## ABSTRACT

Over the past few decades, colloid and colloid-facilitated solute transport have emerged as significant environmental issues. Underestimating the migration and retention behavior of colloid-facilitated contaminants imparts a potential threat and risk to subsurface contamination of hazardous pollutants in the aquifer ecosystem. This research study dealt with the experimental investigation on mobilization and retention of CML colloids and colloidfacilitated heavy metals [Cr(VI) and Pb(II)] in saturated quartz sand medium comprising different median grains sizes. The experimental inspection revealed that the retention of CML colloids increased with a decrease in sand grain sizes. The peaks of the relative concentrations of CML colloids occurred earlier compared to that of dissolved Cr(VI) and Pb(II) and that signified the co-transport of heavy metals along with colloidal particles in the porous medium having finer grains. Due to the microscopic size of colloidal particles, the movement of the colloidal particles was faster compared to the dissolved heavy metals. The temporal moment analysis was performed utilizing the experimental data of the column study to interpret the plume behavior of colloid-facilitated contaminant transport. The result of temporal moments suggested that the eluted mass of CML colloids reduced with higher depth from the column inlet and also, the reduction was maximum for the medium having a higher percentage of finer particles. The increase in the first temporal moment for both CML colloids and dissolved heavy metals with a decrease in sand grain sizes indicated that the average residence time of CML colloid-facilitated heavy metals was higher for finer particles. This research utilized the experimental breakthrough plots of heavy metals in the Monte Carlo simulation technique to provide a realistic scenario of risk assessment for adults and children through the ingestion and dermal exposure of groundwater resources contaminated by the heavy metals under consideration. The statistical interpretation revealed that both the health quotient and cancer risk for non-carcinogenic risk and carcinogenic risk, respectively, exceeded the permissible

limits prescribed by USEPA, 2018. Appropriate and suitable strategies for groundwater remediation need to be formulated to address the harmful effect of ingestion of carcinogenic Cr(VI) and Pb(II) on human health.