Removal Efficiency of Benzene from Chemical Wastewater by a Treatment Plant Using Activated Carbon Adsorption and Coagulation Precipitation Processes

ATSUKO ADACHI and TADASHI KOBAYASHI
Kobe Women's College of Pharmacy

Introduction

Benzene is encountered in a wide variety of chemical processes. Because of its high toxicity, it is important to keep concentrations of this compound as low as possible in environmental water. Since there have been few reports on the effectiveness of benzene's removal by an established treatment plant using activated carbon adsorption and coagulation precipitation, we investigated this and also studied the removal mechanism of this compound.

Methods

Untreated and treated wastewater samples were taken 65 times throughout 1992 (from January through October) from a chamber storing wastewater collected from chemical laboratories and from an outflowing stream discharging into a public sewer, respectively.

One hundred ml of a water sample was placed in a separatory funnel and 5 ml of *m*-xylene was added. The mixture was shaken for 1 min. The separated *m*-xylene layer was subjected to gas liquid chromatography to assay concentrations of benzene. The assay was performed on a Shimadzu Model GC-6A gas chromatograph equipped with a flame ionization detector and a glass column (3 m × 3 mm i.d.) packed with 20 % polyethylene glycol 1500 on 60—80 mesh Celite 545. An initial column temperature at 30°C was gradually raised to 120°C at a rate of 3°C/min. Both the detector and the injection port were operated at 150°C. The flow rate of carrier gas was kept at 40 ml/min. Under these conditions, benzene eluted at a retention time of 10 min. The peak heights were estimated on gas chromatograms obtained from the sample and benzene standard solutions.

Results

The average concentrations of benzene in untreated and treated wastewater were 0.43 and 0.02 mg/l, respectively. This compound was thus removed from the chemical wastewater by the treatment plant with an average removal efficiency of 88.0%. The removal mechanism was investigated on a laboratory scale by the same reactions as used in the treatment plant. The activated carbon adsorption precipitation process was very effective in removing benzene, while the coagulation precipitation method was not effective.