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TITLE:

Method Development for Determining Trace Quantities of Polychlorinated Biphenyls in Cooling Water - Dept. 246

PERSONNEL:

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PROBLEM:

Develop a method for the determination of PCB's in cooling water from indirect cooling of a new department operation. Uncontaminated water (100°C) can be used as feed water in the powerhouse.

JUSTIFICATION:

Estimated savings are $20,000 per year by use of the hot water. In addition, the method could be applicable in the PCB control program.

SUMMARY:

A method has been developed for this analysis, to be performed in the laboratory, that utilizes the Cary, Model 14, spectrophotometer.

The estimated cost per analysis is approximately $5.00. An alternate method for this analysis by our routine gas chromatography procedure would cost approximately $28.00 per analysis.

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Details

Background

City water at 100°C will be a waste stream from indirect cooling of a new operation in Department 246. This can be used as feed water in the powerhouse if contamination from leaks can be detected early enough to prevent damage to powerhouse equipment. A routine test is needed for early detection of leaks.

A gas chromatography method already exists in our laboratory, but it is a lengthy method that requires the use of clean-up procedures on the sample prior to GC analysis. It was therefore determined that UV spectroscopy be evaluated as a quick means of detecting PCB's in the water.

Experimental

Initial evaluations showed that the PCB's could not be detected in water as is, even at the point of saturation. However, further evaluation showed that a relatively large sample (400 ml) could be extracted with a small volume of solvent, such as hexane, and the PCB's then detected in the concentrated solvent.

Standard solutions of several grades of aroclors (PCB's) in hexane were then prepared and examined on the Cary, Model 14, spectrophotometer. It was shown that the aroclors, as well as biphenyl, could be detected at 2450 angstroms when scanning with the UV lightsource. The Cary was calibrated with the various grades of aroclors.

When evaluations were completed it was found that we could not obtain spectranalyzed grade hexane from our suppliers for some time because of industrial shortages. However, we were able to obtain a sufficient quantity of spectranalyzed grade iso-octane. Evaluations showed that the iso-octane is also a good solvent for this analysis. Recalibration of the Cary with the aroclors in iso-octane showed that the absorptivity coefficients are applicable to either solvent.

Discussion

Present evaluations to this date show that this procedure is applicable for samples that are known to contain no other substances that absorb at 2450 angstroms. Future consideration for analysis of samples from other sources that might contain absorbing substances other than PCB's at the wavelength of concern would present problems. This procedure is not specific for identifying individual aroclors. It will, however, distinguish 1109 and 1221 aroclors as a group from 1242 through 1254 aroclors as another group, due to peak configuration.

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Discussion (Cont'd)

The estimated elapsed time for analysis by this procedure is approximately 20 minutes while the estimated elapsed time for analysis by the GC procedure is approximately 3 hours.

Conclusions

Based on these evaluations the spectrophotometric procedure was written as a WGK method for analysis of the cooling water samples in our laboratory. The lower limit of detection with a 400 g sample (16 ounces) is 0.020 parts per million, PCB's.

Reference

WGK Laboratory Notebook,pp.17834-40 and 17846-47.

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