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High-performance of fluorine-doped tin oxide immobilized on polyurethane foam composite for crude glycerol to ethyl acetate photoconversion
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Abstract
Photocatalytic conversion of crude glycerol into high-value products offers economic and environmental benefits. However, impurities such as organic and inorganic salts, heavy metals, soap, and matter organic non-glycerol (MONG) can hinder direct conversion. This study investigates the transformation of non-purified crude glycerol into value-added products such as ethyl acetate using a newly developed fluorine-doped tin oxide (FTO) photocatalyst immobilized on polyurethane foam (PU). FTO-PU was synthesized by a simple mixture method, and the FTO cluster was evenly distributed on the PU foam, obstructing intrinsic PU pores and leading to a smaller surface area for FTO-PU than FTO catalysts. Despite the smaller surface area, the FTO-PU catalyst demonstrated exceptional performance, achieving 94% conversion of crude glycerol with 86% selectivity to ethyl acetate, resulting in an 81% yield. The stability and reusability of the FTO-PU catalyst were confirmed over six cycles, demonstrating its potential for efficient crude glycerol conversion and laying the foundation for advanced materials in photocatalytic systems. Critical parameters, including light power, reaction time, crude glycerol concentration, and FTO loading within the PU structure, were optimized, with 2% FTO loading on PU, 70 W light intensity, 60 min reaction time, and 10 wt% crude glycerol concentration identified as optimal conditions. Importantly, this study aligns with Sustainable Development Goal 12, emphasizing sustainable consumption and production patterns. By addressing impurities in crude glycerol and converting it into high-value products, this research contributes to efficient resource management and supports the responsible disposal of waste, aligning with global efforts for a sustainable future.

Author Keywords
crude glycerol conversion; Fluorine-doped tin oxide; free radical; polyurethane foam; surface area

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