

Organic matter dynamics and ecological changes in mangrove ecosystem - a case study from India

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Abstract

Mangroves are intermediate coastal ecosystems strategically located at the interface between land and sea, and play an important role in the organic matter cycling. Several studies have shown that hydrobiogeochemical alteration has affected organic matter distribution and result in the mangrove species diversity. A study has been attempted to understand the dynamics and cycling of sedimentary organic matter in the Pichavaram-Vellar-Coleroon mangrove-estuarine complex in south-eastern, India. In order to evaluate the sources and fate of organic matter (OM) in the Pichavaram mangrove-estuarine ecosystem, C_{org} , N_{tot} , C/N_{atm} , stable isotopes ($\delta^{13}C_{org}$ and $\delta^{15}N_{org}$) and organic biomarkers of five ^{210}Pb dated sediment cores were investigated. In mangrove sediments, C_{org} , N_{tot} , and C/N_{atm} concentration in mangroves and estuaries varied in space and time. OM in the sediments is rapidly decomposed or remineralized in these environments. The rate of C_{org} burial is more in mangrove forests than estuaries. In general, the mangrove sediments extracts have higher biomarkers concentration ($22.6 \pm 13.3 \mu g/g$) than the estuarine sediments ($6.42 \pm 4.92 \mu g/g$). In both estuarine and mangrove sediments, triterpenol is the dominant biomarker, and constitutes 55% and 53% of the total lipid extracts, respectively. The high abundance and unimodal distribution of the long-chained *n*-alkanes, high Carbon Preference Index (CPI >8) and Terrestrial Aquatic Ratio (TAR 2.4 - 41) values indicate the presence of higher plant matter is preserved in the sediments. The presence of *n*-alkanols (C_{26} , C_{28} , C_{30}), and abundance of phytosterols (β -sitosterol and stigmasterol) and triterpenoids (taraxerol, β -amyrin, germanicol and lupeol) indicate mangrove vegetation as the primary source of sedimentary OM in these sediments. In contrast, the bimodal distribution of *n*-alkanes, lower CPI (0.75 to 0.90) and TAR (1.9 - 5.7) values, and the ternary plot of ΣC_{27} , ΣC_{28} and ΣC_{27} sterols indicate that phytoplankton/algal derived OM is more pronounced in estuarine sediments. Drastic changes in freshwater input from the Coleroon River in the last decade leads to increase in salinity and replacement of the less salt tolerant *Rhizophora* vegetation to more salt tolerant species like *Avicennia* and *Suaeda*.

Keywords

organic matter cycling, organic biomarker, mangrove sediment, estuarine sediment, Terrestrial Aquatic Ratio