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ANALYSIS AND COMPARISON OF 20 EMPIRICAL EQUATIONS FOR REAERATION RATES IN URBAN RIVERS

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Abstract

Accurate measurements of the pollution in urban basins are essential for the development of effective management strategies. One important parameter is the reaeration rate, which allows for the evaluation of the quality and self-purification rate of water bodies. The reaeration rate can be determined using a variety of methods, such as empirical and semi-empirical equations that can rapidly produce estimates based on hydraulic and hydrodynamic variables. However, depending on the variables, these equations often produce very different results and can lead to underestimated or overestimated values. In order to test these methods, we evaluated 20 empirical equations in three urban rivers in the city of Bogota and categorized them into four groups. Principal component analyses and a dendrogram analysis were performed to compare the equations, revealing two consistent groups of equations for the three rivers. The first group consisted of equations from Langbein and Durum (LD), Padden and Gloyna (PG), and Bansal (B), while the second group consisted of equations from Owens et al. (OW) and Owens and Gibbs (OG). Equations from Thyseen et al. (TH) and Negulescu and Rojanski (NR-DL) did not present reliable clusters due to the high magnitude of their results compared to the other equations. Finally, the Tsvoglou and Wallance (TW), Grant (G), and Tsvoglou and Neal (TN) equations indicated inverse relationships compared to other equations. Hydraulic variables for velocity and water depth presented the greatest sensitivity and exhibited strong relationships with the magnitudes of the reaeration rates.

Key words: Dendrograms, principal component analysis, reaeration rate equations, urban rivers

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