Not for Publication
Presented Before the Division of Environmental Chemistry
American Chemical Society
Houston, Texas, March 23-28, 1980

REMOVAL OF PCB's FROM WATER BY ACTIVATED CARBON IN THE PRESENCE OF HUMIC ACIDS

Massoud Pirbazari and Walter J. Weber, Jr.

Environmental and Water Resources Engineering
The University of Michigan
Ann Arbor, MI 48109

The introduction of polychlorinated byphenyls (PCB's) to the aquatic environment is multifaceted and extensive. Point sources include municipal and industrial discharges containing trace amounts of hydraulic, lubricating, and transformer fluids. Surface run-off and leachate from land-fills and dumps containing PCB-incorporated materials, as well as aerial fallout from improper incineration are additional sources of PCB contamination. Recent evidence also indicates that chlorobiphenyls may form during chlorination of biphenyl wastes. Needless to say, the toxicity of PCB places it high on the list of environmentally important pollutants.

Adsorption on activated carbon has proven to be an effective process for removal of a broad spectrum of organic compounds from aqueous solution. This paper addresses quantification of the effectiveness of carbon for removing PCB's from water supplies in the presence of a major competing class of compounds, humic acids. Equilibrium, kinetic and long-term coluan studies have been conducted to evaluate the adsorption dynamics of PCB's with respect to activated carbon. The development of adsorption methodologies for PCB's requires that the volatility and extremely low solubility of these compounds, coupled with the necessity for detection at very low concentration levels, be given appropriate consideration. Further, commercial PCB's are comprised of various isomers which demonstrate different behaviors with respect to both activated carbon and the glass and/or Teflon reactors in which adsorption studies are typically carried out.

This paper describes the results of adsorption experiments with two types of commercial PCB mixtures and selected single isomers, in the presence and absence of humic acids, designed to evaluate and characterize the adsorption behavior of single-component and multi-component systems. Figure 1 presents typical experimental data and Freundlich isotherms for Aroclor 1254 in organic-free water (OFW) and in humic acid background solutions. Figure 2 demonstrates typical completely mixed batch (CMB) reactor rate data for Aroclor 1254 in OFW and humic acid systems. The paper also discusses the results of investigations of different experimental conditions and types of reactor materials that can be used in conjunction with PCB adsorption studies.

MONS 002800

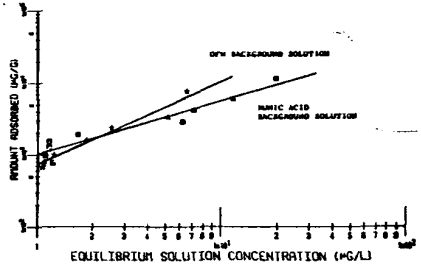


FIGURE 1: EXPERIMENTAL DATA AND FREUNDLICH ISOTHERMS FOR ADSORPTION OF PCB (AROCLOR 1254) USING ORGANIC-FREE WATER (OFW) AND HUMIC ACID BACKGROUND SOLUTION, AT pH 7, 100/200 US SIEVE SIZE FILTRASORB 400 ACTIVATED CARBON

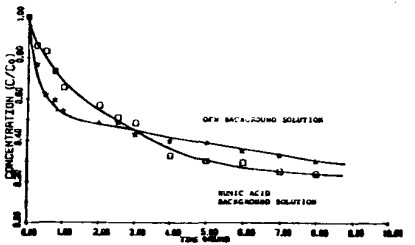


FIGURE 2: CMB REACTOR RATE DATA FOR ADSORPTION OF PCB (AROCLOR 1254) USING DIFFERENT BACKGROUND SOLUTIONS AT pH 7, 0.15 g/l OF 50/60 US SIEVE SIZE FILTRASORB 400 ACTIVATED CARBON