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Conversion of municipal solid waste incineration bottom ash (MSWI-BA) into CO₂ adsorbent for environmental purposes**Barbara Dutka**

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Municipal Solid Waste (MSW) is the everyday waste from households that includes a wide variety of items, such as food scraps, packaging, paper, plastics, and, for example, old furniture. More than 20 billion tons of MSW are generated in the world every year. Waste incineration plants provide a sustainable solution to MSW that is difficult to compost or recycle (1). According to 'Zero Waste Europe' (a network of organisations that work to eliminate waste, prevent waste at the source), in 2022, in the EU, MSW plants produced, in total, approximately 14.5 million tons of ashes, more than 6.4% of all MSW produced (2). 12.5 million tons of ashes were the bottom ash (MSW-BA); the rest were fly ashes from exhaust gas treatment. In Europe, awareness of their value as raw materials for reuse in production processes is growing.

MSW-BA is used in road construction as a substitute for natural aggregates, for example, road bases and asphalt mixtures and in the production of construction materials such as concrete and cement (3). MSW-BA is mainly composed of silica, alumina, calcium and iron oxide, which are natural aggregates (4). Many studies have discussed the effectiveness of various materials for CO₂ removal from industrial gas streams or for reducing its emissions into the atmosphere, including coal-based materials, zeolites, activated carbons, bioadsorbents, MOFs, and calcium and magnesium oxides

(5). The conversion of thermal waste ashes into zeolite-type materials has been shown to be a promising approach due to the compositional similarity (CaO, SiO₂, Al₂O₃, and Fe₂O₃). We performed hydrothermal alkaline activation of MSWI-BA using NaOH solutions to obtain CO₂ adsorbents. The effect of the NaOH concentration (3 or 5M) used at high-temperature stage (125°C, 24 h, autogenous pressure) as well as the storage time at low-temperature stage (25°C, 1, 2, 4, 6, or 9 weeks) on MSWI-BA based products texture and adsorption efficiency was presented.

Biography

Barbara Dutka is a graduate of the Faculty of Energy and Fuels at the AGH University of Krakow. Since 2006, she has been an assistant professor at the Strata Mechanics Research Institute of the Polish Academy of Sciences. In 2017, she obtained Ph.D. in technical sciences, in the field of mining and engineering geology. She specializes in the adsorption processes and porous structure analysis. She is committed to working in the field of waste management, in particular in the valorization of MSW incineration bottom ash. She has experience in laboratory analyses, adsorption methods, filtration tests and density measurements. Her current interests include the modification of incineration bottom ash for CO₂ removal. She is the author of more than 50 scientific publications. Currently, she is the coordinator of the Polish-Romanian research project: Macro and micro strength tests on composite-cement stones.