Development of composite materials using waste plastic, waste stone and fly ash, and evaluation of the harmfulness of heavy metals

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폐플라스틱, 폐석분 및 플라이애쉬를 재활용한 복합소재 개발 및 중금속 방출량의 유해성 평가

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Abstract

Plastic is the most important material used in today's industry, and its output and consumption rate have been growing continuously, it increased from 1.5 million tons in 1950 to 367 million tons in 2020, an increase of about 240 times in 70 years, especially after the global epidemic of COVID-19, more people like to buy things online, which further increases the consumption of plastic packaging products. The emergence of plastics is both convenient and provides a wealth of daily life, which quickly permeates into the life of modern people. At the same time, taking productivity as the starting point, it has made great contributions to the industry. However, in the process of incineration or landfill of plastics, due to the production of environmental hormones, incomplete combustion of highly toxic waste and other reasons, soil and air pollution is caused, which provides a serious reason for environmental pollution. With the explosion of plastic production and consumption, plastic waste flows into the sea, destroying the ecosystem of many marine organisms. At the same time, more than 99% of plastics made from fossil fuels emit greenhouse gases during the entire life cycle (gas and oil extraction, plastic refining and production, incineration and landfill, and recycling), polluting soil and atmosphere. The greenhouse gas emissions in these processes are estimated at 850 million tons, equivalent to 198 thermal power plants with a capacity of 500 MW. With the rise of the severity of the climate crisis caused by plastics, efforts to solve this problem have become the 21st century topic for all mankind to solve. On the other hand, with the development of industry, a variety of industrial by-products are increasing, resulting in increasingly serious pollution of soil, air and water. Therefore, in order to reuse industrial by-products, reduce natural resources and protect the national environment by developing and reusing technologies, many researchers have carried out a lot of research. In addition, the country has formulated laws on resource conservation and promotion of reuse, and has also formulated reuse plans for various industrial by-products in the construction field. Especially recently, the country has increased the research on the reuse of waste stone powder. Waste stone powder mainly occurs in the mining and processing of waste concrete and granite at construction sites. Most of the waste stone produced by waste concrete is classified as recycled aggregate for recycling, while the waste stone and waste stone powder produced in the mining or processing of granite are only partially recycled by recycled aggregate, The rest are illegally landfilled or abandoned without authorization, which will lead to certain environmental pollution. Therefore, how to reuse these industrial by-products to reduce environmental pollution is of great significance for building a green and healthy society.

In this study, in order to expand the utilization of waste plastics and industrial by-products, PP waste plastics, waste stone powder and fly ash as adsorption additives were mixed in a certain weight ratio and then thermoplastic formed. In addition, the types and contents of heavy metals released from thermoplastic composites were also analyzed. The morphology and the crystal structure were investigated by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction patterns (XRD) and Fourier transform infrared spectroscopy (FT-IR).

Acknowledgments

This research was supported by the Technological Innovation R&D Program (S3288085) funded by the Ministry of SMEs and Startups (MSS, Korea), and the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. 2021R1I1A3056655).