FATE OF ENGINEERED NANOPARTICLES IN DIFFERENT SOILS OF SRI LANKA

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Nanotechnology has been a hype in recent sciences leading to mass production and the inevitable release of diverse engineered nanoparticles (ENPs) into the environment. As a result, agricultural soils are gradually becoming a primary sink for ENPs with diverse applications. The fate of ENPs may be different from the generalised hypothesis, due to inherent heterogeneity of Sri Lankan soils. This study was steered to uncover the still not known behaviour of ENPs in dominant agricultural soils of Sri Lanka. Titanium Dioxide (TiO_2) was the selected ENP, as it shows a wide range of applications. Paddy grown Low Humic Gley (LHG) and Reddish Brown Earth (RBE) soils were treated with 10 ppm of TiO_2, after amending with municipal solid waste compost. The behaviour of TiO_2 was tested for leaching and colloidal absorbance using a leaching column and an incubation study, with and without organic matter (OM). Results from the ICP-MS revealed that leaching of TiO_2 from RBE was 0.04%, compared to 0.4% from LHG after the first week. No significant difference ($p>0.05$) was observed with the presence of OM in RBE, while the leaching was 0.2% in LHG. The cumulative TiO_2 leaching was 0.14% in RBE and 0.62% in LHG with the absences of OM, after the third week. No significant variations ($p>0.05$) either in pH or EC were observed in the incubated soils and the leachate from both RBE and LHG with added TiO_2. The incubation study showed that TiO_2 tends to reduce organic carbon percentage of LHG with the absence of OM. organic carbon % of RBE was not changed with TiO_2. The active carbon content of both soils did not show a substantial variation with TiO_2. Added TiO_2 resulted a reduction in potentially mineralisable nitrogen in the absence of OM, in both soils, at two months after incubation. This study concluded that TiO_2 might potentially immobilise in RBE soils than in LHG, yet OM has more potential in immobilising. Colloidal absorbance via CEC sites would result long-term retention of TiO_2 and may amplify in trophic levels too.

Keywords: Engineered nanoparticles, Incubation study, Leaching column study, Titanium dioxide