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Pedochemical and Mineralogical Control on Green House Gas Emissions from Indian Agricultural Soils – A Commentary

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Abstract: *Greenhouse gases emission (GHGs) to the atmosphere is a threat to the humanity in the 21st Century. India's latest report submitted to the United Nations Framework Convention on Climate Change (UNFCCC), mentions that the energy and agriculture sector contributed 75 and 14%, respectively of the total GHGs emission in 2016. Rice cultivation, crop fertilization, manure management and crop residue burning are the principal sources of GHGs emission in agriculture sector. Periodic monitoring of soil organic carbon (SOC) is an essential prerequisite to decipher the effect of GHGs on global climate change. Research initiatives in this important aspect had already started in the world including India. The SOC stock in the 0–30 cm depth in major bio-climatic zones of India is two times more than SIC (soil inorganic carbon), suggesting a positive role of cropping mainly in the semi-arid tropical (SAT) environment. The projected insignificant agriculture mediated loading of GHGs into the atmosphere and the favourable OC balance is inherently linked to some important pedochemical reactions and interactions of clay minerals present in the soils, which hitherto were not given due importance in model exercises to estimate GHG emissions share. The gap in knowledge necessitated us to write a commentary on the role of pedochemical environments and mineralogical make up in carbon capturing without causing a great threat on GHG emissions. Amorphous Fe and Al oxides of Indian tropical soils and hydroxy-interlayered clay minerals have a major role in OC sequestration. Ca-zeolite, an important factor in OC sequestration helps in preventing complete transformation of smectite to kaolinite by maintaining high base saturation, thereby ending up in OC rich Vertisols, Mollisols and Alfisols even in acidic environments. Soils under various agricultural land uses showed their potentiality to sequester OC under both arable and submerged conditions. This commentary is attempted to draw the attention of the simulation and system modelers to make further exercises considering the control of pedochemical and clay mineralogical interactions to reach the real scenario on the extent of reported GHG emissions. The relevant issues pointed out in this commentary may serve as guiding principles to improve OC sequestration programmes in other tropical and sub-tropical parts of the world with no major consequences on GHGs emissions provided some policy re-orientation is accomplished.*

Keywords: C sequesting clay minerals; cultivation practice; methane emission; organic and inorganic carbon; rice.

Greenhouse gases emission (GHGs) to the atmosphere leading to global warming is a serious concern in the 21st Century. At the end of the century, nearly 2°C temperature rise is expected

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