

Trace elements in coal ash and sludge amended soils in India: comparison between baseline and monitored soils

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Deficiency in the nutrient content of several soil types in India have been primarily caused by high rates of erosion under extreme climatic conditions. Remineralising these 'difficult' soils and increasing their bioproductivity has been a challenging task for the last decade. In this work, two environmentally toxic waste materials, coal fly ash and sewage sludge, have been added as amendments to the soils. The fate and mobility of five potential biotoxic metals found in the amendments (As, Pb, Ni, Cr and Co) are part of this study.

X-ray diffraction coupled with SEM studies have been used to identify the relative proportions of important mineral phases in red soils (pH 5.3-6.4), black soils (pH 8.0-8.3) and saline-alkali soils (pH 10.3). The total trace metal concentration (aqua-regia extraction) and the bioavailable portion (Mehlich III) of the metals were analyzed by ICP-AES and have been compared between baseline and two successive years of amended/monitored soils. The lateral distribution of the metals does not correlate with pH, organic matter and cation exchange capacity of soils. The question of metal availability has been addressed from a sequential extraction study of the soil components. The metal concentration in the different fractions of the soil gives an idea of the long-term mobility of the trace elements with changing soil chemical parameters. This has been coupled with an XPS study of the amended soils to detect any surface occurrence of the metals.