

## Diversity of antibacterial substances from selected Indonesian seaweeds

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### Abstrak

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This study, represented by seaweeds growing on the Warambadi seashore of Sumba Island, has therefore the following primary purposes: to screen and to evaluate the antibacterial activities of selected red, green, and brown seaweeds; to isolate and to identify the compounds from active extracts from representative species of red, green, and brown seaweeds; and to evaluate the bio activities of the isolated compounds by antibacterial bioassays. Based on the above experimental problems, the following hypotheses are put forward : (a) seaweeds from Warambadi seashore of Sumba island contain secondary metabolites as bioactive substances; (b) extracts of those seaweeds have potentials against bacteria; (c) according to the classes of seaweeds, those seaweeds have diversity of secondary metabolites both in kinds and in molecular structures; (d) the single compounds of those secondary metabolites are bioactive substances as antibacterial; (e) there is a synergism among single compounds of those secondary metabolites as bioactive substances.

Extracts from 9 species of red seaweeds, 6 species of green seaweeds and 6 species of brown seaweeds collected from Warambadi seashore of Sumba Island were screened for the production of antibacterial compounds. Extraction method used is maceration method with n-hexane (non-polar), acetone (semi-polar) and methanol (polar) as solvents. The antibacterial activities were tested against the Gram-positive bacteria *Staphylococcus aureus* and *Bacillus subtilis*, and the Gram-negative bacteria *Escherichia coli* and *Pseudomonas aeruginosa*. All the extracts were active against Gram-positive and Gram-negative bacteria, except the extracts of *Eucheuma denticulatum*, *Caulerpa racernosa* and *Caulerpa cupressoides* which were active against *Staphylococcus aureus* only. The highest range of extracts showing activity within species were found in the *Eucheuma Serra*, *Laurencia obtuse*, and *Corallopsis urvillae* of red seaweed, *Halimeda opuntia*, *Codiurn edule*, and *Caulerpa racernosa* of green seaweed and *Hydroclathrus ciathratus* and *Sargassum crassifolium* of brown seaweed. The study showed that semi-polar extract yielded higher antibacterial activity than polar and non-polar extracts.

As representative of seaweed classes, acetone extracts of *Eucheuma serra* a red seaweed, *Halimeda opuntia* a green seaweed, and *Hydroclathrus clathratus* a brown seaweed, were fractionated and isolated using Column Chromatography and Thin Layer Chromatography (TLC) methods.

Identification of the compounds used Gas Chromatography - Mass Spectrometry (GC-MS). Total identified compounds were 39, consisted of 15 compounds belonging to fatty acids, 8 compounds of steroids, 4 compounds of hydrocarbons, 6 compounds of alcohols, 4 compounds of aldehyds, and 1 compound each of airline and ether. Mass spectra analysis of *Eucheuma serra* fractions yielded 24 compounds, consisted of 7

compounds of fatty acids, 7 compounds of steroids, 3 compounds of hydrocarbons, 4 compounds of alcohols, and 3 compounds of aldehyde. Mass spectra analysis of *Halimeda opuntia* fractions yielded 4, compounds consisted of 3 compounds of fatty acids and 1 compound of amine. Mass spectra analysis of *Hydroclathrus clathratus* fractions yielded 16 compounds consisted of 8 compounds of fatty acids, 2 compounds of steroids, 2 compounds of hydrocarbons, 2 compounds of alcohol, 1 compound of aldehyd, and 1 compound of ether.

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Fourteen compounds indicated as having antibacterial activities were isolated from fractions of three species of *Eucheuma Serra*, *Halimeda opuntia*, and *H ydroclathrus olathratus* using bioautographic TLC methods.

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Identification of the compounds used GC-MS, and their antibacterial activities were tested by using the agar diffusion method against the Gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis* and *Streptococcus faecalis*, and the Gram-negative bacteria *Echerichia colt* *Pseudomonas aeruginosa* and *Salmonella typhimurium*. All the 14 compounds were active against Gram-positive bacteria especially *Bacillus subtilis*, and only 2 compounds had activity against Gram-negative bacteria *Escherichia coli*. All compounds were not active against *Pseudomonas aeruginosa* and *Salmonella typhimurium* bacteria. Nine compounds showed activity against *Staphylococcus aureus*, and 4 compounds .showed activity against *Streptococcus fascalis*. In *Eucheuma Serra* were found 8 compounds consisted of 3 compounds of fatty acids, 3 compounds of steroids, and 2 compounds of aldehyde. Only two fatty acid compounds came from *Halimeda optmtra*, and six compounds from *Hydroclathrus clathratus* consisted of 4 compounds of fatty acids, and one compound each of steroid and ether.

The results of these studies indicate that seaweed extracts from Warambadi seashore of Sumba Island have potentials against bacteria, Those seaweed species show significant capacity to produce a variety of compounds with antibacterial activities. It means that those seaweeds contain secondary metabolites as bioactive substances.