TRANSPORT OF HEAVY METALS IN PROCESS WASTEWATERS

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RAY F. WILSON, PRINCIPAL INVESTIGATOR

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**DEPARTMENT OF CHEMISTRY
TEXAS SOUTHERN UNIVERSITY
3100 CLEBURNE AVENUE
HOUSTON, TEXAS 77004**

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OBJECTIVES

The research plan for this project focuses on:

1. Preparing and analyzing synthetic solutions of phenols and different toxic and non-toxic metals such as copper, zinc, cadmium, mercury, and nickel to simulate waste water results from coal liquifaction processes.
2. Analyze the complexes formed between phenols and the metal ions to determine their coordination numbers, formation constants and other polarographic and electrochemical parameters.
3. Study the extraction efficiency of the aforementioned complexes from waste water into removing solvents.
4. Collect data and present it in the form of figures, tables, and word description.
5. Provide a procedure for systematic separation and removal of resorcinol from coal conversion waste waters based on their extractability, formation constants, and acceptable toxic levels.

Experimental:

Resorcinol was chosen as a representative of phenols. Determination and quantitation of copper-resorcinol complexes were performed using BAS-200 (LC-EC) and Sargent-Welch 7000 polarographic analyzer. Such instrumental combination allows the detection of trace levels of both compounds in aqueous solutions.

All experiments were done in 0.10 KNO_3 medium at $\text{PH} = 4.00$. Methyl isobutyl ketone was used as the removal solvent. Samples were prepared by adding the desired amounts of copper and resorcinol to a 50.0 ml volumetric flask and then filling it to the mark with 0.10M KNO_3 solution.

Determination of resorcinol and copper were performed before and after each extraction. Copper was analyzed using polarography by scanning the potential from + 0.200V to -0.200V. Resorcinol was quantified using oxidative amperometry at +0.95V.

Each sample was extracted by shaking with 10.0 ml of the solvent for 3 minutes. The aqueous solutions were subsequently, analyzed for copper and resorcinol.

Results:

Figure 1 shows the amperometric peak current for resorcinol before (●), after one extraction (▲), and after two extractions. It is evident that two extractions are enough to obtain quantitative separation of resorcinol into the organic phase.

Figure 2 shows a plot of the current measured for copper as a function of resorcinol concentration before extraction (○), after one extraction (△), and after two extractions (◇). In general, the peak current increases after each extraction indicating some interaction between resorcinol and copper ions in the aqueous solution. No evidence of extraction of copper into the organic phase was observed.

FIGURE 1

AMPEROMETRIC CURRENT AS A FUNCTION OF RESORCINOL CONCENTRATION BEFORE EXTRACTION ($\circ$), AFTER ONE EXTRACTION ($\blacktriangle$), AFTER TWO EXTRACTIONS ($\blacksquare$).

POLAROGRAPHIC CURRENT OF COPPER AS A FUNCTION OF RESORCINOL CONCENTRATION
 BEFORE EXTRACTION (), AFTER ONE EXTRACTION (), AFTER TWO EXTRACTIONS ().

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