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于会彬,高红杰,宋永会,李奎宁,彭剑峰,姚璐璐.城镇化河流DOM组成结构及与水质相关性研究[J].环境科学学报,2016,36(2):435-441

城镇化河流DOM组成结构及与水质相关性研究

Study on composition structure of DOM and its correlation with water quality in an urbanized river

关键词: 三维荧光 多元统计 水溶性有机物 水质 城镇化河流

基金项目: 国家水体污染控制与治理科技重大专项(No.2012ZX07202-005);中国博士后科学基金特别资助项目(No.2013T60148)

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摘要: 应用三维荧光技术和多元统计方法,分析城镇化河流水溶性有机物(DOM)组成结构特征,研究其与河水水质的相关性.根据人类活动对沈阳市白塔堡河影响程度的不同,分别在农村、城镇与城市河段设置3个采样点,采集水样.结果发现,河水营养水平由高到低的顺序为城市河段> 城镇河段> 农村河段,而水质由好变差的顺序为农村河段> 城镇河段> 城市河段.河水DOM由酪氨酸、色氨酸、类糖化蛋白、微生物代谢产物、类富里酸和类胡敏酸组成,主要成分为类蛋白,类蛋白含量由高到低的顺序为城市河段> 城镇河段> 农村河段.从源头到入浑河口,类蛋白丰度增长最大,类胡敏酸丰度增长最小,类富里酸介于两者之间.DOM的腐殖化程度由强到弱的顺序为城市河段> 城镇河段> 农村河段.影响河水营养状态的潜在因子包括COD、NH₃-N、BOD₅、DO和类蛋白,农村河段主要污染物来源于农村生活污水及养殖废水,城镇河段污染物来源于生活污水与工业园排水,城市河段污染物来源于处理和未处理的生活污水及工业废水.河水受人类活动影响由大到小的顺序为城市河段> 城镇河段> 农村河段.

Abstract: Excitation-emission matrix fluorescence spectroscopy combined with multivariable analysis was applied to characterize structural components of dissolved organic matter (DOM) in an urbanized river, and to explain its correlation with water quality. Nine water samples were collected along human impact gradient in Baitapuhe Rive of Shenyang City, China. The increasing order of the trophic level of the river was the urban region> the town region> the rural region, but the increasing order of water quality was the rural> the town> the urban. DOM consisted of tyrosine-like, tryptophan-like, glycolated protein-like material, soluble microbial byproduct-like, fulvic-like and humic-like materials, among which protein-like material was dominant in DOM fractions. The order of the protein-like content was the urban> the town> the rural. The trend in increasing extent of the organic fractions along the river flow was protein-like> fulvic-like> humic-like. The increasing order of humification level of DOM was the urban> the town> the rural. Latent factors for trophic state included COD, NH₃-N, BOD₅, DO and protein-like. The pollutants mainly derived from rural sewage and breeding wastewater in the rural region, from sewage and drainage from industrial parks in the town region, and from treated/untreated sewage and industrial wastewater. The increasing order of human activity impacts was the urban> the town> the rural.

Key words: excitation-emission matrix fluorescence multivariable analysis dissolved organic matter water quality urbanized river

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