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# Forensic identification of the anthropogenic contribution of fatty alcohols to the environment by stable isotope analysis

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As part of a larger study on the source and fate of fatty alcohols in the environment, one river basin catchment in the US and one catchment in the UK with marine discharges were examined. Fatty alcohols are produced naturally by most living organisms and may also be synthesized from various sources of oil. These compounds as ethoxylates or sulphatesare used in many formulated consumer products such as detergents, which typically have a down-the-drain disposal and treatment in a wastewater treatment plant (WWTP). Petroleum-based fatty alcohols are functionally identical to oleochemical-based (natural) fatty alcohols and are not easily distinguished by conventional means. However, the abundances of stable isotopes of carbon (13C) and hydrogen (2H) may be determined as petroleum-based compounds have different values compared to oleochemical-based compounds.
Samples from soils, marine sediments and the local sewerage system were collected from the UK catchment. Similarly, 80 samples were collected from the US catchment including soils, river sediments, road dusts which may runoff into the waters and materials from the WWTP. GC-MS analysis determined the concentrations and profiles, and each sample was also analysed by compound specific stable isotope ratio mass spectrometry. Consumer products sold in the catchments were obtained and analysed as well. Terrestrial soils and plant matter were clearly separated from other samples by having a low $\delta$13C value, typically around -35‰Ṡimilarly, marine derived compounds had $\delta$13C values around -20‰Ṡamples from the WWTP had intermediate values which altered depending on where in the system samples were collected. The $\delta$2H values had a greater range from -350‰ to 0‰Ṫhis approach clearly demonstrated the different sources and the fate of these compounds through the WWTP. In summary, the fatty alcohols in the environment were not derived from the WWTP effluents which in turn were not the same as the ones in the influent; the most likely source is in situ bacterial synthesis.