

EFEK KOMBINASI PESTISIDA BERBAHAN AKTIF Klorpirifos DAN MANCOZEB TERHADAP KERUSAKAN DNA

Chlorella sorokiniana Shihira et Krauss

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INTISARI

Klorpirifos (CP) dan Mancozeb (MZ) merupakan bahan aktif yang umum diaplikasikan sebagai campuran pestisida di Indonesia. Penggunaan campuran pestisida berpotensi meningkatkan tingkat toksisitas pada organisme non-target seperti mikroalga, namun penelitian mengenai efek toksik kombinasi CP dan MZ pada organisme non-target belum banyak dipelajari. Oleh karena itu, penelitian ini dilakukan untuk mempelajari efek kombinasi bahan aktif pestisida CP dan MZ terhadap pertumbuhan dan kerusakan DNA mikroalga *Chlorella sorokiniana*. Penelitian dilakukan dengan 4 variasi kombinasi CP dan MZ berdasarkan nilai IC₅₀ masing-masing toksikan dan waktu sampling dilakukan pada waktu paparan jam ke-0, 6, 24 dan 48 jam. Analisis pertumbuhan mikroalga diestimasi dengan metode hemositometer, dan analisis kerusakan DNA dengan *comet assay* menggunakan parameter *Tail Intensity* (TI%), *Head Intensity* (HI%), *Tail Moment* (TM), *Tail Factor* (TF), dan *Olive Tail Moment* (OTM) melalui perangkat lunak *Comet Score*. Seluruh data dianalisis dengan two-way ANOVA, uji lanjutan DMRT, dan visualisasi menggunakan *Microsoft Excel*. Berdasarkan hasil, perlakuan kombinasi CP dan MZ mampu meningkatkan penghambatan pertumbuhan *C. sorokiniana* secara signifikan, dengan perlakuan CP 2,99 mg/L + MZ 9,48 mg/L memberikan penghambatan pertumbuhan tertinggi. Tingkat genotoksistas *C. sorokiniana* meningkat seiring dengan peningkatan konsentrasi kombinasi CP + MZ, yang ditandai dengan peningkatan nilai TI%, TM, dan OTM, serta penurunan HI%. Genotoksistas cenderung berbanding lurus dengan lama pemaparan toksikan, paparan selama 24 jam menunjukkan hasil peningkatan genotoksistas yang signifikan, namun mengalami penurunan tingkat kerusakan DNA pada waktu paparan 48 jam.

Kata kunci: *Chlorella sorokiniana*, *Comet assay*, Kerusakan DNA, Klorpirifos, Mancozeb.

**COMBINED EFFECT OF PESTICIDES CONTAINING ACTIVE
INGREDIENTS OF CLORPHYRIFOS AND MANCOZEB ON THE DNA
DAMAGE OF *Chlorella sorokiniana* Shihira et Krauss**

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ABSTRACT

The use of pesticides in agriculture nowadays is so extensive, it could potentially increase its toxic effects to non-target organisms such as microalgae. Chlorpyrifos (CP) and Mancozeb (MZ) are active compound that is commonly applied as an insecticide and fungicide in Indonesia in mixture with other pesticides. The use of a mixture of pesticides has the potential to increase the level of toxicity, but research on the toxic effects of the combination of CP and MZ on non-target organisms has not been studied. Therefore, this research was conducted to study the effect of the combination of active ingredients of pesticide CP and MZ on the growth and DNA damage of the microalgae *Chlorella sorokiniana* through comet assay. The study was conducted with 4 variations of exposure to the combination of CP and MZ based on the IC₅₀ value of each toxicant, and the microalgae sampling was carried out at 0, 6, 24 and 48 hours of exposure. Analysis of microalgae growth was estimated by hemocytometer method, and DNA damage analysis by comet assay using Tail Intensity (TI%), Head Intensity (HI%), Tail Moment (TM), Olive Tail Moment (OTM) and Tail Factor (TF) as parameters. Comet assay data were analyzed by Comet Score, all data were analyzed by two-way ANOVA and DMRT follow-up test, and visualization using Microsoft Excel. Based on the results, the combination treatment of CP and MZ was able to significantly increase the growth inhibition of *C. sorokiniana*, with the treatment of CP 2.99 mg/L + MZ 9.48 mg/L providing the highest growth inhibition. The level of genotoxicity of *C. sorokiniana* increased with the increase in the concentration of the combination CP + MZ, which was indicated by an increase in TI%, TM, and OTM values, as well as a decrease in HI%. Genotoxicity tends to be directly proportional to the duration of toxicant exposure, with exposure for 24 hours showed a significant increase in genotoxicity, but the level of DNA damage is decreased at 48 hours of exposure.

Keywords: *Chlorella sorokiniana*, Comet assay, DNA damage, Klorpirifos, Mancozeb.