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Use of molecular markers for the detection of municipal sewage sludge at sea

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ABSTRACT

The concentrations of two classes of waste-specific molecular markers (the linear alkylbenzenes and the fecal sterols, coprostanol and epicoprostanol) were determined in six municipal sewage sludges. Total linear alkylbenzene concentrations ranged from 150 to 7300 $\mu\text{g liter}^{-1}$, whereas coprostanol was present at levels approximately one order of magnitude higher (2.6 to 55 mg liter^{-1}). Experiments were performed to establish the limits of detection and quantitation for these compounds in small volume (<c. 2 liters) bulk water samples using high resolution gas chromatography and gas chromatography/mass spectrometry. In an effort to simulate the degree of dilution expected during the dumping of sludge in waters of the continental slope, water was mixed with the sludge samples in varying proportions ($10^3:1$ to $10^6:1$), and the concentrations of the markers were determined. Comparison of the estimated limits of quantitation with marker concentrations measured in the diluted sludges showed that reliable quantitation of the linear alkylbenzenes was possible at dilutions less than $10^6:1$. Coprostanol and epicoprostanol, however, were measurable at a dilution of $10^6:1$. If background levels of the markers in blanks are reduced and larger volume water samples are processed at sea, it should be possible to extend present measurement capabilities to dilutions one to two orders of magnitude beyond those reported here. These results indicate that molecular markers can be used to monitor the short-term fate of sewage sludge in the deep ocean.

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