

目次

环境工程学科基础研究领域亮点成果系列专稿

我国学者在离子跨膜选择性传输机制研究方面取得进展 ..... (915)

特邀专稿

2023年度环境工程学科国家自然科学基金申请与资助综述 ..... 杨静, 瞿芳术, 曲丹, 戚菁 (917)

“水土污染协同修复技术与装备”专题

地下水污染修复技术及装备研发现状与展望(代序言) ..... 邓家逸, 杨耕, 晏鑫尧, 蒲生彦 (922)

低渗污染场地水力压裂强化修复药剂输运机制 ..... 陈贺, 冯世进, 郑奇腾, 陈宏信 (937)

水动力控制参数对循环井运行效果的影响 ..... 陈韶音, 丁李露, 周睿 (946)

地下水循环井强化过硫酸盐在低渗透含水层中的方向性迁移 .....  
..... 安珮, 李佳, 钟兴豪, 苗竹, 赵越, 倪鑫鑫, 王朋, 蒲生彦 (956)

基于深度学习的双循环井水动力调控工艺参数多目标优化设计 ..... 马彦玲, 方樟, 周睿, 刘治国, 蒲生彦, 丁小凡 (968)

地下水循环井修复不锈钢滤水管设计及性能评价 ..... 田东庄, 杨文佳, 田宏杰 (978)

地下水循环井堵塞成因识别及防堵破堵技术 ..... 罗浩宇, 林秋莲, 陈劲松, 刘雪松, 李铁锋, 马慧 (987)

地下水循环井 V1.0 场地应用效果分析 ..... 程颜, 贾洋, 张帆帆, 刘倬嘉, 马宇飞, 孙永昌, 赵艳, 王雪丽, 杨胜科 (997)

上海典型 NAPL 污染场地补水-抽提与降水-抽提效率对比 ..... 杨春白雪, 冯世进, 郑奇腾, 彭春辉, 吴育林 (1005)

巨厚含水层中循环井结构优化设计 ..... 董倩, 董书君, 陈韶音, 杜中海, 周睿 (1013)

含裂隙污染场地中微生物运移及降解修复规律 ..... 李津, 冯世进, 郑奇腾 (1024)

KMnO<sub>4</sub> 缓释氧化剂降解地下水中的苯酚和苯胺 ..... 张渺, 乔微涵, 胡志欣, 董鲁钰, 夏玉瑾, 王雪丽, 杨胜科 (1032)

包覆型缓释氧化剂的制备及其缓释性能评价 ..... 李凡, 申佳, 张雪花, 唐智超, 阮秀秀 (1044)

压裂缝网特征对低渗透 NAPL 污染地层抽提效率的影响机制 ..... 冯世进, 牛九格, 郑奇腾, 杨春白雪 (1056)

循环井水力激发下多相污染物的迁移转化规律 ..... 刘忠建, 伍世杰, 李博文 (1066)

场地修复异位热脱附碳排放核算、优化与预测 ..... 陈汐昂, 王文兵, 李瑞飞, 李春阳, 范淇峰, 张梦, 相明辉, 李辉 (1073)

基于砂箱实验及数学模拟的地下水循环井修复研究进展 ..... 胡杏璐, 刘传琨, 罗彬, 马蒙, 王佳波, 胡玥 (1083)

水污染防治

炼油污水处理厂二沉出水中溶解性有机物组分分析 ..... 王鑫, 肖向群, 吴倩, 姜峻韬, 宁潇宇, 王庆宏, 陈春茂 (1096)

纳米 Fe<sub>2</sub>O<sub>3</sub> 强化 MBF 生物巢脱氮的机制 .....  
..... 李婉蒙, 徐保荐, 孙朋, 黄婷, 王晓, 梁止水, 杨菲, 刘志刚, 韦静, 李姍蔚, 吴智仁, 周向同 (1104)

多点进水多级生物接触氧化工艺处理农村生活污水 ..... 马宁, 何鹏飞, 付金祥, 张辉, 李炳华, 杨默远 (1113)

生物炭负载铁纳米颗粒对水溶液中镉的吸附性能 ..... 赵子莹, 刘则序, 隋悦, 孙博文, 惠晶, 曹博, 徐诚蛟, 江群 (1120)

梯度曝气 A<sup>2</sup>O<sup>2</sup>-MBR 工艺强化同步硝化反硝化效能 ..... 刘钢, 王丽, 温榛煌, 谌建宇, 黎京士, 何伟, 梅嘉鑫, 张宇 (1130)

碳纳米管强化高铁酸盐降解苯扎贝特的效能与机理 ..... 黄先锐, 田晨浩, 郑志宏, 刘超 (1144)

多氧态垂直流人工湿地系统的构建及其污染物去除特性 ..... 申志强, 徐嫚嫚, 王欣, 张琴, 白少元 (1151)

废弃聚氯乙烯塑料衍生的氮掺杂碳纳米片活化过一硫酸盐去除水中四环素 .....  
..... 龚焱, 汤琪, 白纯, 曹鹤龄, 廉菲, 王骏, 赵旭 (1161)

微纳米级天然黄铁矿负载 nZVI 去除水中 Cr(VI) ..... 解崇巍, 高雨欣, 马鑫辉, 王婷, 田慧霞, 丁庆伟 (1172)

有机碳源对异养硝化-好氧反硝化生物脱氮的影响及其优化 ..... 谭丰佚, 刘新颖, 党岩, 李继云, 徐康宁 (1183)

环境生物技术

饮用水消毒工艺对抗生素耐药性风险的影响及其机理 ..... 黄鸿彬, 汪淑雅, 王文豪, 于起东, 贾舒宇 (1192)

## CONTENTS

- 917 **Application and funding of National Natural Science Foundation of Environmental Engineering Discipline in 2023: An overview**  
YANG Jing, QU Fangshu, QU Dan, QI Jing
- 922 **R&D status and prospect of groundwater pollution remediation technology and equipment**  
DENG Jiayi, YANG Geng, YAN Xinyao, PU Shengyan
- 937 **Mechanisms of amendment transport in low-permeability contaminated sites enhanced by hydraulic fracturing**  
CHEN He, FENG Shijin, ZHENG Qiteng, CHEN Hongxin
- 946 **Influence of hydrodynamic control parameters on the operation effect of groundwater circulation well**  
CHEN Shaoyin, DING Lili, ZHOU Rui
- 956 **Groundwater circulation wells enhance the directional delivery of persulfate in low-permeability aquifers**  
AN Pei, LI Jia, ZHONG Xinghao, MIAO Zhu, ZHAO Yue, NI Xinxin, WANG Peng, PU Shengyan
- 968 **Multi-objective optimization design of process parameters for hydrodynamic regulation of dual circulation wells based on deep learning**  
MA Yanling, FANG Zhang, ZHOU Rui, LIU Zhiguo, PU Shengyan, DING Xiaofan
- 978 **Design and performance research of stainless steel water filter screen for groundwater circulation well remediation**  
TIAN Dongzhuang, YANG Wenjia, TIAN Hongjie
- 987 **Review of the clogging causes identification and anti-clogging techniques for groundwater circulation well**  
LUO Haoyu, LIN Qiulian, CHEN Jinsong, LIU Xuesong, LI Tiefeng, MA Hui
- 997 **The application effect of an in-situ groundwater circulation well (V1.0)**  
CHENG Yan, JIA Yang, ZHANG Fanfan, LIU Fengjia, MA Yufei, SUN Yongchang, ZHAO Yan, WANG Xueli, YANG Shengke
- 1005 **Remediation of typical NAPL contaminated sites in Shanghai using recharge- extraction and dewatering- extraction: A comparison**  
YANG Chunbaixue, FENG Shijin, ZHENG Qiteng, PENG Chunhui, WU Yulin
- 1013 **Optimization design of groundwater circulation well structure in super-thick aquifer**  
DONG Qian, DONG Shujun, CHEN Shaoyin, DU Zhonghai, ZHOU Rui
- 1024 **Study on microbial transport and biodegradation in fracture contaminated sites**  
LI Jin, FENG Shijin, ZHENG Qiteng
- 1032 **Degradation of phenol and aniline in groundwater by  $\text{KMnO}_4$  slow-release oxidant**  
ZHANG Miao, QIAO Weihai, HU Zhixin, DONG Luyu, XIA Yujin, WANG Xueli, YANG Shengke
- 1044 **Preparation of coated slow-release oxidants and evaluation of their slow-release performance**  
LI Fan, SHEN Jia, ZHANG Xuehua, TANG Zhichao, RUAN Xiuxiu
- 1056 **Mechanism of fracture network characteristics on extraction efficiency in low-permeability NAPL-contaminated formations**  
FENG Shijin, NIU Jiuge, ZHENG Qiteng, YANG Chunbaixue
- 1066 **Migration and transformation of multiphase contaminant under hydraulic excitation by circulation well**  
LIU Zhongjian, WU Shijie, LI Bowen
- 1073 **Accounting, optimization and prediction of carbon emission in ex-situ thermal desorption for site remediation**  
CHEN Xiang, WANG Wenbing, LI Ruifei, LI Chunyang, FAN Qifeng, ZHANG Meng, XIANG Minghui, LI Hui
- 1083 **Advances in studies about the groundwater pollution remediation through the groundwater circulation well using sandbox experiments and simulation methods**  
HU Xinglu, LIU Chuankun, LUO Bin, MA Meng, WANG Jiabo, HU Yue
- 1096 **Characterization of four fractions of dissolved organic matters in secondary effluent of refinery wastewater treatment plant**  
WANG Xin, XIAO Xiangqun, WU Qian, JIANG Juntao, Ning Xiaoyu, WANG Qinghong, CHEN Chunmao
- 1104 **Augmentation of nitrogen removal by MBF bio-nests supplemented with nano- $\text{Fe}_2\text{O}_3$**   
LI Wanmeng, XU Baojian, SUN Peng, HUANG Ting, WANG Xiao, LIANG Zhishui, YANG Fei, LIU Zhigang, WEI Jing, LI Shanwei, WU Zhiren, ZHOU Xiangtong
- 1113 **Multi-stage biological contact oxidation process with multi-point influent for rural domestic sewage treatment**  
MA Ning, HE Pengfei, FU Jinxiang, ZHANG Hui, LI Binghua, YANG Moyuan
- 1120 **Adsorption performance of cadmium in aqueous solution using biochar-supported iron composites**  
ZHAO Zixuan, LIU Zexu, SUI Yue, SUN Bowen, HUI Jing, CAO Bo, XU Chengjiao, JIANG Qun
- 1130 **Enhanced SND performance of step-wise aeration  $\text{A}^2\text{O}^2$ -MBR process**  
LIU Gang, WANG Li, WEN Zhenhuang, CHEN Jianyu, LI Jingshi, HE Wei, MEI Jiabin, ZHANG Yu
- 1144 **The efficiency and mechanism of carbon nanotube-enhanced bezafibrate degradation by ferrate**  
HUANG Xiankun, TIAN Chenhao, ZHENG Zhihong, LIU Chao
- 1151 **Construction of vertical flow constructed wetland system with multi-aerobic and anaerobic zones and its removal characteristics on pollutant**  
SHEN Zhiqiang, XU Manman, WANG Xin, ZHANG Qin, BAI Shaoyuan
- 1161 **Nitrogen doped carbon nanosheet derived from waste PVC plastic activated peroxydisulfate for tetracycline removal**  
GONG Yan, TANG Qi, BAI Chun, CAO Heling, LIAN Fei, WANG Jun, ZHAO Xu
- 1172 **Removal of Cr (VI) from water by micro-nano-scale natural pyrite loaded nZVI**  
XIE Chongwei, GAO Yuxin, MA Xinhui, WANG Ting, TIAN Huixia, DING Qingwei
- 1183 **Effect of organic carbon on the biological nitrogen removal through heterotrophic nitrification-aerobic denitrification and its optimization**  
TAN Fengyi, LIU Xinying, DANG Yan, LI Jiyun, XU Kangning
- 1192 **Influence and mechanism of drinking water disinfection strategies on antibiotic resistance risk**  
HUANG Hongbin, WANG Shuya, WANG Wenhao, YU Qidong, JIA Shuyu