

The detection limits of fluorescein determined by the various exciting sources so far reported are shown in Table I. The sensitivity of the fluorometric analysis excited by the esculin laser in this work exceeds those in the previous works and that by a conventional spectrophotometer by more than an order of magnitude. Thus the dye laser was proved to be useful as an exciting source for the trace fluorometric analysis.

At the limit of detection, the major source of noise of the conventional spectrophotometer is the dark current of the photomultiplier and that of the previous apparatus with the laser source was concluded to be noise on the background signal, caused by fluorescence of impurities in the solvent (2). In the present investigation, the discharge circuit and the electronic devices for the photodetection were shielded carefully by metal enclosures; the background fluorescence of solvent impurities was reduced by repeated purifications of the solvents; the optical system was strictly adjusted to reduce the scattering light of the excitation laser. Thus, the background signal was reduced to allow the observation of such weak fluorescence as 2 ppt of fluorescein. Either a stray light of the monochromator, or the fluorescence of the residual impurities in the distilled water may contribute to the background signal from the solvent water.

The detection limit of fluorometry can be improved by using the interference filter instead of the emission mono-

chromator. For example, the sub-part per trillion detection of Rhodamine 6G was reported (6). However, the Raman band cannot be used as the internal standard, and the fluorescence from the unwanted species cannot be resolved on the fluorescence spectrum. Thus, the use of a monochromator, as reported here, has definite advantages over such a simple method.

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## Composition Differences in Commercial Polyethylene Bottles and Their Relation to the Stability of Stored Part-per-Billion Mercury(II) Solutions

*Sir:* During a study of the suitability of linear polyethylene bottles for storage of trace Hg(II) solutions, we have found several lots of commercial bottles which are a mixture of 45% polypropylene and 55% linear polyethylene, and which differ significantly from 100% linear polyethylene bottles with respect to the types and levels of additives. The losses of Hg(II) incurred when 1 ppb Hg(II) solutions are stored, and the interaction of the container with the preservative solution are quite different in 100% linear polyethylene bottles and in 45% polypropylene bottles. Such differences in the stability of trace level Hg(II) samples stored in the two types of bottles constitute a potentially serious source of variance in Hg(II) analysis of samples stored for an appreciable time as is often necessary in environmental studies that involve large numbers of samples. Because polyethylene bottles of the two compositions may well exert differential effects on other samples, we wish to alert others to the possibility of unexpected variations in losses when trace samples are stored in commercial linear polyethylene bottles.

Differences in the efficiency of preservatives in stabilizing 1 ppb Hg(II) solutions stored under apparently identical conditions in bottles from different manufacturers' lots first suggested that, although the bottles within each lot are relatively uniform, the various lots represent two distinct types of bottles, which we have denoted LPE I and LPE II. In their behavior toward 1 ppb Hg(II), solutions stabilized with 5% v/v HNO<sub>3</sub>-0.05% w/v K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, as recommended by Feldman (1), the two types of bottles differ in two important respects. First, losses of Hg(II) after 10 days storage, as monitored by a cold vapor atomic absorption technique similar to that of Kopp et al. (2) were 43% in the LPE I bottles but only 6% in the LPE II bottles. Second, the dichromate preservative is often reduced in the LPE II bottles. The degree of reduction varies substantially from one bottle to another, and occasionally the

dichromate suffers complete reduction after several days. The bottles have a capacity of 500 mL, so that complete reduction represents the loss of 0.85 mmol of dichromate. In contrast, little if any of the dichromate is reduced in LPE I bottles, even after storage for a month or longer.

The infrared spectra of thin films of the LPE I plastic and the LPE II plastic in Figures 1 and 2, respectively, clearly demonstrate that the LPE I plastic is linear polyethylene and that the LPE II plastic contains substantial quantities of polypropylene. The spectrum of LPE I shows, in addition to the C-H bands of aliphatic hydrocarbons, bands at 907 and 989 cm<sup>-1</sup> characteristic of terminal unsaturation, and an olefinic C=C stretching band at 1638 cm<sup>-1</sup> is detectable if much thicker films are used. The 907 and 989 cm<sup>-1</sup> bands indicate that LPE I is a low pressure, linear polyethylene, and the spectrum corresponds closely to representative spectra of linear polyethylenes given by Hummel and Scholl (3). The spectrum of LPE II exhibits a number of bands characteristic of crystalline isotactic polypropylene (4), the more prominent of which are the six moderately intense bands at 809, 840, 898, 970, 998, and 1165 cm<sup>-1</sup>, and an intense methyl deformation band at 1375 cm<sup>-1</sup>. A strong doublet with maxima at 718 and 728 cm<sup>-1</sup>, characteristic of crystalline polyethylene (5) appears in the spectra of both LPE I and LPE II.

The polypropylene content of the LPE II polymer as estimated using four methods based on the intensities of appropriate infrared bands, is approximately 45% polypropylene by weight. The first method, based on the relative intensities of the 718 cm<sup>-1</sup> polyethylene band and the 970 cm<sup>-1</sup> polypropylene band (6), yields a composition of 45% polypropylene. The second method, using the relative intensities of the 718 cm<sup>-1</sup> polyethylene band and the 1165 cm<sup>-1</sup> polypropylene band (7) also indicates that the polypropylene content of LPE II is 45%. The third method utilizes the film thickness and the