Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Doctor of Philosophy

BIODEGRADABILITY OF MICROPLASTICS BY BIOFLOC-PRODUCING BACTERIA DURING LARVAL REARING OF MUD CRAB, GENUS *Scylla*

MD. SHAHADAT HOSSAIN

JULY 2024

Main Supervisor : Assoc. Prof. Ts. Nor Azman Kasan (Ph.D.)

Co-Supervisor : Ts. Khor Wai Ho (Ph.D.)

School/Institute : Institute of Tropical Aquaculture and Fisheries

Biofloc technology (BFT) has been effective in controlling chemical toxicants in aquaculture, but its role in mitigating Microplastic (MP) pollution in hatchery systems is understudied. This research aimed to evaluate the efficiency of Biofloc-producing Bacteria (BPB) during the larval rearing (Zoea 1 to Zoea 5) of mud crab, genus *Scylla*, focusing on water quality, growth, and larval development. BPB were isolated from a mud crab farm, and MPs were assessed for abundance and pollution index. Six bacterial strains, identified as *Bacillus tropicus* (SHBF1), *B. cereus* (SHBF2), *Cytobacillus firmus* (SHBF3), *Micrococcus luteus* (SHBF4), *Priestia flexa* (SHBF5), and *Vibrio alginolyticus* (SHBF6), were tested for flocculation activity, with SHBF1 and SHBF2 exhibiting the highest rates 94.99 ± 0.006% and 93.67 ± 0.022%, respectively. SHBF4 and SHBF6 were excluded due to lower flocculation activity and pathogenicity, respectively. MP abundance in water ranged from 0.864 to 1.96 particles/L, while sediment ranged from 37.08 to 57.83 particles/g. Transparent and fibrous MPs were most prevalent, with polyethylene (PE), polypropylene (PP), polystyrene (PS), and nylon being identified through FTIR analysis. The four selected bacterial strains were incubated with MPs (PE, PP, PS, and nylon) for 60 days, confirming their biodegradation ability. SHBF1 exhibited the highest degradation rates for PE (9.21%), PS (11.08%), and PP (7.99%), while SHBF3 was most effective for nylon (8.06%). Quantitative and qualitative analyses

confirmed significant ($p<0.05$) degradation, with parameters such as hydrophobicity, pH, CO_2, and enzyme activity indicating MP breakdown. SHBF1 was identified as the most effective strain through multi-criteria decision analysis (MCDA). Its application in the hatchery significantly improved mud crab larval survival in MP-exposed conditions, enhancing survivability to 37.5% ($p>0.05$) compared to non-biofloc treatments. In conclusion, all four selected BPB strains can be used to degrade MPs, with SHBF1 improved mud crab seed production in the hatchery.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

KEBOLEHAN UNTUK BIODEGRADASI MIKROPLASTIK OLEH BAKTERIA PENGHASIL-BIOFLOK SEMASA TERNAKAN LARVA KETAM NIPAH, GENUS *Scylla*

MD. SHAHADAT HOSSAIN

JULAI 2024

Penyelia : **Prof. Madya Ts. Nor Azman Kasan (Ph.D.)**

Penyelia Bersama : **Ts. Khor Wai Ho (Ph.D.)**

Pusat Pengajian/Institut : **Institut Akuakultur Tropika Dan Perikanan**

Teknologi bioflok (BFT) berjaya mengawal bahan toksik kimia dalam akuakultur, namun peranannya terhadap pengurangan pencemaran mikroplastik (MPs) dalam sistem penetasan belum dikaji. Kajian ini bertujuan untuk menilai keberkesanan bakteria penghasil-bioflok (BPB) untuk mendegradasi MPs semasa ternakan larva (Zoea 1 hingga Zoea 5) ketam nipah, genus *Scylla* dengan memberi tumpuan kepada kualiti air, prestasi pertumbuhan, dan perkembangan larva. BPB dipencilkan daripada ladang ketam nipah, manakala kelimpahan dan indeks pencemaran MPs juga dikaji menggunakan sampel yang sama. Enam strain BPB seperti *Bacillus tropicus* (SHBF1), *B. cereus* (SHBF2), *Cytobacillus firmus* (SHBF3), *Micrococcus luteus* (SHBF4), *Priestia flexa* (SHBF5), dan *Vibrio alginolyticus* (SHBF6) dikenalpasti dengan aktiviti penggumpalan antara 74.81% hingga 94.99%. Strain SHBF4 dan SHBF6 dikecualikan kerana patogenisiti dan aktiviti flokulasi yang rendah. Purata kelimpahan MPs dalam air ialah 0.864 hingga 1.96 zarah/L, manakala dalam sedimen ialah 37.08 hingga 57.83 zarah/g. MPs jenis lutsinar dan fiber adalah yang paling dominan, dengan polietilena (PE), polipropilena (PP), polistirena (PS), dan nilon dikenalpasti melalui spektroskopi *Fourier Transform Infrared* (FTIR). Empat strain BPB yang sesuai diinkubasi dengan zarah MPs selama 60 hari, dan penguraian biodegradasi ditentukan melalui analisis kualitatif dan kuantitatif. SHBF1 menunjukkan kadar penguraian tertinggi bagi PE (9.21%), PS

(11.08%), dan PP (7.99%), manakala SHBF3 paling berkesan untuk nilon (8.06%). Parameter seperti hidrofobisiti, pH, pembebasan CO_2, aktiviti enzim hidrolisis, serta lekatan sel bakteria, perubahan fizikal, dan pembentukan biofilem menunjukkan penurunan MPs yang signifikan ($p<0.05$) oleh semua strain. Analisis keputusan multi-kriteria (MCDA) telah mengenalpasti SHBF1 sebagai strain paling berkesan untuk digunakan sebagai inokulum bioflok. Aplikasi SHBF1 meningkatkan kemandirian larva ketam nipah kepada 37.5% ($p>0.05$) berbanding kawalan, dan dengan ketara ($p<0.05$) dalam kedaan yang terdedah kepada MPs (PP, PS, dan nilon). Kesimpulannya, kesemua empat strain BPB boleh digunakan untuk menguraikan MPs, dengan SHBF1 akan meningkatkan pengeluaran benih ketam nipah di hatcheri.