疏浚底泥免烧陶粒的制备及其净水效果

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摘 要 以疏浚底泥为原料,采用免烧法制得疏浚底泥免烧陶粒(DSUC),同时对 DSUC 磁改性制得磁改性免烧陶粒(MUC),并将其作为陶粒过滤器滤料,与商品烧结陶粒(CSC)进行净水实验对比,探究了不同滤料对原水的处理效果,并调节循环水温度探究最佳运行温度。在净水实验中,控制原水流速 0.07 mL·s^{-1},进水方式为连续进水。结果表明,运行温度为 30 ℃时效果最优,此条件下 COD、NH_3-N、SS 和 TP 的去除率在 22 d 后稳定,平均去除率分别为 55%、65%、78% 和 50%。DSUC 对原水处理效果与 CSC 相近,MUC 效果更佳,MUC 对 COD、NH_3-N、SS 及 TP 去除率在 22 d 后分别稳定在 65%、69%、79% 和 51% 左右,说明弱磁性可能能够增加微生物活性,促进其在陶粒表面生长,提高处理原水的效果。

关键词 疏浚底泥; 免烧陶粒; 磁改性; 陶粒过滤器; 净水效果

中图分类号 X703 **文献标识码** A **文章编号** 1673-9108(2017)05-2804-08 **DOI** 10.12030/j.cjee.201512152

Preparation of dredged sediment unburned ceramsite and its water purification effect

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Abstract Dredged sediments unburned ceramsites (DSUC), which utilized dredged sediments as raw material, were manufactured in an unburned process. Moreover, magnetically modified unburned ceramsites (MUC) were used as a biological ceramsite filter (BCF) for wastewater treatment. To study the performance of wastewater treatment using different materials, commodity sintered ceramsites (CSC) were chosen as a reference, and the optimum biofilm culturing temperature of the MUC and CSC was determined by adjusting the temperature of the circulating water. During the wastewater treatment processes, the inflow of wastewater was continuous, with a velocity of 0.07 mL·s^{-1}. The study results revealed that the treatment performed best at 30 ℃, for which the removals of COD, NH_3-N, SS, and TP stabilized after 22 days, and their values were 55%, 65%, 78%, and 50%, respectively. Among the three types of BCFs (DSUC, MUC, and CSC), the wastewater treating capacity of the DSUC was similar to the CSC, and the performance of the MUC was the most significant. The removal rates of COD, NH_3-N, SS, and TP by the MUC were stable at 65%, 69%, 79%, and 51%, respectively, after 22 days. This result showed that microbial activity was more likely enhanced in the weaker magnetic environment, allowing microorganism growth on the surface of the ceramsites to increase, thus improving the wastewater treatment efficiency.

Key words dredged sludge; unburned ceramsites; magnetic modification; ceramsite filter; water purification effect

近年来,随着全球水资源污染日趋加重,越来越多的污水处理厂投入建设,关于污水处理的研究也日渐增多[1],人工湿地[2-7]及生物滤池[8-9]便是目前广泛应用于污水处理的工艺;但是人工湿地技术的废水处理效率低且易堵塞[10],而生物滤池技术在之前的应用中发现传质效果欠佳,导致净水效果差且所挂生物膜易脱落[11],因此探究新型填料及高效的挂膜工艺已成为当今研究人员共同的目标。

收稿日期: 2015-12-21; **录用日期**: 2016-04-27

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