Development of High-Performance Composite Pellets through Nylon Recycling from Waste Fishing Nets

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폐어망에서 나일론을 재활용한 고성능 복합펠렛 개발에 관한 연구

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Abstract

The rapid growth of global fisheries and aquaculture industries has led to a substantial increase in the use of plastic-based fishing gear, especially nylon fishing nets, many of which are abandoned, lost, or otherwise discarded at the end of their service life. Estimates indicate that between roughly 500,000 and 1,000,000 tonnes of fishing gear enter the ocean each year, with a frequently cited central estimate of about 640,000 tonnes annually, representing roughly ten percent of marine plastic pollution [1]. Recent scientific assessments using fisher surveys and global catch/survey data further quantify the scale and spatial distribution of lost nets and support the conclusion that discarded fishing gear constitutes a major and persistent component of ocean debris [2]. These discarded nylon nets degrade very slowly in the marine environment, releasing microplastics and chemical additives over long timeframes, while also causing entanglement of marine fauna and physical damage to habitats. Conventional disposal methods such as landfilling and incineration not only contribute to environmental pollution but also result in irreversible loss of high-value polymer resources. Consequently, mechanical recycling, chemical depolymerization, and upcycling routes for recovering nylon from waste fishing nets have gained attention as critical strategies to mitigate environmental harm and to advance circular economy practices for sustainable resource reuse [3].

In this study, discarded fishing nets were systematically collected and subjected to a series of pretreatment processes, including separation, shredding, washing, and drying, to ensure the removal of impurities and the stabilization of the recycled polymer. Following pretreatment, the processed nylon was blended with controlled amounts of recycled carbon fiber reinforced plastic (CFRP) and activated carbon during the melting stage. This synergistic combination was subsequently extruded into high-performance composite pellets with enhanced strength, durability, and environmental compatibility. The incorporation of recycled CFRP improves the mechanical reinforcement of the pellets, while activated carbon contributes to additional functionalities such as improved thermal stability and potential adsorption capacity. By utilizing extrusion molding, the study demonstrates an efficient and scalable pathway for producing eco-friendly composite pellets, which not only reduce plastic waste but also create value-added materials suitable for various industrial applications. Ultimately, this approach highlights a sustainable strategy to promote circular resource utilization and support carbon neutrality goals through innovative waste-to-resource conversion.

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References

[1] KOZIOŁ, Anna; PASO, Kristofer Gunnar; KUCIEL, Stanisław. Properties and recyclability of abandoned fishing net-based plastic debris. Catalysts, 2022, 12.9: 948.
[2] RICHARDSON, Kelsey, et al. Global estimates of fishing gear lost to the ocean each year. Science Advances, 2022, 8.41: eabq0135.
[3] KIM, Soosan, et al. Marine waste upcycling—recovery of nylon monomers from fishing net waste using seashell waste-derived catalysts in a CO 2-mediated thermocatalytic process. Journal of Materials Chemistry A, 2022, 10.37: 20024-20034.