

Artificial Intelligence in Medical Waste Management: Research Trends and Future Directions

Sena Kumcu

Faculty of Engineering, Department of Industrial Engineering
Gazi University, Ankara, Türkiye
senakumcu@gazi.edu.tr

Ece Arzu Yıldız

Faculty of Engineering, Department of Industrial Engineering
Gazi University, Ankara, Türkiye
arzudemircan@gazi.edu.tr

Abstract

The COVID-19 pandemic has accelerated the growth of healthcare services, leading to a significant increase in medical waste generation globally. Accordingly, medical waste management (MWM) remains a critical issue at the intersection of public health, environmental sustainability, and operational complexity. Traditional MWM systems are becoming less adequate as the volume of wastes, the different hazardous categories and the regulatory criteria are growing stricter. This study emphasizes the importance of artificial intelligence (AI) technology to overcome these issues. Data were obtained from the Scopus database. A bibliometric analysis is performed using VOSviewer to investigate publishing trends, worldwide collaboration network and keyword association patterns. Our findings suggest that AI research in MWM is still emerging but developing fast, primarily driven by Asian and Middle Eastern countries with limited cross-regional collaboration. The findings indicate that, despite growing academic interest, the field remains fragmented and insufficiently explored regarding global collaboration and methodological diversity, with the logistics aspect of MWM, particularly waste collection and transportation, emerging as a promising yet underexamined application area for AI. This study aims to provide a study framework for academics and practitioners focused on safe, efficient, and sustainable medical waste management.

Keywords

Medical supply, artificial intelligence (AI), sustainability, logistics

Biographies

Sena Kumcu is a Research Assistant in the Department of Industrial Engineering at Gazi University, Ankara, Türkiye. She holds both a Master's and a PhD degree in Industrial Engineering from Gazi University. During her PhD studies, she was a visiting PhD student at the University of Padova (Italy), where she conducted research on sustainable supply chain optimization. Her research interests include mathematical modelling, network optimization, supply chain management, and decarbonization technologies.

Ece Arzu Yıldız is an Assistant Professor of Industrial Engineering at Gazi University, Ankara, Türkiye. She received her BSc and MSc degrees in Industrial Engineering from TOBB University of Economics and Technology, and her PhD in Industrial Engineering from Gazi University. Her research interests include optimization theory and methods, discrete-event simulation, supply chain and logistics management, and network design. Her research focuses on the development of mathematical models and analytical approaches for addressing complex decision problems in engineering systems.