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FEASIBILITY OF EFFICIENT COD REMOVAL OF SIMULATED DOMESTIC SEWAGE FROM INLAND SHIPS IN SINGLE-STAGE CSTR UNDER MICROAEROBIC CONDITION

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Abstract

To improve domestic sewage treatment technology applied on inland ships, the feasibility of using a simplified single-stage continuous stirred tank reactor (CSTR) under microaerobic conditions was assessed in this study. With an optimized hydraulic retention time of 24 hours, the oxidation–reduction potential of the system fluctuated between –329 and –171 mV, confirming stable microaerobic conditions. The minimum effluent chemical oxygen demand (COD) reached 39 mg/L, corresponding to a maximum degradation efficiency of 96.9% on day 106, while the highest total nitrogen (TN) removal was 77.1%. Analysis of microbial diversity showed higher abundance and metabolic activity in the intermediate and late stages, with dominant microflora shifting from *Betaproteobacteriales* (53.0%) and *Flavobacteriales* (22.9%) to *Saccharimonadales* (average 76.6%) at the order level. These microbial community dynamics were closely associated with pollutant removal efficiency, highlighting the adaptability of functional microorganisms under microaerobic conditions.

This study validated the feasibility of effectively treating high-concentration simulated ship sewage using a single-stage CSTR without continuous aeration. The results emphasize the advantages of a compact, low-energy, and high-efficiency treatment process suitable for small and medium-sized inland vessels. Beyond meeting discharge standards, this approach offers potential for sustainable onboard wastewater management and provides a scientific basis for future development and scaling of practical treatment technologies in inland waterway transport.

Key words: COD removal, continuous stirred tank reactor, domestic sewage, inland ships, microaerobic condition

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