

Physicochemical analysis of wastewater discharges and social perception study on environmental education and offensive odors in Santander, Colombia

Water pollution caused by untreated wastewater discharges is a highly significant environmental and public health problem, especially in rural areas where basic sanitation coverage is limited. These discharges have direct effects on water resources and associated ecosystems, but they also produce sensory impacts such as offensive odors, resulting from the anaerobic decomposition of organic matter and the release of volatile compounds. These odors cause discomfort, a perception of risk, and a decline in the quality of life among nearby communities. The persistent presence of these odors, along with indicators of environmental degradation, reinforces the community's perception of shortcomings in water resource management and wastewater treatment.

In this context, the present study aimed to analyze both community perceptions and the physicochemical state of the receiving water body, integrating a comprehensive socio environmental approach. To this end, a structured survey was administered to residents of the urban area of Charta, designed to explore perceptions of water quality, health risks, the impact of offensive odors, community participation, and the evaluation of environmental education processes. The instrument was validated through expert review, and its reliability was verified using Cronbach's alpha coefficient.

Additionally, physicochemical monitoring was conducted at three points along the Charta River (upstream, the discharge point, and downstream) to assess the actual conditions of the water resource and determine the impact of domestic wastewater discharge. Key parameters such as pH, BOD₅, COD, fats and oils, settleable solids, and total suspended solids were measured, allowing for the identification of significant alterations in water quality associated with the discharge. These results revealed high organic loads at the discharge point, the presence of biodegradable substances that promote anaerobic processes responsible for the offensive odors perceived by the population and a decrease in water quality downstream, despite the river's natural self purification processes.

The findings show a convergence between community perception and monitoring results: the community identifies the environmental impact and recognizes the offensive odors as a clear sign of pollution, while the physicochemical analyses confirm the presence of organic matter and conditions that can compromise aquatic life, public health, and water security. Furthermore, a high level of citizen willingness to participate in training programs and environmental campaigns was identified, along with significant gaps in technical knowledge regarding wastewater management and current regulations.

In this regard, it is concluded that the implementation of contextualized environmental education programs is fundamental to strengthening collective awareness, promoting sustainable practices, and supporting decision making regarding water resource management. The integration of technical monitoring, community participation, and educational processes is essential for reducing pressure on the Charta River and advancing the municipality's environmental sustainability.

Keywords: environmental education, community perception, water monitoring, discharges, offensive odors, wastewater, sustainability, environmental management