

## Antibacterial activity of temu kunci tuber (*kaempheria pandurata*) essential oil against *Bacillus cereus*

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### Abstrak

Tujuan mekanisme khasiat antibakteri minyak atsiri rimpang temu kunci belum pernah dilaporkan. Telah dilakukan analisis mekanisme aktivitas antibakteri minyak atsiri rimpang temu kunci yang berasal dari Yogyakarta terhadap *Bacillus cereus*. Aktivitas yang diamati meliputi kemampuan minyak atsiri temu kunci dalam mengganggu permeabilitas membran sel sehingga menyebabkan kebocoran sel dan perubahan morfologi sel. Kebocoran sel diamati dengan keluarnya ion  $\text{Ca}^{+2}$ ,  $\text{K}^{+}$ , protein dan asam nukleat. Kebocoran ion diukur dengan metoda spektrometri serapan atom. Kebocoran protein diamati dengan alat spektrofotometer UV pada panjang gelombang 280 nm, sedangkan asam nukleat pada 260 nm. Perubahan morfologi sel diamati dengan alat scanning electron microscopy. Hasil Nilai minimum inhibitory concentration (MIC) dari minyak atsiri temu kunci adalah 0,12 % (v/v). Perlakuan *B.cereus* dengan minyak atsiri 1 MIC dan 2 MIC memberi pengaruh yang signifikan terhadap kebocoran sel dibanding kontrol ( $P<0.05$ ). Ion  $\text{K}^{+}$  yang terlepas dari sel adalah 10.32-35.57%, dan ion  $\text{Ca}^{+2}$  adalah 15.05-41.54%. Protein yang teramati pada 280 nm menunjukkan absorbansi antara 0.6330-0.8670, sedangkan asam nukleat 0.4320-0.8307, dan semuanya berbeda bermakna dibanding kontrol ( $P<0.05$ ). Pada pemberian 1 MIC minyak atsiri temu kunci sel *B.cereus* berubah menjadi lebih tebal, dengan lekukan-lekukan yang signifikan di seluruh sel. Pemberian 2 MIC minyak atsiri menyebabkan sel berubah menjadi transparan, kosong dan berpenampilan seperti ghost cell. Kesimpulan Minyak atsiri *kaempheria pandurata* menyebabkan kebocoran dan perubahan morfologi bakteri.

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<b>Abstract</b><br>

Aim The mechanism of temu kunci tuber essential oil potential as antimicrobial agent has not been reported. To analyze the mechanism of antibacterial activity of temu kunci tuber essential oil from Yogyakarta on *B.cereus*. Antibacterial activity of essential oil were analyzed for its ability to disrupt bacterial cell membrane, that caused cell leakage and altered the morphology of the bacteria. Leakage was measured by analyzing the  $\text{Ca}^{+2}$ ,  $\text{K}^{+}$  ion outflow using an atomic adsorption spectrometry (AAS), and protein and nucleic acid using an ultraviolet spectrophotometer (UVS) on 280 nm and 260 nm respectively. Alterations in morphology were assessed using scanning electron microscopy (SEM). Results Minimum inhibitory concentration (MIC) of temu kunci essential oil on *B.cereus* was 0.12% (v/v). Treatment of *B. cereus* using 1MIC and 2MIC showed significant leakage compared to control ( $P<0.05$ ). The  $\text{K}^{+}$  and  $\text{Ca}^{+2}$  ion leakage from the bacterial cells were between 10.32-35.57% and 15.05-41.54% respectively and showed significant difference compared to control ( $P<0.05$ ). The absorbance observed by UVS for protein and nucleic acid leakage were 0.6330-0.8670 at 280 nm and 0.4320-0.8307 at 260 nm, respectively, and were significantly different compared to control ( $P<0.05$ ). Exposure of 1 MIC temu kunci essential oil on *B.cereus* caused thickening as well as irregularities on the cell wall. At 2 MIC cells seemed transparent, empty looking and showed a ghost-like appearance. Conclusion *Kaempheria pondurata* essential oil could cause leakage and

alter the morphology of the bacteria.