Deteksi Gen Resisten Antimikroba dan Analisis Kelimpahan Logam Berat di Lingkungan Industri Pertanian-Peternakan Intensif

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INTISARI

Antimikroba dan pestisida seperti herbisida, insektisida, fungsida, dan bakterisida banyak digunakan di lingkungan pertanian dan peternakan di Indonesia. Penggunaan antimikroba dan pestisida memicu penyebaran gen resisten antimikroba dan logam berat di lingkungan pertanian dan peternakan. Oleh karena itu penelitian ini bertujuan untuk mendeteksi penyebaran gen resisten antimikroba, menganalisis kelimpahan gen resisten antimikroba, dan mengukur kelimpahan logam berat di lingkungan industri pertanian-peternakan intensif di Lampung.

Deteksi gen resisten antimikroba dilakukan dengan metode *Polymerase Chain Reaction* (PCR) menggunakan 10 primer gen resisten antimikroba yaitu *aadA7, blaSFO, qepA, tetW, vanTC, ermX, blaVIM, mcr8, tetX5,* dan *blaNDM5*. *Quantitative Polymerase Chain Reaction* (qPCR) dilakukan untuk mengetahui kelimpahan gen resisten antimikroba dengan 5 primer gen resisten antimikroba yaitu *tetW, vanTC, ermX, tetX5,* dan *aadA7*. Pengukuran kelimpahan logam berat dilakukan dengan mengukur konsentrasi total Cd, Cr, dan Pb menggunakan *X-Ray Fluorescence* (XRF).

Terdapat 5 gen resisten antimikroba yang ditemukan di lingkungan industri pertanian-peternakan intesif yaitu *tetW, vanTC, ermX, tetX5,* dan *aadA7*. Kelimphan masing-masing gen resisten antimikroba berbeda tiap sampel. Gen *aadA7* merupakan gen resisten antimikroba yang paling melimpah di antara keempat gen yang lain. Cr, Cd, dan Pb terdapat pada semua sampel kecuali sampel effluent cair, larutan dekomposer, dan air embung. Konsentrasi Cr paling melimpah di antara logam berat yang lain tetapi tidak melebihi batas yang diperbolehkan (*permissible limit*) pada semua sampel kecuali pada sampel sampel limbah industri pengalengan nanas/kulit nanas dan sampel limbah industri pembuatan enzim bromelain/bonggol nanas.

Kata Kunci: Antimikroba, Gen Resisten Antimikroba, Logam Berat, Pertanian, Peternakan

Detection of Antimicrobial Resistance Gene and Analysis The Abundance of Heavy Metals in Intesive Agricultural Environment

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ABSTRACT

Antimicrobials substances and pesticides such as herbicides, insecticides, fungsicides, and bacteriocides were widely used in agricultural and livestock environments in Indonesia. The used of antimicrobials and pesticides triggered the spread of antimicrobial and heavy metal resistant genes in the agricultural and livestock environment. Therefore, this study aims to detect the spread of antimicrobial resistant genes, analyze the abundance of antimicrobial resistant genes, and measure the abundance of heavy metals in the intensive agricultural-livestock industry environment in Lampung.

Detection of antimicrobial resistant genes was carried out by *Polymerase Chain Reaction* (PCR) method using 10 antimicrobial resistant gene primers namely *aadA7, blaSFO, qepA, tetW, vanTC, ermX, blaVIM, mcr8, tetX5,* and *blaNDM5*. *Quantitative Polymerase Chain Reaction* (qPCR) was performed to determine the abundance of antimicrobial resistant genes with 5 antimicrobial resistant gene primers namely *tetW, vanTC, ermX, tetX5*, and *aadA7*. Measurement of heavy metal abundance was carried out by measuring the total concentration of Cd, Cr, and Pb using *X-Ray Fluorescence* (XRF).

There were 5 antimicrobial resistant genes found in the intensive agricultural industry environment, namely *tetW, vanTC, ermX, tetX5*, and *aadA7*. The abundance of each antimicrobial resistant gene was different for each sample. The *aadA7* gene was the most abundant antimicrobial resistant gene among the other four genes. Cr, Cd, and Pb were present in all samples except liquid effluent, decomposer solution, and pond water (irrigation water). The concentration of Cr was the most abundant among the other heavy metals but did not exceed the permissible limit in all samples except for waste of post harvest fruit process/waste of pineapple skin and waste of plant enzyme extraction (bromelain enzyme).

Keywords: Antimicrobial Substance, Antimicrobial Resistance Gene, Heavy Metal, Agriculture, Husbandary