Investigating mercury contamination in freshwater lakes in Korea

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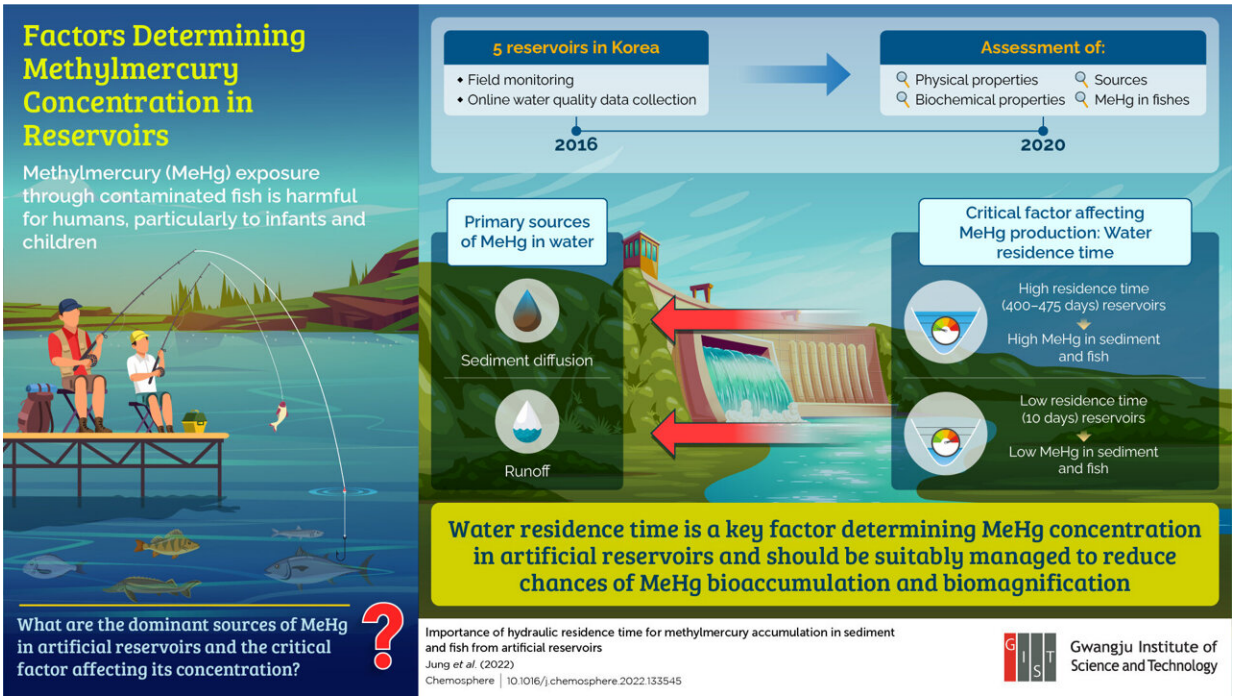

Anthropogenic activities have led to increased amounts of mercury being discharged into aquatic systems, where it accumulates in fish as methylmercury, an organic form of mercury that is neurotoxic. Eventually, the mercury makes its way up the food chain and enters the human body. In light of the dangers of methylmercury accumulation, researchers from Korea monitored five artificial lakes to identify the sources and accumulation patterns of methylmercury in sediment and fish. Credit: Gwangju Institute of Science and Technology (GIST)

During the 1950s and 1960s, Minamata Bay in Japan was the site of widespread mercury poisoning caused by the consumption of fish containing methylmercury—a toxic form of mercury that is synthesized when bacteria react with mercury released in water. Mercury poisoning caused deaths and widespread neurological disorders, as well as intergenerational harm as many of the survivors had children with birth defects. As methylmercury was stored in fish, it continued to remain in the food chain long after the discharge of mercury into the environment has ceased.

The dangers posed by methylmercury to unborn children have concerned Eunji Jung, a Ph.D. student who works in the Trace Metal Biogeochemistry Laboratory at the Gwangju Institute of Science and Technology (GIST). "As the health of infants and children is an important issue for all women, I felt great responsibility as a female scientist while conducting this research," explains Jung.

As part of a program to assess the methylmercury levels in aquatic systems in Korea, Jung and her colleagues under the guidance of GIST Professor Seunghee Han monitored mercury levels in five artificial reservoirs between 2016 and 2020. "We analyzed total mercury and methylmercury concentrations in water and sediment, and total mercury concentrations in common fish species. Data from the national water quality monitoring network were used to comprehensively understand the temporal and spatial variations in reservoir conditions; this was necessary to analyze the transport and fate of mercury," explains Prof. Han.

Their findings were made available online on 5 January 2022 and were subsequently published in the journal *Chemosphere* in April 2022.

They found that most of the mercury in the reservoirs originated from soil in the catchment areas. In reservoirs with shorter water residence

time, i.e., from which water was frequently discharged, the major source of methylmercury was surface runoff. In reservoirs with longer water residence time, where water was stored longer, the source of the toxin was accumulated methylmercury in the sediment. Methylmercury in sediments was also the source of mercury in fish, and higher mercury concentration were found in fish from reservoirs with longer residence times.

The researchers explain that it is possible to reduce mercury contamination in reservoir fish by preventing accumulation of methylmercury in the reservoir's sediment. They suggest increasing the rate of water discharge from reservoirs to accomplish this. "Reducing the synthesis rate of methylmercury by controlling the water residence time should ultimately exert a positive effect on human health," observes Jung.

Continuous monitoring of reservoir water quality might help detect human activity-induced changes in mercury levels and lower methylmercury poisoning due to fish consumption.

More information: Eunji Jung et al, Importance of hydraulic residence time for methylmercury accumulation in sediment and fish from artificial reservoirs, *Chemosphere* (2022). DOI: 10.1016/j.chemosphere.2022.133545

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