



Refractory dissolved organic carbon reservoir pool and microbial constraints in a karst aquatic system: A case study of Lijiang River, Southwest China

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Refractory dissolved organic carbon (RDOC) resulting from the microbial carbon pump (MCP) process is promising as a relatively long-term natural carbon sink in marine systems, but this concept remains challenging to determine in terrestrial aquatic systems. We investigated the spatial changes in hydrochemistry, carbon isotopes and microbial diversity from the upper to lower Lijiang River, a karst aquatic system in Southwest China, to expose the organic carbon originations and probable microbial constraints of RDOC formation. The anomalous $\delta^{13}\text{CDIC}$ values increase indicated submerged aquatic plants' and microbes' participation of transformation from DIC into DOC. The $\delta^{13}\text{CDOC}$ values and C/N ratios decreased significantly with increasing DOC and RDOC concentrations, which revealed RDOC composed greater 90% percent of DOC and characterized by autochthonous RDOC. While, RDOC concentrations increased significantly with increasing genus *norank_f_ACK-M1* from the upper to the middle to lower Lijiang River, which indicated heterotrophic actinorhodopsin bacteria (such as genus *norank_f_ACK-M1*) can use DOC to reconstitute RDOC and constitute a natural carbon sink.