

A Study on the Effect of Temperature and Storage Time on the Leaching of Antimony (Sb) from Polyethylene Terephthalate Drinking Water Bottles

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We examined the effects of temperature and storage time on the release of antimony from polyethylene terephthalate drinking water bottles to determine whether antimony exposure presented a health risk to consumers. Simulation experiments were based on actual storage conditions recorded at three distributors over an eleven-day period. The highest temperature recorded at the distributor level was 50.8°C and a storage time of 7 days. The release of antimony based on temperature and time followed the equation: $C = C_0 \times k \times e^{kt}$. The mean concentrations of antimony released from the experiments were $0.05 \pm 0.01 \mu\text{g/L}$ at 29°C, $0.12 \pm 0.02 \mu\text{g/L}$ at 40°C, and $0.61 \pm 0.02 \mu\text{g/L}$ at 50°C. Antimony concentrations increased with storage time, temperature, and with the combined effect of storage time and temperature. However, the Maximum Contaminant Levels of the Caribbean Community (5 $\mu\text{g/L}$) and the World Health Organisation (20 $\mu\text{g/L}$) were not violated. The highest chronic daily intake values, which were calculated based on the average daily intake of drinking water (2 litres for adults and 1 litre for children) and average body weight (70 kg for adults, 20 kg for children), were 28.57 ng/kg/d for adults and 50 ng/kg/d for children. These values were far below the United States Environmental Protection Agency Reference Dose of 400 ng/kg/d. Antimony exposure from the leaching of polyethylene terephthalate drinking water bottles investigated in this study does not represent a significant health risk to adults and children.

Keywords: Antimony; polyethylene terephthalate (PET); drinking water