

Boron concentrations in river water and effects of boron on organism
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Abstract

Boron, the fifth element of the periodic table as B, is widely distributed in the environment with oxygen to form compounds called as borates. Borates occur naturally in fruits, vegetables and elsewhere in the food chain. Boron deficiency has been reported in studies in rats, chickens, and humans; boron appears to affect calcium and magnesium metabolism. On the other hand, recent investigations have been revealed the reproductive and developmental toxicities of inorganic boroncontaining compounds.

In Hokkaido area in Japan, the serious problem Jyozankei Hot Spring containing high level boron located at the upper stream of Toyohira River and then the hot spring water mixed with the river water. The main source of water supply is depending on Toyohira River occupied about 98% of tap water in Sapporo city. In this study, to clarify effects of boron on human health in Sapporo City, seasonal changes of boron concentrations in the river waters were investigated in several points of Toyohira River. In addition to compare with boron concentrations in Toyohira River, boron concentrations in Kusurisanbetsu River that runs through Noboribetsu, one of the most famous hotspring towns in Hokkaido, were measured. Moreover cell viability and DNA injury were investigated using the PC12 cell exposed with 0 to 1,000 mg boron/L for 72 hr and 30 days.

As the obtained results, the river water contained more than 1.0 mg/L boron could be supplied for tap water in Sapporo City especially in winter. From the results using PC12 cell system, when over 1.0 mg/L boron was exposed to the PC12 cells, cell viabilities decreased significantly. It means that more than 1.0 mg/L boron showed cytotoxicity to the cell system, and have a possibility that some healthy obstacle occurred in human health. In addition, the cell death and DNA damage caused by boron were considered as necrosis from the results of DNA electrophoresis and western blotting analyses. Furthermore, in the experiment of chronic boron exposure (30 days), cell viabilities were slightly increased like as acute boron exposure (72 hr). The more detail investigation will be needed to understand the mechanism of chronic and acute boron injuries in organism.