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Tetracycline Resistance and Prevalence of Tetracycline Resistance Genes in Bacteria from Marine Aquaculture Farms in Peninsular Malaysia

(Rintangan Tetrasiklin dan Kelaziman Gen Rintangan Tetrasiklin dalam Bakteria daripada Ladang Akuakultur Marin di Semenanjung Malaysia)

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ABSTRACT

The indiscriminate use of antibiotic in aquaculture and leaching of antibiotic from aquaculture to the environment may led to the emergence and spread of antibiotic resistant bacteria and their resistant genes which is a public concern. Five tetracycline antibiotics (minocycline, doxycycline, chlorotetracycline, oxytetracycline and tetracycline) and 14 types of tetracycline genes, tet*[(A), (B), (C), (D), (E), (G), (K), (L), (M), (O), (S), (P), (Q) and (X)], were investigated in waters from five marine aquaculture farms in Peninsular Malaysia. Tetracycline was detected in low concentrations from <LOQ to 25.6 ng/L. A total of 93 isolates of bacteria were isolated whereby* Vibrio *(n=29) and* Pseudoalteromonas *(n=7) were the predominant bacteria. Forty-eight of the isolates carried* tet *genes with 22.9% encoded multiple* tet *genes and 72.9% encoded a single* tet *gene.* tet*(A) (n = 20, 42%) was the most prevalent gene followed by* tet*(B) (n = 14, 29%) and* tet*(K) (n = 13, 27%). A few common* tet *carriers* (Enterobacter, Vibrio, Photobacterium, *and* Pseudoalteromona*s*) *carrying* tet *genes that have not been reported were identified. The values of the risk quotients (RQs) of tetracycline in Matang was 0.28 which posed a medium ecological risk to algae. Thus, the antibiotic residues in the aquaculture farm in Matang need to be monitored closely.*

Keywords: Aquaculture; risk assessment; tetracycline; tetracycline resistance gene

ABSTRAK

Penggunaan antibiotik secara sembarangan dalam akuakultur dan pengaliran antibiotik daripada akuakultur ke alam sekitar menyebabkan kemunculan dan penyebaran bakteria rintangan antibiotik dan gen rintangan, ini merupakan isu dibimbangkan oleh masyarakat. Lima antibiotik tetrasiklin (minosiklin, doksisiklin, klorotetrasiklin, oksitetrasiklin dan tetrasiklin) dan 14 jenis gen tetrasiklin, tet*[(A), (B), (C), (D), (E), (G), (K), (L), (M), (O), (S), (P), (Q) dan (X)], dikaji di perairan daripada lima ladang akuakultur laut di Semenanjung Malaysia. Tetrasiklin dikesan dalam kepekatan dari <LOQ hingga 25.6 ng/L. Sebanyak 93 isolat bakteria telah dipencilkan,* Vibrio *(n= 29) dan* Pseudoalteromonas *(n = 7) merupakan bakteria yang dominan. Empat puluh lapan isolat didapati membawa gen* tet *dengan 22.9% membawa pelbagai gen* tet *dan 72.9% membawa satu gen* tet*.* tet*(A) (n = 20, 42%) merupakan gen yang paling lazim diperoleh diikuti* tet*(B) (n = 14, 29%) dan* tet*(K) (n = 13, 27%). Sebilangan besar pembawa* tet *biasa* (Enterobacter, Vibrio, Photobacterium *dan* Pseudoalteromonas) *didapati membawa gen* tet *yang belum dilaporkan dan telah dikenal pasti dalam kajian ini. Nilai kuota risiko (RQ) tetrasiklin di Matang didapati 0.28, ia akan menimbulkan risiko ekologi yang sederhana terhadap alga. Oleh itu, sisa antibiotik di ladang akuakultur Matang perlu dipantau dengan teliti.*

Kata kunci: Akuakultur; penilaian risiko; tetrasiklin; tetrasiklin gen rintangan

Introduction

With a growing population, wild captured fishes are no longer sufficient to fulfil the need for human consumption of seafood. Aquaculture industry has become an important sector with the production of global aquaculture in 2016 at 80 million tonnes with an estimated value of USD231.6 billion (FAO 2018). Malaysia was ranked 15th top aquaculture producer globally in 2014