Mangrove tannins in aquatic ecosystems: Their fate and possible influence on dissolved organic carbon and nitrogen cycling

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ABSTRACT: We describe the fate of mangrove leaf tannins in aquatic ecosystems and their possible influence on dissolved organic nitrogen (DON) cycling. Tannins were extracted and purified from senescent yellow leaves of the red mangrove (*Rhizophora mangle*) and used for a series of model experiments to investigate their physical and chemical reactivity in natural environments. Physical processes investigated included aggregation, adsorption to organic matter-rich sediments, and co-aggregation with DON in natural waters. Chemical reactions included structural change, which was determined by excitation-emission matrix fluorescence spectra, and the release of proteins from tannin-protein complexes under solar-simulated light exposure. A large portion of tannins can be physically eliminated from aquatic environments by precipitation in saline water and also by binding to sediments. A portion of DON in natural water can coprecipitate with tannins, indicating that mangrove swamps can influence DON cycling in estuarine environments. The chemical reactivity of tannins in natural waters was also very high, with a half-life of less than 1 d. Proteins were released gradually from tannin-protein complexes incubated under light conditions but not under dark conditions, indicating a potentially buffering role of tannin- protein complexes on DON recycling in mangrove estuaries. Although tannins are not detected at a significant level in natural waters, they play an important ecological role by preserving nitrogen and buffering its cycling in estuarine ecosystems through the prevention of rapid DON export/loss from mangrove fringe areas and/or from rapid microbial mineralization.

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