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滦河流域上游地区主要河流水污染特征及评价

### Stream pollution analysis and hydrochemical assessment of the upper Luanhe River Basin

关键词: [水质评价](#) [污染特征](#) [水质标识指数法](#) [滦河流域上游地区](#)

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摘要: 在水资源管理与污染控制的研究过程中,进行水质特征分析与评价具有重要意义.本研究选取滦河流域上游地区29个监测站点,在2010年对河流溶解氧、氨氮、高锰酸盐指数等14项指标进行监测,并分别采用了单因子评价法、综合污染指数法、分级评价法、内梅罗污染指数法、模糊综合评价法及水质标识指数法6种方法对该地区主要河流水污染特征进行分析及评价.结果表明,水质标识指数法比较适于滦河流域上游地区河流的评价.单因子水质标识指数显示,该地区的主要污染物为总氮、氨氮、总磷和高锰酸盐指数,基本呈现富营养化状态;29个站点中小东区水质最差,达到劣V类水质,且出现黑臭现象;波罗诺、窑沟门、下板城和平泉4个站点水质最好,均达到I类标准;在河流总体评价中,柳河污染最为严重.根据评价结果将所有监测站点分为达标和未达标两类,并应用主成分分析和多元线性回归进行分析,结果表明达标站点和未达标站点的污染物的最大贡献者分别是生活污水和工业废水.研究结果对指导滦河流域水污染防治及水资源管理具有重要意义.

**Abstract.** In the context of water resource management and pollution control, the analysis of stream pollution and assessment of hydrochemistry are of great significance. In this study, we investigated such kind of water quality issues based on analyses of 14 hydrochemical variables that were monitored in 29 sites of the upper Luanhe River Basin in 2010. The stream hydrochemistry was assessed using the methods of single factor assessment, comprehensive pollution index, water quality grading, Nemerow pollution index, fuzzy comprehensive evaluation and water quality identification index. Our results showed that water quality identification index is the best method for stream hydrochemical assessment of the upper Luanhe River Basin. The dominant pollutants were total nitrogen, ammonia nitrogen, permanganate index and total phosphorus. According to the National Surface Water Environmental Quality Standards of China, the stream water quality at Xiaodongqu was classified as inferior to grade V. The water at Xiaodongqu appeared malodorous and black, which had the worst water quality grade among the 29 sites. The stream water quality at Boluonuo, Yaogoumen, Xiabancheng and Pingquan sites is grade I - the best grade. Liuhe River, one of the branches in the Luanhe River Basin, suffered the worst pollution. Our results also showed that 14 sites were classified as "attainment standard" of drinking water (AS, grade III or better) while the other 15 sites were classified "non-attainment standard" of drinking water (NAS, grade IV or worse). We also applied principle component analysis (PCA) and multiple linear regressions for determining contributions from identified pollution sources. We found that the most significant pollution sources were municipal sewage and non-point sources in AS sites. In NAS sites, chemical industry wastewater pollution dominated. Our findings provide valuable information and guidance for water pollution control and water resource management in the Upper Luanhe River Basin.

**Key words:** [hydrochemical assessment](#) [stream pollution characteristics](#) [water quality identification index](#) [the upper Luanhe River Basin](#)

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