peptides with lower molecular weights that have antioxidant activity. From the research results, the highest degree of hydrolysis was 27.94%, the highest DPPH antioxidant was 57.53% (%RSA), and the highest FRAP antioxidant was 8.6955 mg/ml ascorbic acid. For the functional properties of okara protein hydrolysate WHC of 1.4787 ml of water/mg sample and OHC of okara protein hydrolysate of 2.52 ml of oil/mg sample.

Keywords: Okara, hydrolysate protein, papain enzyme, antioxidant, *in silico*, *in vitro*