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A simple process for removing chloroform from water

Chloroform in water is a byproduct of the chlorination process (1). Bathing or showering in chlorinated tap water exposes individuals to chloroform by ingestion, inhalation, or dermal contact. Some epidemiological studies have suggested that exposure to chlorinated water causes bladder cancer (2, 3) and is associated with rectal cancer (3) and potential birth defects (4).

Several studies, including some based on exhaled breath analysis, suggest that significant dermal exposure to chloroform occurs while showering, and the dose is roughly comparable to that resulting from inhalation (5, 6). (Breath analysis measures the time elapsed between first skin contact and when the chloroform is first observed in the exhaled breath.) Other studies have extended this work to swimming in indoor pools (7, 8). Most of these investigations have used breath measurements to determine total exposure.

We have proposed a process to remove chloroform from water. The process was tested and found to be adequate by public health standards for water that contains a concentration of chloroform up to 6.7 g/L.

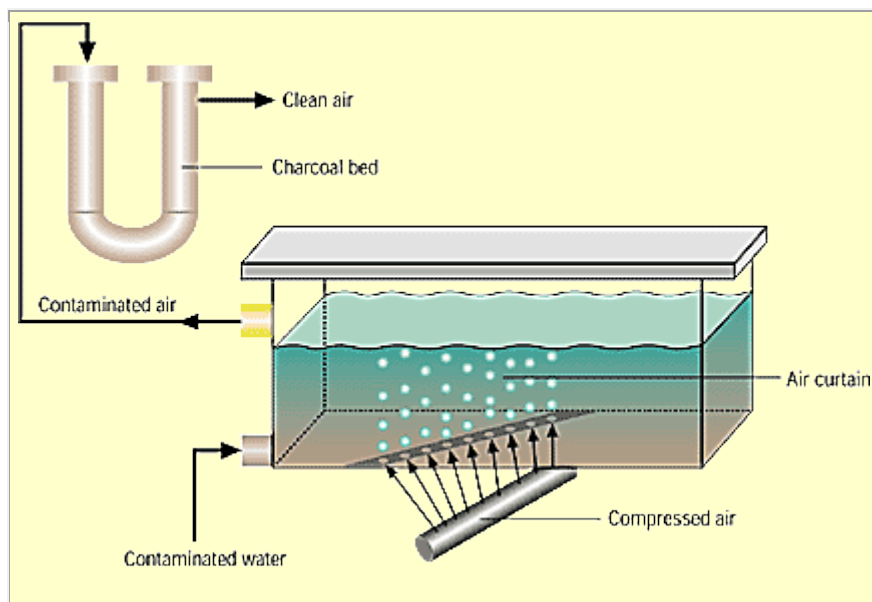


Figure 1. A two-step process removes chloroform from water. Contaminated water is fed into a convection tank, where it passes through a “curtain” of compressed air. The air removes the chloroform from the water, and a charcoal bed removes the chloroform from the air. The purified air is released to the atmosphere.

We use an air curtain convection tank (Figure 1) coupled with a carbon bed system located at the air exit (9–11). This process provides rapid, efficient mass transfer of the chloroform from the liquid phase to the gas phase (11). The location of the air curtain and the flow rate of the compressed air have been optimized with respect to mass transfer and good mixing. Compressed air is injected into the convection tank through series of 16 equally spaced perforations (1.6 mm diam) in a single row along a transverse tube to create fluid circulation with an air curtain. The tube is placed centrally across the width of the bottom of the tank.

Saka and Doi (10) found that carbonized woody materials effectively adsorb chloroform from water and benzene from the atmosphere. Using their technique, we fed the air exiting the aerated tank into a charcoal-packed bed. This air contains chloroform and a small amount of water. The packed bed consists of a Perspex U tube (2 cm diam, 10 cm high) filled with granulated charcoal 0.5 mm in diameter. This shape was the most effective for reducing the concentration of chloroform in air.

We started with 5 L of water containing 18.25 g of chloroform. Air at 5 L/min aerated the water via the perforated pipe. The air exited the water tank, then passed through the carbon bed. The exhaust from the carbon bed was vented to the atmosphere.

([Figure 2](#)) shows the change in the concentration of chloroform in water when air was blown into the contaminated water for 90 min. Gas chromatography was used to analyze for chloroform in the water. After 90 min, the concentration of chloroform in water went almost to zero. The chloroform was then removed from the air exiting the tank using the U-shaped charcoal bed. The air exiting the carbon bed was assumed to be free of chloroform (10).

This simple, novel process is very effective in eliminating chloroform from water. We believe that this method will be useful in protecting our environment from such a harmful pollutant.

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