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Identification of Potentially Harmful Transformation Products of Selected Micropollutants in Swimming Pool Water

Phouthone Keohavong*

Department Environmental and Occupational Health, University of Pittsburgh, Pennsylvania, USA

Editorial

The presence of hundreds of various inorganic and organic micropollutants in the entire water environment has emerged as one of the most pressing and pressing concerns in environmental engineering. Numerous research papers have proven the presence of these possibly harmful-to-swimmer-health chemicals in swimming pool water. Fill water and swimmers are thought to be the most significant sources of micropollutants in this unique aquatic habitat. Many conditions, including disinfectants, natural sunshine and artificial illumination, can cause micropollutants to be converted or degraded. Not only is chlorine utilised in drinking water disinfectants, but it is also a good disinfectant for swimming pools and recreational water [1].

Description

Swimming in chlorinated pools causes various molecular alterations, according to Van Veldhoven. These alterations can occur as a result of direct interaction with the leftover chlorine and/or the formation of disinfection by-products. Richardson. identified over 600 disinfection by-products that can develop in this environment. This figure, however, does not include all of the chlorination intermediates seen in various types of disinfected recreational water reservoirs. Many studies have been conducted on well-known disinfection by-products such as chloramines, trihalomethanes (THMs), haloacetic acids (HAAs), chloral hydrates (CH), haloketones (HKs), dichloromethylamine (CH_3NCl_2), cyanogen chloride (CNCl), haloacetonitriles (HANs) and nitrosamines found in swimming pool water. However, the breakdown of pollutants from the surrounding pool space and the pool users themselves is seen as a substantial risk to swimmers. More than 100 contaminants were detected by Lempart including pharmaceuticals, hormones, vitamins, industrial admixtures and cosmetic components [2].

The same intermediates are thought to be probably carcinogenic to humans, according to data from the International Agency for Research on Cancer (IARC). As a result, it is necessary to investigate the interactions that occur between the applied disinfection chemical and the contaminants in the pool water. The insights gained might lead to the development of strategies to safeguard pool users against dangerous substances without the production of a wide spectrum of toxic intermediates. Membrane processes, for example, are taken into account in this context. The study looked at the probable transformation routes of selected micropollutants from the pharmaceutical and personal care product categories (carbamazepine, caffeine), industrial additives (bisphenol A) and pesticides (oxadiazon) in swimming pool water [3].

Understanding the basic principles of compound breakdown in swimming pool water was made feasible by a series of experimental studies performed on model water solutions exposed to specific physical or chemical processes. The efficacy of chemical breakdown during the chlorination and ozonation processes is dependent on the oxidant dosage. These processes are particularly vigorous in the first 5 minutes after dispensing. However, not all compounds are susceptible to the action of a single unit process, due to differences in individual molecule structures and physicochemical qualities. CAF was resistant to ozonation and CBZ was very minimally eliminated during this process, as found by Soufan and in prior Gibs experiments.

The study of the chromatograms obtained during the testing of the CBZ water samples exposed to the action of NaOCl revealed the production of one chemical that the NIST v17 software could not properly identify. This molecule is distinguished by the heaviest ion, which has a m/z value of 227 and is classified as a molecular ion. Furthermore, two peaks in the molecular ion area were discovered. This showed the existence of a Cl in the compound's chemical structure. This chemical is thought to have been formed during the chlorination of Iminostilbene. The Cl atom was joined to the phenol ring, resulting in 3-Chloro-5H-dibenzazepine, which after being connected to a second Cl atom converts into 3,7-dichloro-5h-dibenzazepine [4].

There were no by-products found in samples following the natural sunlight action process, which was corroborated by the presence of NaOCl and O_3; however, samples after single chlorination contained only 2,6-Dichlorohydroquinone. The analytical methodologies used did not allow for the precise quantification of these CEC degradation processes. Zhao, for example, hypothesised an ODZ breakdown mechanism during the non-thermal plasma treatment procedure. The ODZ molecule is denitrated and dechlorinated, resulting in the creation of various open ring compounds that totally breakdown to CO_2 and H_2O under the action of HO• radicals and O_3 [5].

Conclusion

When exposed to sunshine, micropollutants disintegrate quicker than when exposed to artificial illumination. As a result, the real quantities of these chemicals in indoor swimming pools may be greater than in outdoor swimming pools. Because some CECs, such as CAF and CBZ, are resistant to light degradation, their decomposition should be aided by other processes or compounds that can function as an oxidant source. The procedure that combines the action of natural sunshine, NaOCl and O_3 has the greatest CEC removal degrees.

Acknowledgement

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Conflict of Interest

No potential conflict of interest was reported by the authors.

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***Address for Correspondence:** Phouthone Keohavong, Department of Environmental and Occupational Health, University of Pittsburgh, Pennsylvania, USA; E-mail: keovhavongphouthone@gmail.com*

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