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EDITED BY

Narottam Saha,
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Daoud Ali,
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*CORRESPONDENCE

Virendra Kumar Yadav,
✉ yadava94@gmail.com
Timsi Modi,
✉ timsimodi90@gmail.com
Min-Kyu Ji,
✉ mkji@kei.re.kr
Byong-Hun Jeon,
✉ bhjeon@hanyang.ac.kr

RECEIVED 07 February 2023

ACCEPTED 24 May 2023

PUBLISHED 20 July 2023

CITATION

Yadav VK, Modi T, Alyami AY, Gacem A,
Choudhary N, Yadav KK, Inwati GK,
Wanale SG, Abbas M, Ji M-K and
Jeon B-H (2023), Emerging trends in the
recovery of ferrospheres and
plerospheres from coal fly ash waste and
their emerging applications in
environmental cleanup.
Front. Earth Sci. 11:1160448.
doi: 10.3389/feart.2023.1160448

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Emerging trends in the recovery of ferrospheres and plerospheres from coal fly ash waste and their emerging applications in environmental cleanup

Virendra Kumar Yadav^{1,2*}, Timsi Modi^{3*}, Abeer Yousef Alyami⁴,
Amel Gacem⁵, Nisha Choudhary^{1,3}, Krishna Kumar Yadav^{6,7},
Gajendra Kumar Inwati⁸, Shivraj Gangadhar Wanale⁹,
Mohamed Abbas¹⁰, Min-Kyu Ji^{11*} and Byong-Hun Jeon^{12*}

¹Department of Biosciences, School of Liberal Arts and Sciences, Mody University of Science and Technology, Sikar, Rajasthan, India, ²Department of Life Sciences, Hemchandracharya North Gujarat University, Patan, Gujarat, India, ³Department of Environment Sciences, School of Sciences, P P Savani University, Surat, Gujarat, India, ⁴Department of Chemistry, College of Science and Arts, Najran University, Najran, Saudi Arabia, ⁵Department of Physics, Faculty of Sciences, University 20 Août 1955, Skikda, Algeria, ⁶Faculty of Science and Technology, Madhyanchal Professional University, Bhopal, India, ⁷Environmental and Atmospheric Sciences Research Group, Scientific Research Center, Al-Ayen University, Thi-Qar, Nasiriyah, Iraq, ⁸Department of Chemistry, Medicaps University, Indore, Madhya Pradesh, India, ⁹School of Chemical Sciences, Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra, India, ¹⁰Electrical Engineering Department, College of Engineering, King Khalid University, Abha, Saudi Arabia, ¹¹Korea Environment Institute, Sejong, Republic of Korea, ¹²Department of Earth Resources and Environmental Engineering, Hanyang University, Seoul, Republic of Korea

Coal fly ash (CFA) is a major global problem due to its production in huge volumes. Fly ash has numerous toxic heavy metals; thus, it is considered a hazardous material. However, it also has several value-added minerals like ferrous, alumina, and silica along with other minerals. Fly ash also has several natural micro- to nano-structured materials; for instance, spherical ferrous-rich particles, cenospheres, plerospheres, carbon nanomaterials, and unburned soot. These micron- to nano-sized particles are formed from the molten slag of coal, followed by condensation. Among these particles, plerospheres which are hollow spherical particles, and ferrospheres which are ferrous-rich particles, have potential applications in the environmental cleanup, research, catalytic industries, and glass and ceramics industries. Additionally, these particles could be further surface-functionalized or purified for other applications. Moreover, these particles are widely explored for their potential in the army and other defense systems like lightweight materials and sensing. The recovery of such particles from waste fly ash will make the process and remediation technology economically and environmentally friendly. The current review focuses on the various structural and elemental properties of ferrospheres and plerospheres from fly ash. This review also focuses on the emerging applications of both naturally formed materials in CFA.

KEYWORDS

coal fly ash, plerospheres, cenospheres, ferrospheres, ceramics