Abs. Nr. PO-095

Studies on the Impact of Biological Fertilizers on Methane Emission from Rice Paddy Microcosms

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Methane is a trace gas in the Earth's atmosphere. It came into the focus of public and scientific interest because of its expected contribution to global climatic changes (green house effect). Although it is a relatively minor component of the global carbon cycle, it is of great importance because its relative capacity for infrared absorption is greater than that of CO_2. The major sources of CH_4 are rice paddy fields, natural wetlands, enteric fermentation, biomass burning, termites and gas drilling. Methane emission is the outcome of the balance between methane production, oxidation and transport. Emissions from rice paddies indicate a global source of 60 $Tg.yr^{-1}$ with a range between 20-100 Tg yr^{-1}. Besides affecting the climate, methane plays an important role in both troposphere and stratospheric chemistry. Thus, in an effort to reduce uncertainties, the research work was carried out to study the impacts of biofertilizers of methane emission using rice microcosms (IR50 cultivar type) inoculated with Azolla and Asospirillum amendments. The Control microcosms were without any amendments.

Azolla (symbiotic) and Asospirillum (asymbiotic) organisms, fix large amount of atmospheric N_2. The soil used for microcosm study was Alfisol soil type with predominant sandy nature. The soil pH ranged between 6.8 and 7.4 providing optimal conditions for menthanogenesis. The total organic carbon in the soil is observed as 0.74%. The amount of available nitrogen was observed as 78 mg kg^{-1} dry weight of soil. The average methane flux from Control rice microcosms increased from 22.9 mg m^{-2} d^{-1} at the time of transplantation to 80.2 mg m^{-2} d^{-1} during reproductive stages and finally declined to 38.4 mg m^{-2} d^{-1} at the harvesting stage of the crop. The mean seasonal average integrated methane flux and its range was found to be 3.8±1.5 g m^{-2}. In Azolla amended microcosms average methane flux increased from 21.8 mg m^{-2} d^{-1} during transplantation to 128.01 mg m^{-2} d^{-1} at reproductive stages and finally declined to 48.53 mg m^{-2} d^{-1} during harvesting stage of the crop. The mean seasonal average integrated methane flux and its range was found to be 4.97±2.7 g m^{-2}. The highest average fluxes correspond to 65th day after transplantation. Azolla application shows some important effects on chemical soil properties, which could affect CH_4 emission by decrease in dissolve O_2 concentration of the overlying water, increase NH_4^+-N content of the soil, depress water-soluble organic carbon, Eh, and porosity of the soil. In Asospirillum amended microcosms average methane flux increased from 20.08 mg m^{-2} d^{-1} during transplantation to 76.01 mg m^{-2} d^{-1} at reproductive stages and finally declined to 34.1 mg m^{-2} d^{-1} during harvesting stage of the crop. The

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mean seasonal average integrated methane flux and its range was found to be 3.2±1.3 g m^{-2}. The highest average fluxes correspond to 65^{th} day after transplantation. The inoculation of rice roots with *Asospirillum spp.* may result in decrease in methane emission due to stimulation of root growth and root hairs by the production of phytohormone, 3-5 fold increase in the permeability of the root cell wall causing an enhanced oxidation of the rhizosphere. Thus in conclusion Azolla amendment has enhanced methane fluxes by 35%, while Asospirillum amendment resulted in the decline of methane emissions by 8.65% in comparison with Control microcosms.

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Biogeochemical Cycle of Methane in a Coastal Lagoon: Pulicat Lake, South India

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Concern about the steadily increasing atmospheric CH_4 concentration from terrestrial and aquatic environments has stimulated research to quantify their sources and sinks. Tropical natural wetlands in recent times have been of great environmental concern due to human intervention such as urbanization, intensification of agriculture etc. The present study focuses on the biogeochemical pathways of methane and its cycling from a coastal lagoon (Pulicat Lake) in South India. The first aspect of the study deals with the various processes of methane formation including the methanogenic stimulation by competitive and non-competitive substrates, sequential reduction of electron acceptors (SO_4, Fe) and the effect of methanogenic inhibitors on CH_4 production. The second aspect of the work deals with CH_4 production along the profile and *in vitro* CH_4 production by algae/sea grass and sediment slurries. The third aspect of the research work provides an insight into the phenomenon of CH_4 oxidation (*in vitro*) in the algae/sea grass and sediment upper layers (0-2 and 2-4 cm). The fourth aspect deals with the spatial variation of CH_4 in the surface water (dissolved form) and sediments (soil pore water) from the entire lake. Also the temporal variations of CH_4 fluxes (i) chamber fluxes from the sediment-water interface; and (ii) bubble ebullition and (iii) sediment core fluxes from the boundary layer have also been studied. Pulicat Lake contributes only a minor source of CH_4 to the atmosphere. Increases in the concentration of CH_4 can be expected in the future if there is a continuation of the current rate of human change due to intensified human mediated disturbances.

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Seasonal Dynamics of Nitrous Oxide and Methane Emission from Muthupet Mangroves

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N_2O and CH_4 are relatively long lived trace gases which strongly influence earth's climate and the chemical budget of the atmosphere. Atmospheric inventories of N_2O and CH_4 are increasing by ~25% yr^{-1} and ~0.3% yr^{-1} and together they account for ~18% of enhanced green house forcing. Natural wetlands are one of the major sources for N_2O and CH_4 emissions to the atmosphere. This study deals with the seasonal and temporal fluctuation of N_2O and CH_4 in the Muthupet mangroves, Tiruvarur District, Tamil Nadu. Fluxes of CH_4 and N_2O were measured using closed chamber technique from the sediment water interface during four different seasons of a year. Results revealed that the average annual emission of N_2O was about 8.19mg m^{-2} d^{-1} and CH_4 was about 16.07 mg m^{-2} d^{-1}. It was observed that the N_2O efflux was maximum during monsoon season, followed by post monsoon and summer and least in the premonsoon. CH_4 efflux was maximum during summer season followed by premonsoon and monsoon and least in the post monsoon. It was also noticed that the N_2O and CH_4 emission from Muthupet mangroves is modulated by the number of pneumatophores, physico-chemical factors and also the anthropogenic influence such as aquaculture and agricultural inputs.

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Cauvery Delta Progradation Towards the Northern Srilankan Coast due to the Holocene Period Coastal Environmental Changes

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Tamil Nadu witnessed a major sea level rise during the Cretaceous period. As a result of this, the sweater inundated and invaded the shallow depressions in and around Ariyalur, in a narrow eat west strip of land west of Thanjavur to the east of Puddukottai etc., and these depressions became shallow seas. The shallow seas are extinct now, but the marine origin deposits in those places is an evidence to show the existence of the ancient Cretaceous period seas.

From Cretaceous to the end of Pleistocene period, there was only a seasonal sea level rise and fall due to monsoon effects and hence there was no invasion of the seawater in the inland area of this State as it was during the Cretaceous period. But during the later part of the Holocene period, there might be a fall in sea level coupled with fluvial sediments deposition particularly in the Cauvery Delta. Hence, this portion of land started to emerge and this process is still continuing there. As a result of these Neocene period coastal environmental changes, in the last 3,500 yeas, about 35 kilometers stretch of land from Thiruthuraipoondi to Vedaranyam has emerged in four successive stages. The emerging land is likely to occupy the remaining concave coast from Vedaranyam to Rameshvaram in the south up to the northern Srilankan coast, if there will be no human or natural hindrance both inland and in the Palk Bay. The development of the fresh small deltas in the east west direction in all the river mouths of the Palk Strait perhaps is the fifth stage of the coastal progradation supports the above prediction.

This study indicates that this area is underlain by the Recent to Tertiary period sedimentary rocks. The micro landforms like 1. Beach ridges 2. Beach 3. Crescent beach. 4. Swale 5. Swamp 6. Lagoon 7. Spit 8. Off shore bar 9. Erosional surface lie above the geological terrains of this area. This study also indicates that the Cauvery delta is prograding at a rate of about 10 km per 1,000 years.

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Sediment Characteristics of Coastal Waters along North Chennai Coast, Southeast Coast of India

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A coastal stretch of about 30 km length, lying between southern side of Ennore Creek to the inlet of Pulicat Lake along the coast of Bay of Bengal has been chosen as the study area. This area is vulnerable to erosion and deposition due to natural and man-made structures such as Chennai Port and Ennore Port. Therefore, the present study has been carried out to identify the grain size distribution and suspended sediment characteristics of coastal waters of north Chennai coast. Grain size distribution along the coastal region revealed that coarser grains are observed in the region and it confirmed that the beaches are reflective in nature and are subjected to significant seasonal variations on beach profiles. Sediment characteristics in the north of Ennore Port indicate the presence of coarser sediment along the offshore boundary of shoal and finer sediments on the coastline. This clearly demonstrates that the shoal while interacting with large waves around offshore boundary, reduces the energy of the incoming waves resulting in deposition of coarser sediments. Finer fragments of the sediment are carried over the shoal by relatively low energy waves and deposited adjacent to the coastline. Suspended sediment concentration in coastal waters range between 12 mg/l and 243 mg/l. However, these values are less compared to the values (25 to 321 mg/l) noted for Chennai coastal waters and are higher than the values (32.8 to 131.5 mg/l) for Kalpakkam coastal waters. Among seven transects suspended sediment concentration, observed on surface waters at transect 2 and 4 are higher and the reason may be the dredging operations near transect 2 and beach fills near transect 4 on the Ennore creek and north of Ennore port respectively. From the present study, it is concluded that regular monitoring and periodical study has to be undertaken in this part of the coast since accretion and erosion on the shoreline is vulnerable.

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Coastal Ecosystem Management and Monitoring using Remote Sensing and Geographic Information System - A case study Tuticorin coast of India

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Tuticorin coast is situated in the extreme southeastern corner of Tamil Nadu state in Bay Bengal. Population pressure and poor land use practices like unplanned industrial and urban developments lead several environmental problems on coastal environment. The study area receives various types of industrial and urban waste regularly. More than seven large scale and water polluting industries are located in a minimum geographical area.

Industrial effluents are discharged in to the sea. For example tuticorin thermal power station is generating 3000 tones of Ash per day and of just 300 tones are removed for cement production and the rest is being dumped into the sea. Nearly 5 Sq.Km area of the coast has been converted in to Ash Dyke near the estuary area. A significant amount of mangroves are removed for this purpose. IRS 1C LISS III image clearly shows the leakage of ash into the sea. Suspended sediment concentration is significant in the study area. Also Southern Petrochemical Industries Corporation (SPIC) produces chemical fertilizer like urea using raw materials like Naphtha, Sulphur and Rock phosphate. The volume of effluent waste produced includes sewage of 331 Kl /day and trade effluent of 6200 Kl /day more over Darangadara chemical works (DCW) has two units (PVC unit, Caustic Soda unit) has also discharges effluents into the sea. Total discharges of municipal and industrial waste in tuticorin coast are more than 8 lakh litres per day.

Ecological evaluation has been made using remote sensing techniques and GIS with serious view of all the above said factors. The study reveals the ecological imbalance and its impacts on coastal ecosystem have been assessed and the detailed management planning strategies were drawn for sustainable development marine resources.

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