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河流潜流带颤蚓生物扰动对沉积物渗透性的影响研究

**Effects of *Tubificid* bioturbations on vertical hydraulic conductivity of the hyporheic streambed sediments**

关键词: [颤蚓生物扰动](#) [垂向渗透系数](#) [粒度分布](#) [影响分析](#)

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**摘要:** 为了探究河流沉积物中底栖动物扰动对沉积物渗透性的影响,以渭河陕西段为研究对象,通过原位采样,布置不同颤蚓密度的试验管,进行室内颤蚓生物扰动对渗透系数影响的模拟实验测试.同时,通过对不同颤蚓密度下垂向渗透系数和沉积物指标进行相关分析和回归分析,研究颤蚓密度大小对渗透系数变化、沉积物表层特征、成分及渗透性变化的影响.结果表明,在研究时段内,渗透系数在白天和晚上的变化程度小于在整个试验时段上的变化程度;光照条件对颤蚓扰动作用影响不明显;沉积物的渗透系数在颤蚓密度约为 $1.0 \text{ ind.} \cdot \text{cm}^{-2}$ 时达到最大值,颤蚓密度越大,沉积物表面越粗糙,沉积物厚度变化程度越大,沉积物成分变化越大,沉积物颗粒有变小趋势,浮泥含量增加.颤蚓生物扰动作用能够影响沉积物的渗透性能,当颤蚓密度小于一定量值时,颤蚓生物扰动对沉积物渗透性有加强作用;而颤蚓密度大于一定量值后,颤蚓生物扰动对沉积物渗透性有减弱作用,这一颤蚓密度量值大致在 $2.0 \sim 2.5 \text{ ind.} \cdot \text{cm}^{-2}$ 之间.研究表明,颤蚓通过生物扰动改变沉积物的内部和表层结构、沉积物成分组成等,以此破坏或加强沉积物中细小颗粒物的阻塞,致使沉积物的渗透性能增强或减弱.

**Abstract:** In order to investigate the effects of *Tubificid* bioturbations on vertical hydraulic conductivity of the hyporheic streambed sediments, the experimental test for the vertical hydraulic conductivity of sampling sediments with different *Tubificid* densities from the Weihe River were simulated. The variation of surface structure, composition and permeability of sediment were estimated by regression and trend analysis method to explore the relationship between vertical hydraulic conductivity and sediment indicators with different *Tubificid* densities. The results indicated that the range of variance for the vertical hydraulic conductivity between daytime and nighttime was smaller than the variance in the entire period. There was no obvious variation occurred on *Tubificid* bioturbations when illumination conditions changed. The vertical hydraulic conductivity reached its maximum value when *Tubificid* density was  $1.0 \text{ ind.} \cdot \text{cm}^{-2}$ ; The pore space increased with enhanced *Tubificid* density, which further changed sediment thickness and sediment composition. Therefore, the *Tubificid* bioturbations have an impact on the vertical hydraulic conductivity and strengthen the permeability of streambed sediments when *Tubificid* density is lower than a critical value, roughly between  $2.0 \text{ ind.} \cdot \text{cm}^{-2}$  and  $2.5 \text{ ind.} \cdot \text{cm}^{-2}$ . It can be concluded that the *Tubificid* bioturbations can increase or decrease sediment permeability by changing internal and surface structure and particle composition of streambed sediments.

**Key words:** [Tubificid bioturbations](#) [vertical hydraulic conductivity](#) [grain-size distributions](#) [impact analysis](#)

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