

ABSTRAK

AKTIVITAS ANTIBAKTERI DAN ANTIKANKER KITOSAN DAN SENYAWA METABOLIT SEKUNDER FUNGI DARI ISOLAT 19A15-RF MENGUNAKAN METODE FERMENTASI

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Produksi kitosan dari limbah krustasea menghadapi tantangan keberlanjutan dan isu lingkungan, sehingga diperlukan sumber alternatif yang lebih ramah lingkungan. Fungi laut, terutama mikroba yang berasosiasi dengan sponge, berpotensi sebagai penghasil kitosan dan metabolit bioaktif. Penelitian ini bertujuan untuk mengeksplorasi potensi isolat unggul 19A15-RF, jenis *Aspergillus ochraceus* asal perairan Gorontalo, Indonesia, dalam menghasilkan kitosan dan senyawa metabolit sekunder melalui dua metode fermentasi: terendam/ *Submerged Fermentation* (SmF) dan padat/*Solid-State Fermentation* (SSF). Produk hasil fermentasi dikarakterisasi menggunakan *Fourier Transform Infrared Spectroscopy* (FTIR) dan *Liquid Chromatography-Tandem Mass Spectrometry* (LC-MS/MS), serta divalidasi secara kualitatif melalui analisis Kromatografi Lapis Tipis (KLT). Uji aktivitas antibakteri dilakukan terhadap *Staphylococcus aureus* dan *Pseudomonas aeruginosa* menggunakan metode difusi agar, sementara uji aktivitas antikanker terhadap sel A549 (kanker paru-paru), HeLa (kanker serviks), dan MCF-7 (kanker payudara) dilakukan dengan metode *Methyl Thiazolyl Tetrazolium* (MTT). Rendemen kitosan yang diperoleh sebesar 75,25% (SmF) dan 75,21% (SSF). Pada uji antibakteri, kitosan SmF menghasilkan zona hambat sebesar 17 mm terhadap *S. aureus* dan 10 mm terhadap *P. aeruginosa*, sedangkan kitosan SSF masing-masing sebesar 13 mm dan 8 mm. Aktivitas antikanker tertinggi terlihat pada metabolit yaitu hasil SSF yang mengandung β -sitosterol-D-glukosida terhadap sel kanker MCF-7 (55,99%), sedangkan kitosan yaitu hasil SmF lebih aktif terhadap sel A549 (21%) dan HeLa (18%). Kebaruan penelitian ini terletak pada eksplorasi isolat laut 19A15-RF sebagai sumber kitosan dan metabolit bioaktif yang berpotensi sebagai agen antibakteri dan antikanker. Temuan ini membuka peluang pemanfaatan biodiversitas laut Indonesia untuk pengembangan bahan bioaktif yang berkelanjutan.

Kata kunci: Kitosan fungi, metabolit sekunder, fermentasi, antibakteri, antikanker

ABSTRACT

ANTIBACTERIAL AND ANTICANCER ACTIVITY OF CHITOSAN AND FUNGAL SECONDARY METABOLITE COMPOUNDS FROM 19A15-RF ISOLATES USING FERMENTATION METHOD

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Chitosan production from crustacean waste faces sustainability and environmental challenges, making alternative, more eco-friendly sources necessary. Marine fungi, particularly sponge-associated microbes, have the potential to produce both chitosan and bioactive metabolites. This study aims to explore the potential of the superior isolate 19A15-RF, a strain of *Aspergillus ochraceus* originating from the waters of Gorontalo, Indonesia, in producing chitosan and secondary metabolite compounds through two fermentation methods: submerged fermentation (SmF) and solid-state fermentation (SSF). The fermented products were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Liquid Chromatography–Tandem Mass Spectrometry (LC-MS/MS), and qualitatively validated through Thin Layer Chromatography (TLC) analysis. Antibacterial activity tests were performed against *Staphylococcus aureus* and *Pseudomonas aeruginosa* using the agar diffusion method, while anticancer activity was tested on A549 (lung cancer), HeLa (cervical cancer), and MCF-7 (breast cancer) cell lines using the Methyl Thiazolyl Tetrazolium (MTT) assay. The chitosan yields obtained were 75.25% (SmF) and 75.21% (SSF). In the antibacterial tests, SmF-derived chitosan produced inhibition zones of 17 mm against *S. aureus* and 10 mm against *P. aeruginosa*, while SSF-derived chitosan produced zones of 13 mm and 8 mm, respectively. The highest anticancer activity was observed in the SSF-derived metabolite containing β -sitosterol-D-glucoside, which showed 55.99% inhibition against MCF-7 cells. Meanwhile, SmF-derived chitosan showed greater activity against A549 (21%) and HeLa (18%) cells. The novelty of this research lies in the exploration of marine isolate 19A15-RF as a source of chitosan and bioactive metabolites with potential antibacterial and anticancer properties. These findings open new opportunities for utilizing Indonesia's marine biodiversity in the sustainable development of bioactive materials.

Keywords: Chitosan fungi, secondary metabolites, fermentation, antibacterial, anticancer