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Entitled

IMPROVING PHYTOREMEDIATION OF OIL POLLUTED SOIL IN THE UAE USING ACC DEAMINASE PRODUCING BACTERIA UNDER ARID CONDITIONS

by

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Abstract

Many 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase-producing and oil-degrading rhizosphere actinomycetes were isolated from oil-contaminated soils in the United Arab Emirates. These actinomycetes isolates were further selected based on their ability to solubilize phosphorus, to produce siderophores, and to produce plant growth regulators (PGRs) including auxins and polyamines. The ability of the most-promising isolates to promote the growth of the hyper-accumulating plants "Bermuda grass" in soil polluted with Light Arabian Crude Oil (LACO) was evaluated under greenhouse conditions. Under controlled greenhouse conditions, the application of the strongest actinomycete isolate which exhibited the maximum production of ACC deaminase and PGRs promoted Bermuda grass roots and shoots in oil-polluted soils compared to control plants grown in oil-polluted soils but without the application of actinomycete isolate. The application of the actinomycete isolate has also significantly ($P < 0.05$) increased photosynthetic pigment contents and promoted Bermuda grass growth characteristics including increased fresh and dry weight and increased length of roots and shoots, and increased total leaf area compared with control plants. The application of the actinomycete isolate also significantly ($P < 0.05$), reduced the levels of ACC in the roots and shoots compared with control plants grown in oil-polluted soils without the application of actinomycete isolate. The application of actinomycete isolate with the hyper-accumulating plants significantly, reduced the levels of the total recoverable hydrocarbons (TRH) and polycyclic aromatic hydrocarbons (PAHs) in oil-polluted soils compared with control treatment. The application of actinomycete isolate with the hyper-accumulating plants significantly, increased the levels of the total recoverable hydrocarbons (TRH) and polycyclic aromatic hydrocarbons (PAHs) in Bermuda grass roots compared with control Bermuda grass treatment without the addition of the actinomycete isolate. The TRH were reported as four alkane groupings based on the carbon chain length of the compounds: C_6 - C_9, C_{10} - C_{14}, C_{15} - C_{28}, and C_{29} - C_{36}. The PAHs tested were naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo [*a*] anthracene, chrysene, benzo [*b*] fluoranthene, benzo [*k*] fluoranthene, benzo [*a*] pyrene, Indeno [*I 23-cd*] pyrene, dibenzo [*ah*] anthracene and benzo [*ghi*] perylene. In conclusion, I report the production of ACC deaminase by different actinomycetes isolates and their ability to enhance the growth of the hyper-accumulating plants in the presence of LACO through the reduction in the *in planta* levels of endogenous ethylene levels. This study is the first report to demonstrate the potential of oil-degrading rhizosphere actinomycetes to produce ACC deaminase and to improve the phytoremediation capability of the hyper-accumulating plants grown in oil-contaminated soil through the production of ACC deaminase and PGRs. The application of these beneficial actinomycetes may help in the phytoremediation of oil-polluted environments in the UAE.

Keywords: Phytoremediation, Actinobacteria, ACC deaminase, Oil pollution