

**GM 41****Antibacterial Activity of Extracts and Essential Oils from  
*Agathis borneensis* Resin****Ismail Jusoh<sup>1\*</sup>, Fouziah Alet<sup>2</sup>, Zaini Assim<sup>2</sup> and Fasihuddin Badruddin Ahmad<sup>2</sup>**<sup>1</sup>Department of Plant Science and Environmental Ecology, <sup>2</sup>Department of Chemistry,  
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**Abstract**

Studies on bioactivity of extracts and essential oils from resin of *Agathis borneensis* were carried out. The antibacterial activity of *A. borneensis* extracts and essential oils were evaluated against five bacteria by agar diffusion method. The chemical constituents of the extracts and essential oils from the resin were analysed using gas chromatography-flame ionisation detector (GC-FID) and gas chromatography-mass spectrometer (GC-MS). Diameter of the inhibition zone of hexane extracts of *A. borneensis* resin varied from 8.7 to 10.0 mm. The largest zone of inhibition was obtained for *Salmonella typhi* (10 mm) and the lowest for *Enterobacter aerogenes*. Inhibition zones of dichloromethane extracts ranged from 8.7 to 11.1 mm. The largest zone of inhibition was obtained for *Salmonella typhi* (11.1 mm) whereas the lowest was for *Staphylococcus aureus* (8.7 mm). Chemical analyses showed that the most abundant constituents of the hexane and dichloromethane extracts were compounds from the phenolic, alcohol and terpene groups. The major phenolic compound was 2,4-di-tert-butylphenol. The main alcohol groups detected include dodecanol, tetradecanol, pentadecanol, nonadecanol, docosanol and tetracosanol. The terpene group detected were limonene-1,2-diol, manoyl oxide, pimaric acid, (-)-terpinen-4-ol and  $\alpha$ -campholenic aldehyde. Ethyl acetate and methanol extracts from the resin showed no significant activities. Hexane and dichloromethane extractives obtained from *A. borneensis* resin showed weak to moderate antibacterial activities. Resin essential oils did not show any significant activity.

**Introduction**

This tree species, *Agathis borneensis*, is known by several vernacular names all around Malaysia. It is known as "Bindang" in Sarawak, "Damar Minyak" in Peninsular Malaysia, "Manggilan" in Sabah and "Tulong" in Brunei. It usually found in mixed dipterocarp and kerangas forest of Sarawak in areas above 610 meter. At maturity the tree is resinous and it is usually collected by locals for household use. Resin is a sticky plant exudates that are mainly insoluble in water and harden when exposed to air. Resin is usually confused with other plant exudates including gums, mucilages, oils, waxes, and latex. Resin components are derived from photosynthetically produced carbohydrates that are broken down to produce simpler compounds known as pyruvate products (Langenheim, 2003). Resin is released as a response to tissue injury or attack by herbivore, pathogen and insect. *Agathis* resin is called 'dammar' locally whereas commercially it is called copal (Langenheim, 2003). The resins derived from various species of *Agathis* have a considerable industrial use such as in the production of varnishes, lacquers and floor covering while local used it for incense, torches, illumination, sealing wax and as a liniment (Soerianegara *et al.*, 1994). Chemical studies on the resin of *Agathis* especially *A. borneensis* from Sarawak are still limited. Thus the objectives of this study were to determine the chemical