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Behaviors, characteristics and fate of pollutants in the urban river: a field experiment with transient tracers

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Abstract The transverse mixing is a more dominant process in water-quality management than either vertical or longitudinal mixing, especially for two-dimensional process. In this study, a series of transient tracer experiments were performed based on the ammonia solution and red ink instantaneously injected into an urban river in the northeast of China. A three-dimensional sampling device was designed to track the transport of pollutants, observe the behavior of real-time processes and collect the trace data. The outcomes of the tests show that the concentration change in the transverse section was close to a normal distribution as the tracer was released into the center of the stream section. The average value of the transverse dispersion coefficient (E_y) in the study was 0.0038 m^2/s. However the dimensionless coefficient was smaller than the value estimated from the empirical formula because of the original characteristics of urban river destructed by human activities. The analysis of experiment found that the E_y was sensitive to the channel aspect ratio and affected by the specific gravity of the contaminant. This paper presents a theoretical formula of the E_y derived by the friction term, channel aspect ratio and specific gravity. The newly proposed theoretical formula can estimate the pollutant transport in the river, which may be of significant support to the emergency treatment of urban rivers.

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