# A Study on the Development of Waste Plastic (PVC) Recycling Technology

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# 폐플라스틱(PVC) 재활용 기술 개발에 관한 연구

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Abstract

Plastic has the advantages of heat resistance, cold resistance, corrosion resistance, light weight and easy molding, is widely used in industrial products such as automobiles and electronic appliances, as well as various daily necessities such as packaging. However, with the rapid increase in plastic production and usage, the environmental pollution caused by the large amount of waste plastic has attracted global attention. According to reports, global plastic production surged from 2 million tons to 380 million tons between 1950 and 2015. Approximately 9% of plastic fragments were recycled, 12% were incinerated, and approximately 79% of plastic was collected in landfills [1]. Approximately 12 million tons of uncontrolled plastic debris are released into the environment each year, accounting for 40% of disposable plastics, making it a critical environmental issue. Burning waste plastics not only generates a large amount of harmful gases, but also a large amount of greenhouse gas (GHG) emissions. According to reports, greenhouse gas emissions caused by plastics will reach 1.34 gigatons per year by 2030 and 2.8 gigatons per year by 2050 [2]. Therefore, it is particularly important to effectively develop efficient and environmentally friendly technologies for the reuse of waste plastics. The most common plastic polymers are polypropylene (PP), polyethylene (PE), and polyvinyl chloride (PVC), which account for 24%, 21%, and 19% of the total global plastic production, respectively [3]. Compared to PVC, PP and PE have good thermoplasticity and non toxicity, making them easier to reuse. This is because PVC generates toxic chlorine gas and harmful by-products during the recycling process, posing a threat to the environment and human health. In addition, there are various additives in PVC plastic, such as plasticizers including phthalates, adipates, trimethylesters, phosphates, citrates, etc. The presence of plasticizers can disrupt the intermolecular forces within the PVC matrix and deteriorate the flow characteristics of PVC [4].

Therefore, in the current work, the morphological characteristics, composition, and thermal decomposition properties of new PVC and waste PVC were first compared and investigated. Then, based on these experimental data, a novel mechanical recycling technique was designed. In order to improve the mechanical properties and antibacterial properties of PVC, waste carbon-fiber reinforced plastics (CFRP) and antibacterial agents were added. Finally, the optimisation was carried out to find the best mixing ratio based on mechanical and bonding characteristics.

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