Study of changes in physiochemical properties of soil by the addition of cement

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Solution for Atmospheric dust and Problematic soils

The effect of cement on physiochemical properties of three types of soils i. e garden soil, agricultural soil and roadside soil was investigated. The ordinary Portland cement was used. The amount of cement added to soil samples, as dry mass percentage was 20%.The results of analysis showed that the addition of cement is capable of bringing about changes in physiochemical properties of soil. The electrical conductivity and organic matter content in three soils get decreased by the addition of cement. While the pH, bulk density and water holding capacity of soils after the addition of cement gets increased. The soil found most suitable to be treated with cement was roadside soil. It was concluded that cement can be used to change the physiochemical properties of soil and this technique has great utility in improving the quality of problematic soils. This technique has great utility in controlling the loss of valuable cover of top soil by binding the lose particulate matter in cement matrix. Natural (wind and water erosion, landsliding etc) as well as anthropogenic disturbances (construction etc) which allowed the dissimination of particulates in air can be overcomed by using soil cement mixing techniques. Further more, small bricks were also made from these three types of soil and the brick with lowest organic matter i. e roadside soil plus cement mixture showed greater stablity then others. This idea of brick making from cheap resource which is abundant in nature i. e soil, can be used to in making of earthquake resistant buildings. As statellites cannot see through soil structures so by making buildings with soil-cement bricks, can enchance the security of nations as well. Soil cement mixing can be used in making of high ways and for reclamation of problematic soils.

Understanding natural perchlorate formation by ozone and UV-oxidation of aqueous Cl species

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Recent studies have demonstrated that natural perchlorate (ClO_4^-) ubiquitously occurs throughout the world. However, currently there is little understanding of the production pathway (s) that is responsible for natural ClO_4^- formation. Our work has systematically examined the production of ClO_4^- formed by both O_3 mediated oxidation and photo-oxidation of aqueous oxy-chlorine anions (e.g. Cl^-, OCl^-, ClO_2^-, ClO_2) including evaluating the impact of major environmental parameters such as pH, reactant concentration, and irradiation wavelength. Further, we have evaluated the stable isotopic composition of the produced ClO_4^-.

ClO_3^- is not an effective reactant as neither O_3 nor photolysis produced ClO_4^- under the experimental conditions studied. ClO_4^- production yield (0.18 to 0.006 %) were in general greater for higher incident radiant wavelength when ClO_2^- was used as the initial reactant. Ozone oxidation of ClO_2^- and ClO_2 produced the highest yields of ClO_4^- (0.6 to 2.7 %) compared to other reactants evaluated. Perchlorate production yields (0.0016 to 0.00012 %) were much lower for both ozonation and photolysis of HOCl/OCl^-. Ozonation but not photolysis of Cl^- solutions produced ClO_4^-. Chlorine dioxide is considered to be the critical intermediate in the formation of ClO_4^-.

ClO_4^- produced from ozonation of OCl^-, and ClO_2^- exhibited non-mass-dependent O isotopic variation (preliminary $\Delta^{17}O$ values around 20 and 12 ‰, respectively), whereas ClO_4^- produced by photolysis of OCl^- and ClO_2^- exhibited largely mass-dependent O isotopic variations. The $\delta^{18}O$ values of ClO_4^- products were higher than those of the Cl-O reactants for all processes except photolysis of OCl^-. New insights about the relative importance of these potential formation pathways may be gained by comparing isotopic compositions of experimentally produced ClO_4^- with reported isotopic compositions of natural ClO_4^-.