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Analysis of coplanar polychlorinated biphenyls (PCBs) using immunoaffinity chromatography cleanup with immunoassay detection

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Abstract

High analytical costs and uncertainties in the assessment of human exposures to environmental contaminants are concerns expressed by risk assessors. Environmental and biological monitoring studies require cost-effective, high sample capacity methods to determine exposure pathways and minimize risk. Bioanalytical methods, such as immunoassays, have been shown to fulfill these monitoring needs for several target analytes and matrices. Polychlorinated biphenyls (PCBs) are pollutants of environmental and human health concern. We developed a tandem bioanalytical method for the cleanup and determination of coplanar PCBs in soil and sediment samples. The method utilized a pressurized liquid extraction (PLE) followed by an immunoaffinity chromatography (IAC) column cleanup with detection by an enzyme-linked immunosorbent assay (ELISA).

The IAC columns were developed using a co-planar PCB specific antibody. Column conditions including support material, loading capacity, antibody binding, and elution solvents were optimized. The IAC column was compared with other sample preparations used for PCBs (acid wash, multi-step cleanup) and was shown to effectively remove interferences from the environmental samples. The columns could be reused more than 20 times without a loss in performance. The ELISA was calibrated against PCB-126 and provided a single measurement representing a PCB-126 equivalent value for the 12 coplanar PCBs. The ELISA was compared to a gas chromatography/mass spectrometry (GC/MS) procedure that provided a summation of the co-planar PCBs present. Quantitative recoveries of 84-130% of PCB-126 were obtained in fortified samples using the PLE/IAC/ELISA method. The ELISA-derived PCB-126 equivalent values and the GC/MS summation data were highly correlated for all the samples with a correlation coefficient of 0.99.

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Biography

Jeanette Van Emon completed her Ph.D. from the University of California, Davis and postdoctoral studies from the Lawrence Livermore National Lab. Her research at the U.S. EPA includes the development and application of immunochemical methods for environmental monitoring and human exposure assessment including biomarker discovery through proteomics. She is a Fellow of the American Chemical Society (ACS) and serves as an ACS Division Councilor, Chairman of the Western Regional Board and editorial board member of the *Journal of Agricultural and Food Chemistry.* She has published more than 60 papers in reputed journals in addition to several EPA reports and presentations at national and international meetings.