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Demonstrating Association between Dissolved Organic Carbon and Pesticide in Shallow Groundwater of Western Bengal basin, India

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The role of increasing population density is especially prominent as the major force driving the need to increase food production, environment stress on water, forest, soils and air that stem from agriculture. The environmental challenges that the country faces are intrinsically connected with the state of environmental natural resources and poverty in its different dimensions and economic growth. Due to increasing global population and demand for food production projected to increase by 70%. Consequently, the use of pesticides has been increased dramatically since the early 1990s. The need of understanding transport process of pesticide contamination in groundwater has developed besides the discovering of contamination of soil and groundwater due to anthropogenic activity. The mobility of pesticide in the soil is affected by its partitioning to dissolved organic carbon (DOC). The effects of DOC on the conveyance of pesticides into groundwater are still unexplored. Use of pesticide has been increased from 13% to 52% from 1990 to 2017 and Western Bengal basin uses 41% of the pesticide as the insecticide and 34% as the herbicide. The aim of this study was to investigate the transport processes of Malathion and Atrazine with DOC by fabricating laboratory-based batch study. This study involves 235 shallow groundwater samples collected across Western Bengal basin. The study was validated by a transport model using modeling software PEST. Groundwater at different locations was characterized by high Malathion and Atrazine content together with high DOC content. Two different modeling scenarios were developed, viz. transport of Malathion with K_{DOC} median value, transport of Atrazine with K_{DOC} median value, to assess the role of DOC on the movement of Malathion and Atrazine into groundwater. The result showed a significant positive correlation at 99% confidence level with Malathion and at 95% confidence level with Atrazine ($r^2_{malathion-DOC}$ = 0.892; $r^2_{atrazine-DOC}$ = 0.865). The persistence of high DOC has significant implications for the fate of pesticide into groundwater. Co-occurrence network analysis was performed based on measured dissolved organic carbon concentration and pesticide concentration in groundwater samples. The network consisted of different sub-networks which were composed of both positive and negative association.