ABSTRAK

POTENSI PRODUKSI BERSIH DAN EKO-EFISIENSI SERTA DIVERSIFIKASI PRODUK PADA INDUSTRI MINYAK ATSIRI PALA DI PROVINSI LAMPUNG

Oleh

WIDIA RINI HARTARI

Provinsi Lampung merupakan salah satu daerah intensifikasi tanaman pala dari kementerian pertanian, sehingga memiliki potensi untuk dikembangkan dan menjadi produk unggulan jika dilihat dari produksi terbesar ke-3 dari Pulau Sumatera. Industri pengolahan pala menjadi minyak atsiri juga sudah cukup berkembang di daerah Pesawaran, dan Tanggamus, tetapi masih diolah dari bagian biji dan fuli pala. Padahal bagian lainnya seperti daun pala dan limbah penyulingan minyak atsiri pala dapat diolah menjadi produk yang bernilai jual tinggi. Penelitian ini bertujuan untuk melihat potensi ekoefisiensi dan produksi bersih yang dalam industri penyulingan minyak atsiri, mengetahui karakterisasi dari minyak atsiri biji dan daun pala, serta diversifikasi dari limbah yang tidak banyak dimanfaatkan. Penelitian ini dilakukan melalui 5 tahap, tahap pertama dilakukan dengan melihat potensi ekoefisiensi di industri dengan survei langsung ke lapangan, tahap kedua dilakukan dengan karakterisasi minyak atsiri biji dan daun pala dengan mengidentifikasi senyawa kimia yang dikandung menggunakan GC-MS, tahap ketiga minyak atsiri (warna, bau, bobot jenis, indeks bias, kelarutan dalam alkohol, sisa penguapan, dan putaran optic), dan melihat aktivitas antioksidan (%) inhibisi dengan spektrofotometer UV-Vis. Tahap ketiga adalah pengujian aktivitas antimikroba minyak atsiri pala terhadap daya hambat bakteri *E.coli, Salmonella thypi,* dan *Staphylococcus aureus*. Tahap keempat adalah diversifikasi produk sabun padat dengan pemanfaatan limbah cair (air hidrosol pala) dan VCO, kemudian dianalisis nilai pH sabun yang dibuat. Tahapan kelima adalah diversifikasi limbah padat ampas pala menjadi Biopelet, dengan pengamatan (kadar air, kadar abu, nilai kerapatan, dan nilai kalor). Pengujian GC-MS, mutu, dan aktivitas antioksidan dianalisis secara Deskriptif, sedangkan untuk pengujian aktivitas antimikroba dan diversifikasi produk sabun dan biopelet disusun secara RAKL dengan 3 ulangan dan diuji lanjut BNT. Hasil penelitian menunjukkan bahwa teridentifikasi 12 senyawa kimia minyak atsiri biji pala padang cermin, senyawa tertinggi dengan luas are mencapai 64,905% adalah

Phenazine dan turunannya. Senyawa pada minyak atsiri biji pala Sungai Langka teridentifikasi 23 senyawa kimia, dengan 6,205% luas area menunjukkan senyawa dl-Laudanosoline hydrobromide pentacyclo. Selain itu teridentifikasi 28 senyawa kimia pada minyak atsiri daun pala Padang Cermin, yang didominasi oleh senyawa D-Streptamine mencapai 76,46% luas area. Senyawa kimia pada minyak atsiri daun pala dari Tanggamus teridentifikasi 24 senyawa yang didominasi senyawa Phenanthrene mencapai 56,95% luas area. Sampel minyak atsiri biji dan daun pala yang diambil memiliki mutu yang baik, dan terdapat aktivitas antioksidan yang tinggi yaitu 93,36% pada minyak atsiri biji pala Padang Cermin, 96,89% pada minyak atsiri biji pala Sungai Langka. Pada minyak atsiri daun pala padang cermin juga mengandung 94,74% aktivitas antioksidan, dan 88,65% pada minyak atsiri daun pala dari Tanggamus, yang tergolong tinggi. Aktivitas antimikroba yang terkandung pada minyak atsiri biji dan daun pala pada konsentrasi 100% juga tergolong daya hambat sangat kuat yaitu >20-30 mm, terhadap bakteri *E.coli, Salmonella thypi,* dan *Staphylococcus aureus.* Limbah cair berupa air hidrosol teridentifikasi 15 senyawa dengan senyawa dominan yaitu Di (2-ethylhexyl) adipate. Selain senyawa kimia, terdapat senyawa antioksidan saponin mencapai 0,05% dan aktivitas antioksidan mencapai 95,63%. Oleh karenanya air hidrosol dapat dikembangkan menjadi diversifikasi produk sabun. Produk sabun padat berbasis air hidrosol pala memiliki pH yang netral sekitar 7-8 yang mendekati pH kulit, sehingga aman untuk dipakai oleh kulit manusia. Pada pengolahan biopelet dari ampas penyulingan pala juga menunjukkan mutu yang baik dari kadar air, kadar abu, nilai kerapatan dan nilai kalor sesuai dengan standar SNI 8675:2018 tentang Biopelet, sehingga Biopelet yang diolah dapat menjadi alternatif bahan bakar pengganti kayu bakar di industri penyulingan minyak pala dan dapat menerapkan Ekoefisiensi.

Kata Kunci : Ekoefisien, Diversifikasi, Hidrosol, Minyak Atsiri, Antioksidan.

ABSTRACT

IMPLEMENTATION OF CLEAN AND ECO-EFFICIENCY PRODUCTION AND PRODUCT DIVERSIFICATION IN THE NUTS ESSENTIAL OIL INDUSTRY IN LAMPUNG PROVINCE

By
WIDIA RINI HARTARI

Lampung Province is one of the nutmeg intensification areas of the Ministry of Agriculture, so it has the potential to be developed and become a superior product, as seen from the 3rd largest production on the island of Sumatra. The industry for processing nutmeg into essential oil is also quite developed in the Pesawaran and Tanggamus areas, but it is still processed from the nutmeg seeds and mace. In fact, other parts, such as nutmeg leaves and waste from refining nutmeg essential oil, can be processed into products with high selling value. This research aims to see the potential for eco-efficiency and clean production in the essential oil refining industry, then find out the characteristics of essential oil from nutmeg seeds and leaves, as well as diversification from waste that has not been widely utilized. This research was carried out in five stages. The first stage was carried out by looking at the potential for eco-efficiency in the industry with direct field surveys. The second stage was carried out by characterizing the essential oil of nutmeg seeds and leaves by identifying the chemical compounds contained using GC-MS, then the quality of the essential oil (color, odor, specific gravity, refractive index, solubility in alcohol, residual evaporation, and optical rotation), and looking at the antioxidant activity (%) inhibition with a UV-Vis spectrophotometer. The third stage was testing the antimicrobial activity of nutmeg essential oil against the inhibition of E. coli, Salmonella typhi, and Staphylococcus aureus bacteria. The fourth stage is the diversification of solid soap products by utilizing liquid waste (nutmeg hydrosol water) and VCO, then analyzing the pH value of the soap made. The fifth stage is the diversification of solid waste nutmeg dregs into biopellets with observations (moisture content, ash content, density value, and heating value). GC-MS testing, quality, and antioxidant activity were analyzed descriptively, while testing for antimicrobial activity and diversification of soap and biopellet products was prepared using RAKL with 3 replications and tested further by BNT. The results of the research showed that 12 chemical compounds in the essential oil of Padang Cermin nutmeg were identified; the highest compound with an area of 64.905% was phenazine and its derivatives. The compounds in the essential oil of rare river nutmeg seeds were identified as 23 chemical compounds, with 6.205% of the area showing the compound dl-Laudanosoline hydrobromide pentacyclo. Apart from that, 28 chemical compounds were identified in the essential oil of Padangmirr nutmeg leaves, which was dominated by the compound D-Streptamine, covering 76.46%

of the area. The chemical compounds in the essential oil of Tanggamus nutmeg leaves were identified as 24 compounds, dominated by phenanthrene compounds, covering 56.95% of the area. The samples of essential oil of nutmeg seeds and leaves taken were of good quality, and there was high antioxidant activity, namely 93.36% in the essential oil of Padang Cermin nutmeg seeds and 96.89% in the essential oil of Sungai Langka nutmeg seeds. Padang Cermin nutmeg essential oil also contains 94.74% antioxidant activity and 88.65% of the essential oil of Tanggamus nutmeg leaves, which is relatively high. The antimicrobial activity contained in the essential oil of nutmeg seeds and leaves at a concentration of 100% is also classified as having very strong inhibitory power, namely >20–30 mm, against E. coli, Salmonella typhi, and Staphylococcus aureus bacteria. In liquid waste in the form of hydrosol water, 15 compounds were identified, with the dominant compound being Di (2-ethylhexyl) adipate. Apart from chemical compounds, there are saponin antioxidant compounds reaching 0.05% and antioxidant activity reaching 95.63%. Therefore, hydrosol water can be developed through diversification. Nutmeg hydrosol water-based solid soap products have a neutral pH of around 7-8, which is close to the pH of the skin, so they are safe for use on human skin. The processing of biopellets from nutmeg distillation dregs also shows good quality in terms of water content, ash content, density value, and heating value in accordance with the SNI 8675:2018 standard concerning biopellets, so that the processed biopellets can be an alternative fuel to replace firewood in the oil refining industry. and can implement ecoefficiency.

Keywords: Ecoefficient, Diversification, Essential Oil of Nutmeg Seeds and Leaves, Hydrosol