

# Aktivitas insektisida ekstrak metanol rimpang jahe (*Zingiber officinale*) yang mengandung nanokomposit perak titanium dioksida terhadap larva dan nyamuk aedes aegypti = Insecticidal activity of methanolic extract of *Zingiber officinale* rhizome containing Ag-TiO<sub>2</sub> nanocomposite against *Aedes aegypti* larvae and mosquitoes

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## Abstrak

Latar Belakang: Demam Berdarah Dengue ditransmisikan oleh vektor nyamuk *Aedes aegypti* yang sudah resisten terhadap insektisida sintetik. Tujuan penelitian ini mengevaluasi aktivitas insektisida (larvasida dan adultisida) ekstrak rimpang (*Zingiber officinale*) yang mengandung nanokomposit Ag-TiO<sub>2</sub> terhadap *A. aegypti*.

Metode: Penelitian eksperimen terbagi dua kelompok. Pertama, larva *A. aegypti* dipaparkan dengan ekstrak jahe (konsentrasi 500, 1000, 1500, 2000, dan 2500 ppm), nanokomposit Ag-TiO<sub>2</sub> (konsentrasi 1, 3, 6, 9, dan 12 ppm), dan campuran ekstrak jahe dan nanokomposit (12 ppm) dengan lima pengulangan. Kedua, nyamuk dewasa betina *A. aegypti* dipaparkan dengan ekstrak jahe (konsentrasi 2500, 5000, 10 000, dan 20 000 ppm), nanokomposit Ag-TiO<sub>2</sub> (konsentrasi 5, 10, 20, dan 30 ppm), dan ekstrak jahe yang mengandung nanokomposit (30 ppm) dengan tiga pengulangan.

Hasil: Mortalitas 100% larva ditemukan pada ekstrak jahe yang mengandung Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 704,1 ppm, LC<sub>90</sub> = 1868,5 ppm) dan ekstrak jahe (LC<sub>50</sub> = 765,7 ppm, LC<sub>90</sub> = 1945,1 ppm). Terdapat perbedaan persentase mortalitas larva ( $p < 0,05$ ) dengan korelasi positif bermakna dengan konsentrasi ekstrak jahe ( $r = 0,6$ ), Ag-TiO<sub>2</sub> ( $r = 0,8$ ), dan ekstrak jahe yang mengandung Ag-TiO<sub>2</sub> ( $r = 0,7$ ). Sebesar 100% mortalitas nyamuk ditemukan pada Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 15,5 ppm, LC<sub>90</sub> = 99,0 ppm) dan ekstrak jahe yang mengandung Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 744,4 ppm, LC<sub>90</sub> = 5078,9 ppm). Terdapat perbedaan persentase mortalitas nyamuk ( $p < 0,05$ ) diikuti korelasi positif kuat antara konsentrasi Ag-TiO<sub>2</sub> ( $r = 0,9$ ) dan ekstrak jahe yang mengandung Ag-TiO<sub>2</sub> ( $r = 0,9$  p).

Kesimpulan: Ekstrak rimpang *Z. officinale* yang mengandung nanokomposit Ag-TiO<sub>2</sub> merupakan insektisida yang efektif untuk mengontrol populasi *A. aegypti*.

.....Background: Dengue hemorrhagic fever is transmitted by mosquito vector *Aedes aegypti* which has been reported resistant to synthetic insecticides. The aim of this study was to evaluate insecticide activities (larvacidal and adulticidal) of *Zingiber officinale* rhizome extract and Ag-TiO<sub>2</sub> nanocomposite against *A. aegypti*.

Method: This experimental study consists of two groups. First, the larvae of *A. aegypti* exposed to ginger extract (concentrations 500, 1000, 1500, 2000, and 2500 ppm), Ag-TiO<sub>2</sub> nanocomposite (concentrations 1, 3, 6, 9, and 12 ppm), and mixture of *Z. officinale* rhizome extract and Ag-TiO<sub>2</sub> (12 ppm) in 5 replicates. Second, adult female *A. aegypti* mosquitoes exposed with ginger extract (concentrations 2500, 5000, 10000, and 20000 ppm), Ag-TiO<sub>2</sub> nanocomposite (concentrations 5, 10, 20, 30 ppm), and ginger extract containing nanocomposite (30 ppm) in 3 replicates.

Result: *A. aegypti* larvae 100% mortality was found on the ginger extract containing Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 704,1 ppm, LC<sub>90</sub> = 1868,5 ppm) and ginger extract (LC<sub>50</sub> = 765,7 ppm, LC<sub>90</sub> = 1945,1 ppm). There was a

significant difference ( $p < 0,05$ ) and a significant positive correlation between larvae mortality and the concentration of ginger extract ( $r = 0,6$ ), Ag-TiO<sub>2</sub> ( $r = 0,8$ ), and ginger extract containing Ag-TiO<sub>2</sub> ( $r = 0,7$ ). Mosquitoes 100% mortality was found on the Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 15,5 ppm, LC<sub>90</sub> = 99,0 ppm) and ginger extract containing Ag-TiO<sub>2</sub> (LC<sub>50</sub> = 744,4 ppm, LC<sub>90</sub> = 5078,9 ppm). Percentage difference ( $p < 0,05$ ) and strong positive correlation was found between the mortality of mosquitoes and the Ag-TiO<sub>2</sub> ( $r = 0,9$ ) and ginger extract containing Ag-TiO<sub>2</sub> ( $r = 0,9$ ) concentrations.

Conclusion: *Zingiber officinale* rhizome extract containing Ag-TiO<sub>2</sub> nanocomposite is an effective insecticide to control *A. aegypti* population.