[Poster presentation]

CBPD Recycling Strategies Driven by Alternative Fuels in the Cement Industry

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ABSTRACT

This study aims to analyze the trends and types of CBPD recycling technology based on domestic and internationally published papers and patent applications, and to suggest future directions for technology development. To this end, we collected and constructed CBPD-related papers and patent data, and quantitatively analyzed technology trends by year, country, and research field. Through this, we identified the flow of CBPD resource technology and major research trends.

The analysis results showed that recently, there has been an increase in papers and patent applications on technologies for recycling CBPD in its original form in other industries or chemically recovering useful resources such as potassium chloride (KCl). Initially, research and development was focused on circular recycling centered on resource circulation and improvement of chlorine bypass facilities, but recently, carbon reduction-type recycling technology development has been actively conducted to respond to strengthened environmental regulations. This can be interpreted as an attempt to utilize calcium and silica, which are major components of CBPD, as raw materials for cement manufacturing. In addition, advanced technologies that simultaneously absorb greenhouse gases and produce KCl are being proposed to achieve the carbon neutrality goal. CBPD is washed and the sludge is used to absorb carbon dioxide through carbonation reaction, and KCl is extracted and purified from the residue. In addition to replacing raw materials and fuels, it can be applied as an additional means for reducing carbon in the cement industry where direct greenhouse gas reduction is difficult.

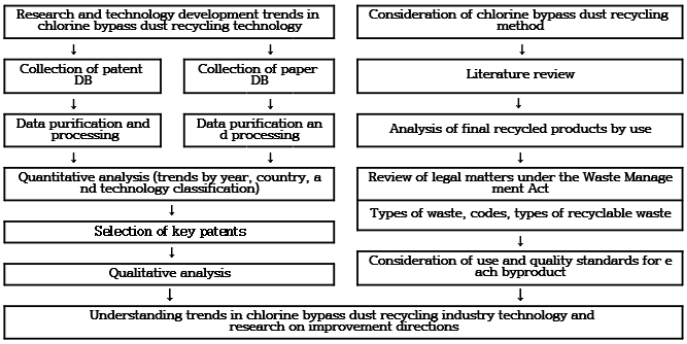
The recycling of CBPD is evaluated as an important opportunity to create industrial added value while improving environmental sustainability. If a practical R&D strategy is established and promoted based on the results of the technology trend analysis presented in this study, it is expected to contribute to the establishment of a circular economy system in the cement industry.

Keywords: Chlorine Bypass Dust, CBPD, Waste Recycling, Cement Industry, Resource Circulation, Technology Trend Analysis

Contents

A database was constructed for domestic and foreign papers and patents related to Chlorine Bypass Dust (CBPD), and based on this, the technology trends were analyzed by year, country, and research field, and the characteristics and applicability of each type of recycling technology were compared and evaluated. In addition, the legal and institutional requirements for the activation of recycling technology

were analyzed based on the main chemical composition and recyclability of CBPD.



As a result of the analysis, it was confirmed that the number of research papers and patent applications for technologies that examine the possibility of recycling CBPD in its original form in other industries or chemically recovering useful resources such as potassium chloride (KCl) is increasing. As for technological activities and national trends, Japan has been leading the way in chlorine bypass dust research since mid-2010. In the past, the focus was on technologies centered on CBPD original reuse or chlorine bypass facilities for resource circulation purposes, but recently, in response to environmental regulations, recycling technologies with carbon reduction as the main goal have been actively developed. This is interpreted as an effort to reduce the resources required for cement manufacturing by replacing the main components of chlorine bypass dust, such as calcium and silica, which are the main components of cement clinker, and to reduce costs by recycling waste in the cement industry. However, as time passes, the demand for various technologies that reduce greenhouse gas emissions is increasing in order to comply with international commitments to respond to climate change. As the level of technology improves, technologies for producing new products using byproducts are being proposed. Recently, technology development is being conducted in the direction of maximizing the recovery of KCl. The main technologies for recycling chlorine bypass dust are largely classified into four categories.

(1) Raw material reuse: Reusing chlorine bypass dust as cement raw material
(2) Recycling after pretreatment: Technology to remove chlorine through water washing and recycle it
(3) Carbonate mineralization: Technology to replace existing clinker after producing CaCO3 through a CO2 capture plant
(4) Carbonate mineralization and effective resource recovery: Recycling technology to mix chlorine bypass dust with water to make slurry, then react with CO2 in the exhaust gas to undergo a carbonate mineralization process and recover a separated liquid containing inorganic carbonates and high concentrations of KCl

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