

## Antimicrobial Activity of 5-Hydroxy-1,4-Naphthoquinone Isolated from *Caesalpinia sappan* toward Human Intestinal Microorganisms

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The methanol extract of *Caesalpinia sappan* heartwoods was tested for the growth effects toward five intestinal microorganisms. The biologically active constituent of the *C. sappan* extract was characterized as 5-hydroxy-1,4-naphthoquinone ( $C_{10}H_6O_3$ ). The growth responses varied depending on the bacterial species and dose tested. In the test with *Clostridium perfringens*, 5-hydroxy-1,4-naphthoquinone produced the strong (+++) inhibition at 5 and 2 mg/disk and moderate (++) inhibition at 1, 0.5, and 0.25 mg/disk. Furthermore, this isolate revealed a weak (+) growth inhibition against *Lactobacillus casei* at 5 and 2 mg/disk. In comparison of naphthoquinone derivatives, 5-hydroxy-2-methyl-1,4-naphthoquinone had moderate growth inhibition against *C. perfringens* at 5 and 2 mg/disk, whereas 1,4-naphthoquinone at 5 mg/disk significantly inhibited the growth of all bacteria tested. 1,2-Naphthoquinone had growth inhibition against all bacteria tested at 1 mg/disk. The structure-activity relationship revealed that 5-hydroxy-1,4-naphthoquinone had selective growth inhibition against *C. perfringens*. These results indicate that hydroxyl functional group of naphthoquinone seems to be required for selective growth-inhibiting activity against *C. perfringens*. Accordingly, as naturally occurring antimicrobial agents, *C. sappan* heartwood-derived material could be useful as a preventive agent against diseases caused by *C. perfringens*.

### Reference

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