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The Use of Sterol and Biomarker Distributions to Determine the Origin of Fecal Contamination and Anthropogenic Inputs in the Oklahoma River.

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Introduction and Aim.

Water is an important economic resource, and deterioration of its quality by fecal contamination and other anthropogenic inputs is a major concern. The study of sterol and biomarker distributions has proven to be a useful tool to identify fecal contamination and origins of anthropogenic contributions. Differences in the sterol distributions and concentrations can be used to relate the source of the feces to specific warm-blooded animals and the relative proportions of n-alkanes, hopanes and polycyclic aromatic hydrocarbons (PAHs) can indicate contaminations from petroleum sources and/or contributions from combustion processes. The purposes of this study were: (i) to determine the origin of fecal contamination in the Oklahoma River using the sterol fingerprint approach; (ii) to identify other sources of organic matter contribution through the screening of other families of compounds (PAHs, halogenated compounds, n-alkanes and hopanes).

Materials and Method.

Water samples were collected from the Oklahoma River. After filtration, the organic compounds dissolved in the water were extracted by solid phase extraction whereas the filters containing the particulate matter (PM) were sonicated with different solvents. The organic extracts were then separated by liquid chromatography into three fractions: saturate, aromatic and polar compounds. The quantitative and qualitative analyses of these fractions were carried out on a gas chromatograph coupled to a mass spectrometer.

Results.

The major sterol quantified in both water and PM was a phytosterol, except for the PM collected next to the Stockyard and compost plant, which contained a high proportion of a fecal sterol characteristic of herbivore feces. This PM exhibits sterol concentrations almost five times higher compared to the other samples, whereas it shows the lowest concentrations of sterols dissolved in water. Fecal sterols were also detected in the other samples. To clarify their origin, several ratios were calculated.

Conclusions.

The ratios indicate a major contribution from herbivore feces but a higher human feces contribution was detected downstream. Among the screened compounds, PAHs, halogenated compounds, n-alkanes and hopanes were detected. PAH ratios, calculated to identify their origin, indicated mainly a contribution from combustion processes. The presence of hopanes indicates petrogenic inputs whereas most of the detected halogenated compounds are commonly used as herbicides.