Implications of rainfall runoff on arsenic mobilization and bioaccessibility in mining regions

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Physical and chemical weathering of arsenic-enriched mine wastes can lead to the mobilization of potentially harmful sediments into residential areas. Specifically, seasonal weathering events such as rain or wind are likely to lead to arsenic mobilization patterns that can be utilized to estimate the risk of chronic arsenic exposure for residents living near mine areas. It is hypothesized that the concentration and bioaccessibility of arsenic within sediments mobilized via the rainwater runoff pathway are directly related to the total volume of precipitation, thus leading to a higher degree of exposure during the rainy seasons.

To test this, mine runoff sediment from the Red Hill mine in Tustin, California, was collected monthly and following rain events over the course of 13 months and analysed for initial arsenic concentration (range: 113-213 ppm). All samples were then subjected to simulated gastric fluid extractions to determine the potential bioaccessibility of arsenic in the sediments via the ingestion exposure pathway.

Results suggest a moderate inverse correlation (R^2=0.64)39) between arsenic bioaccessibility and average volume of rainfall and a moderate direct correlation (R^2=0.45) little to no correlation(R^2=0.20) between initial concentration and average volume of rainfall in the preceding 30 days volume of preceding rainfall . These findings suggest that during the rainy season, more sediment is mobilized from the tailings piles resulting in higher concentrations of arsenic in sample collections. However, due to the increased precipitation more soluble species may be removed during transport, leaving less bioaccessible arsenic behind. Additionally, effluorescence or formation of secondary arsenic-bearing phases may take place, resulting in the formation of more soluble species and correspondingly higher arsenic bioaccessibility during the drier months.

Applications and New Challenges in Molecular-Scale Characterization of Inorganic Contaminants

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Over the last few decades, advances in spectroscopic techniques have offered an unprecedented ability to study the chemistry of contaminants in natural and model systems at the molecular- to micro-scale. Molecular-scale data have provided