D/H ratios of fatty acids as a tool to infer the metabolism of microbial communities

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Microorganisms are key players in all global nutrient cycles and therefore have a large impact on the environment. In order to understand how environmental changes affects microorganisms and vice versa it is necessary to identify the microorganisms and especially their metabolism. So far only a small percentage of microorganisms has been be cultured or can be cultured by standard techniques. This leaves the need for new, culture-independent techniques in order to characterize microbial communities *in situ*.

Recently, it has been shown, that the deuterium to hydrogen (D/H) ratio of fatty acids reflects the core metabolism of microorganisms in culture [1] and the results from the first environmental studies seem to confirm this conclusion [2].

Here, we present the hydrogen isotopic composition of fatty acids extracted from cultures of environmental relevant microorganisms and different environmental samples. The culture results fit with previous results from Zhang et al. (2009) with fatty acids from heterotrophic organisms being substatially enriched in deuterium relative to the culture medium, photoautrophic organisms being depleted, and chemoautotrophic organisms being the most depleted in D. A seasonal study of the hydrogen isotopic composition of fatty acids from suspended particulate matter in the North Sea reveal the most D depleted fatty acids during the spring algal bloom and, to a certain degree, the autumn algal bloom. The most D enriched signal was meassured during the winter period. This fits with the dominance of photoautotrophic organisms during the algal bloom and dominance of heterotrophic microbes during the rest of the year.

[1] Zhang *et al* (2009), *PNAS* **106**, 12580-12586 [2] Osburn *et al* (2011), *GCA* **75**, 4830-4845