

## INTISARI

Alga laut coklat (*Sargassum turbinarioides* Grunow) tersebar luas di wilayah laut Indonesia. Akan tetapi, hasil kekayaan laut ini belum dikelola maksimal oleh masyarakat. Salah satu komponen bioaktif dalam alga laut coklat terdiri adalah polisakarida sulfat (fukoidan). Fukoidan dapat berkhasiat sebagai antioksidan, imunomodulator, dan anti inflamasi. *Sargassum turbinarioides* mempunyai warna yang kurang menarik, bau yang kurang sedap, serta tidak tahan terhadap suasana asam. Oleh sebab itu, perlu dilakukan peningkatan dan pengembangan teknologi formulasi sehingga berpotensi memiliki nilai tambah.

Tujuan penelitian ini adalah mengkaji pengaruh suhu terhadap proses ekstraksi, mengkaji respon ukuran partikel dan distribusi ukuran partikel formulasi mikroenkapsulasi, dan mengkaji aktivitas imunomodulator ekstrak alga laut coklat. Alga laut coklat diekstraksi kemudian dilakukan formulasi mikroenkapsulasi dengan metode *freeze drying* dan dilakukan uji aktivitas antioksidan dan uji aktivitas imunomodulator. Kandungan fukoidan dalam ekstrak dianalisis menggunakan FTIR, <sup>1</sup>H-NMR, dan LC-MS/MS. Formulasi mikroenkapsulasi dilakukan karakterisasi meliputi ukuran partikel, distribusi ukuran partikel, *entrapment efficiency* (EE). Uji aktivitas imunomodulator diujikan secara *in vivo* dengan pengamatan uji fagositosis sel makrofag dan uji proliferasi limfosit dengan menggunakan hewan coba mencit.

Hasil orientasi suhu ekstraksi didapatkan rendemen optimal pada saat suhu ekstraksi adalah 90 °C sebanyak 7,73±0,47%. Formula optimum mikroenkapsulasi menunjukkan hasil prediksi *software* dengan nilai desirability 0.90. Ekstrak alga laut coklat (EALC) menunjukkan nilai indeks fagositosis 2.51 ± 0.81, sedangkan mikroenkapsulasi ekstrak alga laut coklat (EALC) menunjukkan nilai indeks fagositosis sebesar 1.88 ± 0.70. Hasil pengamatan aktivitas proliferasi limfosit menunjukkan ekstrak alga laut coklat dan mikroenkapsulasi ekstrak alga laut coklat memiliki nilai *Optical density* (OD) lebih tinggi dibandingkan kelompok kontrol aquades. Berdasarkan hasil penelitian disimpulkan bahwa kondisi optimal (ekstraksi) berdasarkan pengamatan kuantitas zat aktif fukoidan dan rendemen ekstrak dicapai pada suhu 90°C, prediksi formula optimum sediaan mikroenkapsulasi berdasarkan *software Design Expert* dengan komposisi ekstrak 0,5%, alginat 0,5%, CaCl<sub>2</sub> 2%. Sediaan mikroenkapsulasi ekstrak *Sargassum turbinarioides* memberikan aktivitas antioksidan dan imunomodulator.

Kata Kunci: ekstrak, sargassum, fukoidan, formulasi, imunomodulator

## ABSTRACT

Brown marine algae (*Sargassum turbinarioides* Grunow) is widely distributed in the Indonesian seas. However, the results of this marine wealth have not been optimally managed by the community. One of the bioactive components in brown marine algae consists of sulfated polysaccharides (fucoidans). Fucoidan can be efficacious as an antioxidant, immunomodulator, and anti-inflammatory. *Sargassum turbinarioides* have an unattractive color, and unpleasant odor, and are not resistant to acidic conditions. Therefore, it is necessary to improve and develop formulation technology so that it has the potential to have added value.

This research aimed to study the effect of temperature on the extraction process, to study the particle size response and particle size distribution of microencapsulation formulations, and to study the immunomodulatory activity of brown marine algae extract. Extracted brown marine algae and then performed microencapsulation formulations using the freeze-drying method and tested for antioxidant activity and immunomodulatory activity tests. The fucoidan content in the extract was analyzed using FTIR, <sup>1</sup>H-NMR, and LC-MS/MS. Microencapsulation formulations were characterized including particle size, particle size distribution, and entrapment efficiency (EE). The immunomodulatory activity was tested in vivo by observing macrophage cell phagocytosis tests and lymphocyte proliferation tests using mice as experimental animals.

The results of the orientation of the extraction temperature obtained the optimal yield when the extraction temperature was 90 °C as much as 7.73 ± 0.47%. The optimum microencapsulation formula shows the results of software predictions with a desirability value of 0.90. Brown marine algae extract (EALC) showed a phagocytosis index value of 2.51 ± 0.81, while brown marine algae extract microencapsulation (EALC) showed a phagocytosis index value of 1.88 ± 0.70. The results of observations of lymphocyte proliferation activity showed that brown marine algae extract and brown marine algae extract microencapsulation had higher optical density (OD) values than the aquades control group. at 90°C, the optimum formula for microencapsulation is predicted based on Design Expert software with a composition of 0.5% extract, 0.5% alginate, and 2% CaCl<sub>2</sub>. Microencapsulated preparations of *Sargassum turbinarioides* extract provide antioxidant and immunomodulatory activity.

**Keywords:** extract, sargassum, fucoidan, formulation, immunomodulator