MONITORING TRIAZINE PESTICIDES IN BRAZILIAN NATIONAL SURVEILLANCE PROGRAM FOR DRINKING WATER FROM 2018 TO 2024

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INTRODUCTION: Brazil is one of the world's largest consumers of pesticides, with a notable emphasis on triazine class herbicides (atrazine, simazine, and ametryn), which are widely used in soybean, corn, and sugarcane crops. Their use can have negative impacts on both the environment and human health. OBJECTIVE: To monitor the presence of triazines in surveillance water analysis results from the Vigiagua Program during the period from 2018 to 2024. METHODOLOGY: The analytical method employed solid-phase extraction (SPE) followed by gas chromatography coupled to triple quadrupole mass spectrometry (GC-MS/MS) to quantify 99 pesticides. A water sample was considered positive if its analytical response exceeded the method's limit of quantification (LOQ). RESULTS AND CONCLUSION: In 2018, 836 samples from 15 states were analyzed, 8 (1%) of which tested positive for triazines. In 2019, 1,196 samples were analyzed, with 16 (1.3%) positives. In 2020, 10 (1.5%) of 641 samples were positive. In 2021, 821 samples from 18 states were analyzed, with 22 (2.7%) positive results. In 2022, 1,828 samples from 16 states were tested and 76 (4.2%) were positive for atrazine, 16 (0.9%) for simazine, and 15 (0.9%) for ametryn. In 2023, 1,947 samples from 24 states were analyzed, with 74 (3.8%) containing atrazine, 2 (0.1%) with ametryn, and 2 (0.1%) with simazine. In 2024, a new method validation was carried out, lowering the limit of quantification to 0.01 μg L^{-1} and limits of detection (LOD) were 0.0029 μg L^{-1} for atrazine and 0.0031 μg L^{-1} for both ametryn and simazine. This increase in sensitivity resulted in a higher detection rate of this class, especially atrazine. A total of 2,943 samples were analyzed, with 385 (13%) testing positive for atrazine. The gradual increase in the percentage of positive samples over the years indicates a rising presence of these pesticides. The enhanced method sensitivity in 2024 significantly increased the detection rates, especially for atrazine. The ongoing surveillance program underscores the importance of monitoring pesticide levels in drinking water and reflects the health and environmental impacts of agricultural practices in Brazil. The findings call for continued vigilance and regulatory measures to safeguard water quality.

Key words: Pesticides; drinking water; triazines.

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