Production of Biosurfactants and Bioemulsifiers by Indigenous Bacteria Isolated from Petroleum Sludge and Their Association with Total Petroleum Hydrocarbon Degradation

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INTRODUCTION

- Microbial biosurfactants and bioemulsifiers are amphiphilic, surface-active compounds produced during biodegradation, increasing the bioavailability of organic pollutants such as hydrocarbons.
- Microorganisms that have the ability to consume petroleum hydrocarbon as carbon source and simultaneously produce biosurfactants and bioemulsifiers can be manipulated for bioremediation and microbial enhanced oil recovery (MEOR) in petroleum industry.
- Bacteria such as Acinetobacter, Aeromonas, Pseudomonas and Rhodococcus have been isolated from different types of petroleum crude oil in Malaysia and were characterized as promising biosurfactant-producers and also hydrocarbon degraders (Hamzah et al., 2010, Hamzah et al., 2013).
- This study was conducted to screen for indigenous bacteria from petroleum sludge which are able produce biosurfactants and bioemulsifiers and the association with their ability to degrade total petroleum hydrocarbons (TPH).

RESULTS & DISCUSSION

- Most isolates are Gram negative bacteria with majority of them are Pseudomonas.
- Preliminary screenings of biosurfactant and bioemulsifier activity from the total number of 26 isolates revealed some potential biosurfactant-producing bacteria (BSP) while some were potentially bioemulsifier-producing bacteria (BEP).
- Surface tension measurement revealed the biosurfactant activity of the isolates, which were as low as ≈ 18.92 mN/m for a potential BSP; while the rest were between the range of 45 to 28 mN/m.
- Highest emulsification index (E24) exhibited by potential BEP (\approx 72.81 %) while for the rest of the isolates were between 64 to 68 %.
- Assuming growth-linked biodegradation; growth curves of these bacterial isolates showed acclimation period for up to more than 72 hours of incubation; whereby no evident disappearance of TPH had been detected.
- after six days, rate of TPH loss became rapid; whereby biodegradation percentage of TPH was about (\approx 73 %). By the 12th day of biodegradation study, the percentage of TPH loss was up to (\approx 85 %).





Figure 1: Biosurfactant activity screening by surface tension measurement of cell free supernatant. Blue bar indicate potential BSP with lowest surface tension.

Emulsification Index





Figure 2: Bioemulsifier activity screening by determining emulsification of cell free supernatant. Blue bar indicate potential BEP with highest emulsification index.

Figure 3: Growth-linked biodegradation of total petroleum hydrocarbon (TPH) showed by the association of growth curve (a) and degradation of TPH (b) over time by potential BSP & BEP

OUTLOOK & CONCLUSION

- Both potential BSP and BEP were potent hydrocarbon biodegraders and that both biosurfactants and bioemulsifiers were unique microbial products showing
 advantageous features in hydrocarbon biodegradation.
- Both bioemulsifiers and biosurfactants could be extracted and purified from bacteria as both molecules have great potential for application in green technology.

REFERENCES

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