A1043 WHO limits for packaged water

The US EPA and Health Canada recommend 6 ppb for antimony in drinking water; Japan recommends 2 ppb. There is no justification for Australia accepting the much higher WHO limit of 20 ppb.

Antimony is a potentially toxic trace element with no known physiological function. Many consumers would be surprised to know that antimony has been detected in food and drinks packaged in polyethylene terephthalate (PET). This is because antimony trioxide is used both as an additive and a catalyst in the manufacture of PET at a maximum level of 0.035%. Although industry has been searching for a substitute catalyst for many years, no satisfactory, commercially-viable alternative has been found, although a titanium catalyst is used in Japan (Thiele, 2004).

A background level of antimony in pristine ground water in Canada is around 2 ppt, but once filled into PET bottles, these levels rise to around 50 ppt in 37 days and 566 ppt after 6 months storage at room temperature. Up to 626 ppt (0.000626 mg/L = 0.626 ppb) have been found in German brands of water in PET bottles (Shotyk et al., 2006).

Shotyk & Krachler (2007) determined antimony in 132 brands of bottled water from 28 countries. Two of the brands were at or above the maximum allowable Sb concentration for drinking water in Japan (0.002 mg/L = 2 ppb). The leaching of Sb from PET bottles showed variable reactivity. In 14 brands of bottled water from Canada, Sb concentrations increased on average 19% during 6 months storage at room temperature, but 48 brands of water from 11 European countries increased on average 90% under identical conditions. A mineral water from France in PET, purchased in Germany, yielded 725 ppt when first tested, but 1510 ppt when it was stored for 6 months at room temperature; the same brand of water, purchased in Hong Kong, yielded 1990 ppt Sb.

Westerhoff et al., (2008) analysed nine commercially available bottled waters in the southwestern USA (Arizona) for antimony. Antimony concentrations in the bottled waters ranged from 0.095 to 0.521 ppb, well below the US Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 6 ppb. The average concentration was 0.195±0.116 ppb at the beginning of the study and 0.226±0.160 ppb 3 months later; samples were stored at 22°C. However, storage at higher temperatures had a significant effect on the time-dependent release of antimony. For exposure temperatures of 60, 65, 70, 75, 80, and 85°C, the exposure durations necessary to exceed the 6 ppb MCL were 176, 38, 12, 4.7, 2.3, and 1.3 days, respectively. Summertime temperatures inside of cars, garages, and enclosed storage areas can exceed 65°C in Arizona, and thus could promote antimony leaching from PET bottled waters. A similar situation is likely to exist in parts of Australia during summertime.

Tukur et al., (2012) analysed 47 freshly purchased British bottled waters and reported antimony concentrations ranging between 0.03 and 6.61 mg/L with only one sample exceeding the EU acceptable limit.

Andra et al., (2012) analysed a market-representative basket survey of bottled water in Boston, USA supermarkets and reported concentrations of antimony ranging from 4 to 634 ppt in non-carbonated water held for 60 days at 23°C.

References

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Note on Units:

milligram per litre = mg/L (parts per million (10^6) or ppm)

microgram per litre = µg/L (parts per billion (10^9) or ppb)

nanogram per litre = ng/L (parts per trillion (10^{12}) or ppt).

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