

1998

Designing a Better Matrix for Solidification/ Stabilization of Hazardous Waster with the Aid of Bagasse (Lignin) as a Polymer Additive to Cement

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Recommended Citation

Janusa, Michael A., "Designing a Better Matrix for Solidification/Stabilization of Hazardous Waster with the Aid of Bagasse (Lignin) as a Polymer Additive to Cement" (1998). *Faculty Presentations*. Paper 4.
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The displacement reactions are interesting for flow injection analysis (FIA) especially because of a possibility to adjust selectivity of metal determination *a priori*. Nevertheless, this rather simple and attractive way is not in wide use for improving of analytical selectivity because the summarizing theoretical principles have not developed yet. A useful approach to the theoretical estimation of selectivity may be connected to the application of graph theory towards all chemical reactions and hydrodynamic phenomena in a flow system.

Having using the ideas of graph methods¹, an advanced theory, allowing estimating selectivity of metals determination by FIA based on reactions of displacement, is developed. The essence of procedure used consists in display all principle in the chosen system reaction for all metals as a summarizing matrix, and in a cumulative estimation their influences on the intensity of a measured signal. The developed theory allows estimating the systematic errors, caused by presence of metals from the certain list, quantitatively.

The working examples successful *a priori* estimation of selective metal determination based on displacement reactions in system complexone - copper(II) - colored indicator, alkali earth metals particularly, will be presented as a result of theory suggested.

This work was supported by grant #95-0148 from the Russian Foundation for Basic Research (RFBR) - International Association for the promotion of cooperating with scientists from the independent states of the former Soviet Union (INTAS) and by grant #97-03-33434 from the RFBR.

1. V.V.Kuznetsov, Zy Din' Dong, Russ. J. Anal. Chem., 51 (1996) 918.

1893P

DESIGNING A BETTER MATRIX FOR SOLIDIFICATION/STABILIZATION OF HAZARDOUS WASTE WITH THE AID OF BAGASSE (LIGNIN) AS A POLYMER ADDITIVE TO CEMENT

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A significant portion of modern industrial waste is disposed by solidification in cements and slags. To be successful, a solidification/stabilization (S/S) procedure must constrain waste so as to prevent leaching (migration of waste through the soil), especially by ground water. In practice, because of the fact that cementitious materials are relatively inexpensive, and the technology required to mix and place the solidified product is relatively simple, there is a strong tendency to use S/S for the treatment of hazardous wastes where it might not be appropriate. Solidification/stabilization of hazardous wastes is a widely used technology; therefore, it is very crucial to be able to evaluate its effectiveness and to make attempts to improve the technique.

The primary objective of this project is to design a better matrix for S/S of hazardous waste that will be effective and economically feasible by adding a polymer additive to the waste/cement matrix. The polymer used is lignin, but to make the process more economically feasible, the source of lignin comes from the large excess of bagasse ($\approx 22\%$ lignin by weight) produced each year from sugar cane processors. The waste/cement/bagasse matrix is analyzed by the Environmental Protection Agency (EPA) recommended Toxicity Characteristic Leaching Procedure (TCLP) to determine the leachability of a solidified waste encountering typical environmental conditions. The studies are done with lead as the initial heavy metal waste source. Preliminary results show that lead leaching is decreased when bagasse is added to the cement/waste matrix.

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METHOD DEVELOPMENT FOR GFAAS ANALYSIS OF CHROMIUM SPECIATION IN LAKE BOTTOM SEDIMENT

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As part of an EPA-funded study of the metals content of the bottom sediments in White Lake, particularly in a bay subjected to historical discharge of tannery wastes containing high levels of chromium compounds, we evaluated analytical methods for determination of chromium. The analysis of total chromium in sediments was achieved with ICP-AES following an acid digestion. However, the environmental hazards of chromium depend greatly upon its oxidation state, so we also have evaluated several methods for the determination of Cr(VI). The sediment matrix presents several difficulties for the determination of Cr(VI): high organic content, including high levels of humic and tannic acids, and presence of very high Cr(III) levels (up to several percent). Samples were prepared with an alkaline digestion based on EPA Method 3060A whose purpose is to bring Cr(VI) into solution while prevent the interconversion of any Cr(III) and Cr(VI). Samples were subsequently centrifuged, filtered through glass fiber filters, through 0.45 μm Metrigard® filters (Gelman Science). However, application of the standard EPA quantitation method based on spectrophotometry after derivatization with diphenylcarbazide (Method 7196A) was precluded by the extremely dark coloration of the digested samples and the relatively low levels of Cr(VI). The initial quantitation method included post-digestion clean-up with cation exchange resins of the neutralized samples followed by graphite furnace atomic absorption spectroscopy. Significant Cr levels were found, which were unexpected because of the reducing and anoxic character of the sediments. However, subsequent filtration of the digestates through a 0.20 μm filter membrane significantly decreased the Cr content as measured by GFAAS. Thus, we suspect that the high Cr results are contributed by a significant fraction of Cr(III) left in solution, either bound to microparticulates or to soluble macromolecules (such as humic acids).

Since the use of cation-exchange resins failed to remove Cr quantitatively, we are exploring other methods to unambiguously determine the concentration of Cr(VI) in the presence of high levels of Cr(III). One approach uses an ion exchange chromatographic separation that resolves Cr(VI) from Cr(III). This procedure employs a Dionex CS-5 column with pre-column derivatization of Cr(III) with pyridine dicarboxylic acid and post-column derivatization of Cr(VI) with diphenylcarbazide. Another approach involves the use of activated alumina minicolumns that preferentially bind to Cr(VI) at low pH and to Cr(III) at alkaline pH, but which release the adsorbed species at more extreme pH values. The results of the analyses of sediments and their environmental significance will be discussed.

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ABSTRACT NOT AVAILABLE AT TIME OF PRINTING