

Determination and quantification of microplastics in compost

by Artikel 2

Submission date: 01-Apr-2024 11:28AM (UTC+0700)

Submission ID: 2336614279

File name: 2024_-_Adi_Sutanto_Compost_compressed.pdf (1.95M)

Word count: 15086

Character count: 84808

Environmental Quality Management

Spring 2024



WILEY



ENVIRONMENTAL QUALITY MANAGEMENT

Spring 2024

1 Editorial Board

Professor Jega Jegatheesan – Editor in Chief
RMIT University, Australia

Professor Ramaraj Boopathy – Executive Editor
Nicholls State University, USA

Section Editors

Resource Recovery

Professor Taku Fujiwara
Kyoto University, Japan

Dr. Li Shu
LJS Environment, Australia

Concentrate Management

Professor Yang Zhang
Qingdao Institute of Bioenergy and Biotechnology, China

Dr. Biplob Kumar Pramanik
RMIT University, Australia

Waste Management/Conversion

Dr. Eldon R. Rene
UNESCO-IHE, The Netherlands

Editorial Board Members

Luca Alibardi
Cranfield University, UK

Sai Bharadwaj
Hanyang University, South Korea

Sartaj Ahmad Bhat
Gifu University, Japan

Cuiyu Chen
Southwest University of Political
Science and Law, China

Achlesh Daverey
Doon University, India

Nour Shafik Emam El-Gendy
Egyptian Petroleum Research
Institute (EPRI), Egypt

Fabián Fernández-Luqueño
Center for Research and Advanced Studies
of the National Polytechnic Institute
(Cinvestav Saltillo), Mexico

Li Gao
South East Water, Australia

Daisuke Inoue
Osaka University, Japan

Atif Jahanger
Hainan University, China

Işık Kabdaşlı
Istanbul Technical University, Turkey

Ramani Ramanitharan Kandiah
Central State University, Ohio, US

Dibyajit Lahiri
University of Engineering and Management,
Kolkata

Michela Langone
ENEA, Italy

Liang Li
Nanjing University of Information Science and
Technology, China

Lu Li
Chinese Academy of Sciences, China

Yongqiang Li
Victoria University, Australia

Tran Le Luu
Vietnamese-German University, Binh
Duong, Vietnam

Leonidas Matsakas
Lulea University of Technology, Sweden

Monjur Moursheed
Cardiff University, UK

Shobha Muthukumaran
Victoria University, Australia

Puthiya Veetil Nidheesh
CSIR National Environmental
Engineering Research Institute, India

Kazuyuki Oshita
Kyoto University, Japan

Ravi Raveendran
Sydney Water, Australia

Harish Ravishankar
Coliban Water, Australia

Santosh Kumar Sahu
Indian Institute of Technology Madras,
India

Palanivel Sathishkumar
Saveetha Institute of Medical and Technical Sci-
ences (SIMATS University), India

Bui Xuan Thanh
Ho Chi Minh City University of
Technology, Vietnam

Ramesh Thiruvengkatachari
Commonwealth Scientific and Industrial
Research Organisation (CSIRO), Australia

Aviral Kumar Tiwari
Rajagiri Business School (RBS), India

Alan Mosele Tonin
University of Brasília, Brazil

Inderjeet Tyagi
Zoological Survey of India, India

Perlie Velasco
University of the Philippines Los Baños, Philip-
pines

Jurate Virkutyte
Airforce Institute of Technology, USA

Jing Wu
Tsinghua University, China

1
Professor Bart Van der Bruggen – Executive Editor
Katholieke Universiteit Leuven, Belgium

Professor C. Visvanathan
Asian Institute of Technology, Thailand

1
Research Translation and Impact

Professor Hung-Yee Shu
Hungkuang University, Taiwan

Cleaner Production & Emerging Sustainable Practices

Dr. Alessandro Spagni
ENEA, Italy

Dr. Zainul Akmar Bin Zakaria
Universiti Teknologi, Malaysi

Disclaimer: The Publisher and Editors cannot be held responsible for any errors in or any consequences arising from the use of information contained in this journal. The views and opinions expressed do not necessarily reflect those of the Publisher or Editors, neither does the publication of advertisements consti-

tute any endorsement by the Publisher, Editors, or Authors of the products advertised.

For submission instructions, subscription and all other information visit: wileyonlinelibrary.com/journal/tqem

[< Back](#)

Quality Management

19 Early View

Online Version of Record before inclusion in an issue

” Export Citation(s)

RESEARCH ARTICLES

Hydrological effects of the conversion of tropical montane forest to agricultural land in the central Andes of Peru

José André Noriega-Puglisevich, Karen I. Eckhardt

Version of Record online: 19 March 2024

<https://doi.org/10.1002/tqem.22221>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Assessing the link between energy intensity, renewable energy, economic growth, and carbon dioxide emissions: Evidence from Turkey

Oluwatoyin Abidemi Somoye

Version of Record online: 19 March 2024

<https://doi.org/10.1002/tqem.22220>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Anodic oxidation of esomeprazole in water by carbon coated titanium (C/Ti) electrode: Optimization and degradation analysis

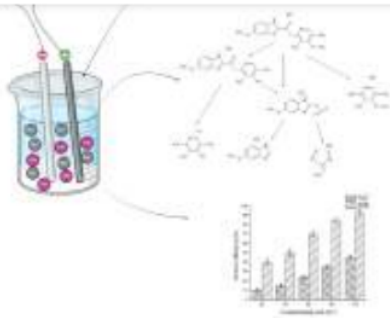
Salman Farissi, Harikrishnan Palasseri, Utukuri Gopi, Gara Ajith, Anbazhagi Muthukumar, Muthukumar Muthuchamy

Version of Record online: 19 March 2024

<https://doi.org/10.1002/tqem.22222>

Anodic oxidation of Esomeprazole in water.

< Back



Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Bioconversion of pineapple wastes for production of *Pleurotus pulmonarius* (gray oyster mushroom) and *Pleurotus ostreatus* (white oyster mushroom)

Norliana Munir, Aizi Nor Mazila Ramli, Aimi Wahidah Aminan, Sharifah Zafierah Syed Badrulzaman, Reshma Vasant Patil, Siti Zulaiha Zailani, Nur Izyan Wan Azelee, Nor Hasmaliana Abdul Manas, Elmie Adha Ismail

Version of Record online: 19 March 2024

<https://doi.org/10.1002/tqem.22223>

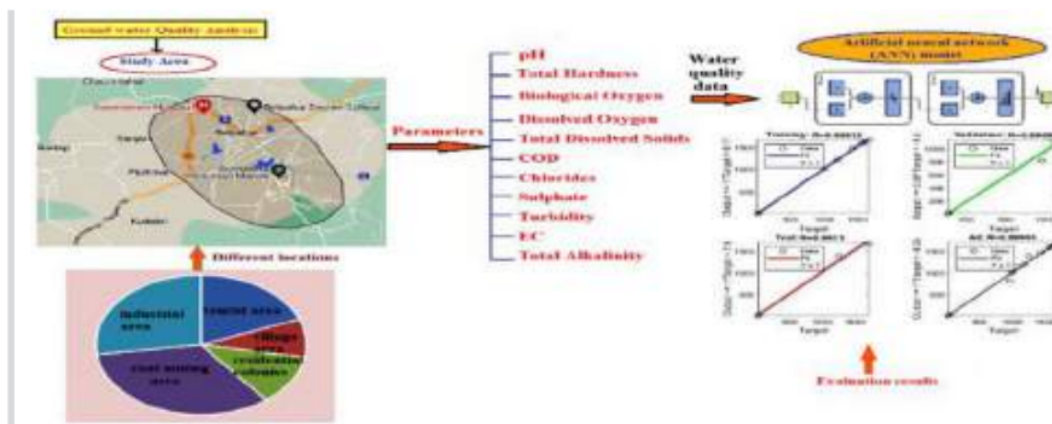
Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Physico-chemical and bacteriological study of ground water quality of Belpahar area, Odisha, India using artificial neural networks

Pritisha Barik, Trinath Biswal

Version of Record online: 18 March 2024

<https://doi.org/10.1002/tqem.22219>



[Back](#)

Establishing criteria for advancing circular economy practices in the beer industry: A case study in South Vietnam

Dung Minh Ho, Binh Thanh Thach, Ha Manh Bui

Version of Record online: 13 March 2024

<https://doi.org/10.1002/tqem.22218>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Valorization of waste coffee silverskin as a source of antioxidant by extraction with agitation

Rajeswari M. Kulkarni, Spandana Samyukthalakshmi Mentha, Aishwarya R, Errol Winston Mascarenhas, Sanjana Polavarapu, Takshak Appaiah

Version of Record online: 12 March 2024

<https://doi.org/10.1002/tqem.22209>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

REVIEW ARTICLE

Advanced analytical techniques for assessing and detecting microplastic pollution in water and wastewater systems

Enes Özgenç

Version of Record online: 11 March 2024

<https://doi.org/10.1002/tqem.22217>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

Assessment of seasonal variations in vehicular emissions at traffic intersections in Ibadan using AERMOD dispersion model

Emmanuel Toluwalope Odediran, Jamiu Adetayo Adeniran, Rafiu Olasunkanmi Yusuf

[Back](#)

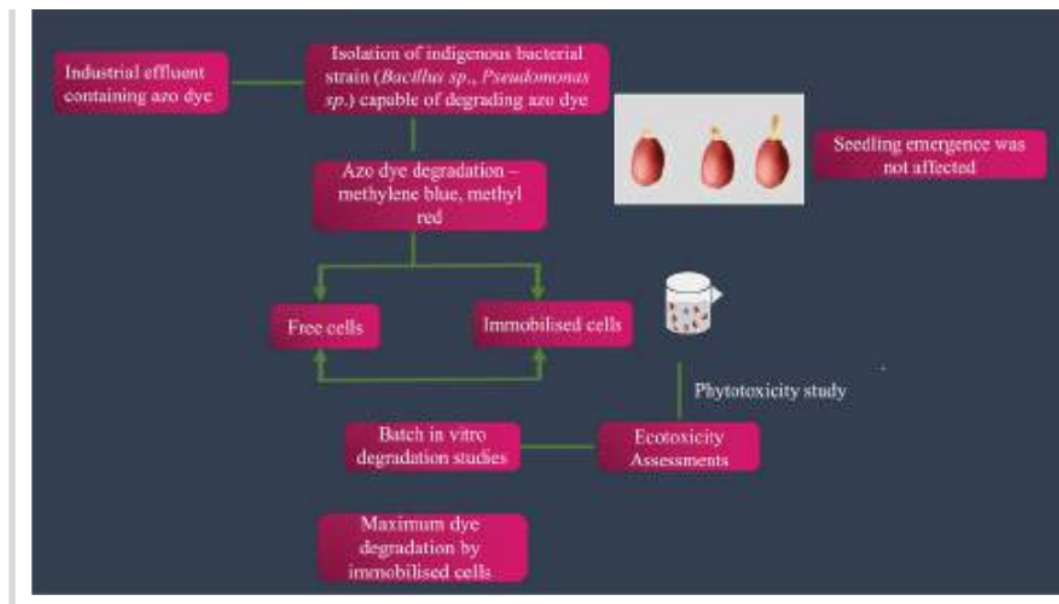
[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Screening of azo dye biosorption efficacy of free, immobilized, indigenous bacterial strains associated with azo dye contaminated river water—An in vitro study

G. S. Amrish Varshan, S. Karthick Raja Namasivayam, S. Viswanathan, Sowmya R, C. Saranya Vellaiammal

Version of Record online: 07 March 2024

<https://doi.org/10.1002/tqem.22214>



[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

The impact of agricultural practices on groundwater depletion: A spatiotemporal analysis of India

Harish Sahu, Kalandi Charan Pradhan

Version of Record online: 07 March 2024

<https://doi.org/10.1002/tqem.22207>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

REVIEW ARTICLE

[< Back](#)

Marcelo Dionisio, Fábio Paula

Version of Record online: 04 March 2024

<https://doi.org/10.1002/tqem.22212>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

Treatment of tannery effluent: An effective biological enhancement approach

P. Aarthi, Zeba Biswas, S. Hemalatha, I. Faridha Begum

Version of Record online: 04 March 2024

<https://doi.org/10.1002/tqem.22216>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Marine macro algae-derived activated carbon an efficient bio-sorbent for Malachite green removal from wastewater

Sayed Amreen, Suresh Kumar Dash, Brundabana Naik, Aditya Kishore Dash, Akshaya Kumar Verma, Abanti Pradhan

Version of Record ¹⁵ online: 03 March 2024

<https://doi.org/10.1002/tqem.22213>

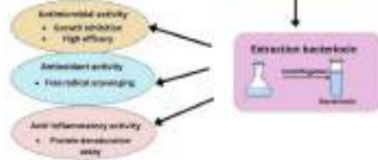
[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Potential biological active bacteriocin production by *Bifidobacterium* via eco-friendly, low-cost solid state fermentation principle

Srinivasan Priyanka, S. Karthick Raja Namasivayam, S. Sudha, Muthukrishnan Lavanya, Thirumal Abiraamavalli

Version of Record ¹⁵ online: 03 March 2024

<https://doi.org/10.1002/tqem.22210>

[Back](#)

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Experimental support for a sustainable treatment strategy of acrylic fiber dyeing wastewater

Işık Kabdaşlı, Derin Orhon

Version of Record online: 28 February 2024

<https://doi.org/10.1002/tqem.22211>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

REVIEW ARTICLE

Systematic review on effects of global climate change on birds

Hewanahannadige Melisha Shavindi Fernando, Medhisha Pasan Gunawardena

Version of Record online: 27 February 2024

<https://doi.org/10.1002/tqem.22196>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

Hydrogeochemical characterization of the groundwater in northern and eastern areas of Kilwa district and Songosongo Island in, Tanzania

Asantael Herman Mlay, Ceven Shemsanga, George Bennett, Justin Ntalikwa

Version of Record online: 26 February 2024

<https://doi.org/10.1002/tqem.22208>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

[< Back](#)

sanitary landfill leachates

Julio Maldonado-Maldonado, Adriana Márquez-Romance, Edilberto Guevara-Pérez, Sergio Pérez-Pacheco

Version of Record online: 23 February 2024

<https://doi.org/10.1002/tqem.22197>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Fate and distribution of microplastics in water and sediment collected from Samiran ditch irrigation

Marchel Putra Garfansa, Lili Zalizar, Syarif Husen, Joko Triwanto, Iswahyudi Iswahyudi, Yenni Arista Cipta Ekalaturrahmah

Version of Record online: 22 February 2024

<https://doi.org/10.1002/tqem.22204>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

A novel method for the remediation of o- and p-aminophenol from industrial wastewater by hexacyanoferrate (III) ions using Ir-complex catalyst

Anjali Goel, Monika Rani

Version of Record online: 22 February 2024

<https://doi.org/10.1002/tqem.22205>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

EDITORIAL

Special Issue: Biomass conversion and utilization for remediation of contaminated systems

Remya Neelancherry, Pornsawasn Amornsakchai, Alberto Wisniewski Jr

Version of Record online: 21 February 2024

<https://doi.org/10.1002/tqem.22206>

[Full text](#) | [PDF](#) | [Request permissions](#)

[< Back](#)

Elimination of arsenic from the reject solution of the reverse osmosis process

Cynthia Corroto, Alejo L. Pérez Carrera, Alicia Fernández Cirelli, Analia Iriel

Version of Record online: 18 February 2024

<https://doi.org/10.1002/tqem.22201>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

ERRATUM


 [Free Access](#)

Erratum

Version of Record online: 14 February 2024

<https://doi.org/10.1002/tqem.22202>

 [This article corrects the following:](#) >

 [Co-development of an integrated assessment framework to evaluate the effectiveness and impact of selected nature-based water treatment technologies in Sri Lanka, The Philippines, and Vietnam](#)

[Veeriah Jegatheesan, Nevelina Pachova, Perlie Velasco, Mohamed Ismail Mohammed Mowjood, Sujithra Kaushaliya Weragoda, Madhubhashini Makehelwala, Ngo Thuy Diem Trang, Bao-Trong Dang, Cong-Sac Tran, Thi-Kim-Quyen Vo, Nguyen Thi Thu Trang, Huy Pham, Ma. Catriona Devanadera, Antonina Torrens, Xuan-Thanh Bui, Phuoc-Dan Nguyen, Amy Lecciones, Krishthombu Baduge Shameen Nishantha Jinadasa](#)

Volume 32, Issue 3, Environmental Quality Management | pages: 335-365 |
First Published online: November 5, 2022

[Full text](#) | [PDF](#) | [Request permissions](#)

RESEARCH ARTICLES

[The bio-control potential of *Alcaligenes aquatilis* against its associated cyanobacteria *Lyngbya aestuarii*](#)

Karisma Dash, Bhabatarini Panda

Version of Record online: 14 February 2024

<https://doi.org/10.1002/tqem.22203>

[< Back](#)

Seasonal variation of surface water quality and streamflow in Rispana: A tributary of Ganges river, India

Manish Pant, Jabrinder Singh

Version of Record online: 14 February 2024

<https://doi.org/10.1002/tqem.22199>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

REVIEW ARTICLE

Impact of climate change and anthropogenic activities on lacustrine ecosystems of the Kashmir Valley, NW Himalaya, India

Rayees Ahmad Shah, Omar Jaan Paul, Reyaz Ahmad Dar, Shakil Ahmad Romshoo

Version of Record online: 14 February 2024

<https://doi.org/10.1002/tqem.22200>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

Optimizing indoor air quality: Investigating particulate matter exposure in household kitchens and source identification

Nawaf S. Alhajeri, Alanood M. Alrashidi, Mohamed F. Yassin, Layla Al-Awadi

Version of Record online: 10 February 2024

<https://doi.org/10.1002/tqem.22198>

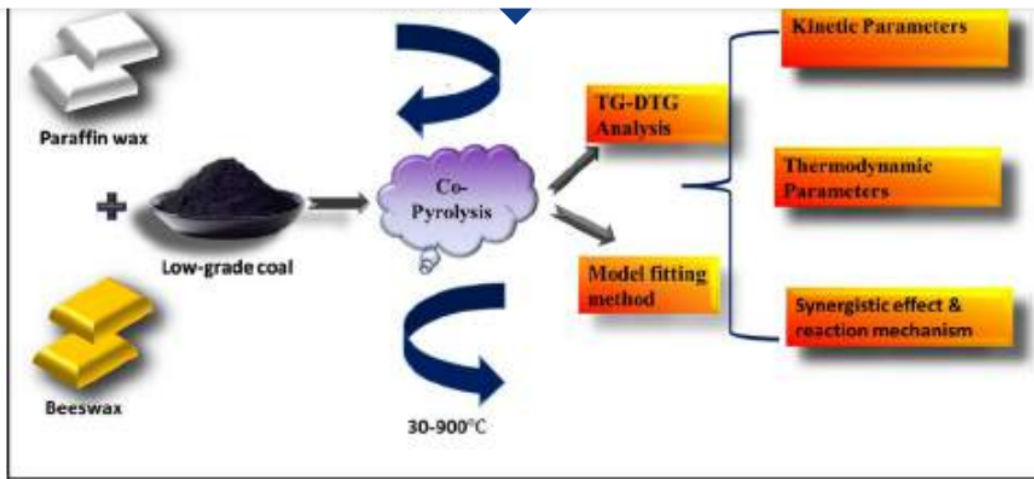
[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Effect of beeswax and petroleum wax on the thermal degradation behavior, kinetics, and thermodynamics of low-grade coal

Pragyandeepi Behera, Pabitra Mohan Mahapatra, Gayatri Sabat, Achyut K. Panda

Version of Record online: 08 February 2024

<https://doi.org/10.1002/tqem.22191>

[Back](#)

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Open coal stock pile impact on surface, river, and groundwater: Noapara, Jashore case study

Md. Mehedi Hasan, SK. Sazzad Hossain, Mohammad Tofayal Ahmed, Md. Abdus Samad, Md. Jamal Faruque

Version of Record ¹⁵ online: 06 February 2024

<https://doi.org/10.1002/tqem.22194>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

ERRATUM

[Free Access](#)

Correction to “Analysis of Brazilian consumers’ perceptions of cosmetics packaging from a circular economy perspective ”

Version of Record ¹⁵ online: 06 February 2024

<https://doi.org/10.1002/tqem.22195>

! This article corrects the following: >

Analysis of Brazilian consumers' perceptions of cosmetics packaging from a circular economy perspective

Ana Cecília Cavalcante da Silva, Patricia Guarnieri, Bárbara de O. Vieira, Thaíssa V. Castelo-Branco

[< Back](#)[Full text](#) | [PDF](#) | [Request permissions](#)

RESEARCH ARTICLES

Environmental surveillances of River Ogio in Edo State, Nigeria

Desmond Odiamehi Onobun, Anthony Moses Ugbenyen, Ajayi Olulope, Young Godwin Irobehian

Version of Record ¹⁵ online: 06 February 2024

<https://doi.org/10.1002/tqem.22187>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

¹³ REVIEW ARTICLE

Biotechnological interventions for monitoring and mitigating microplastic pollution and development of alternatives to single-use plastics

Indumathi Shanmugam Mahadevan, Madurai Kathiravan Harsha Vardhan, Rajkumar Sheeja Rejith Kumar, Mourougavel Rohinth, Zakir Hussain Tawfeeq Ahmed, Pandurangan Prakash, Jagadeesan Aravind Kumar

Version of Record online: 04 February 2024

¹³ <https://doi.org/10.1002/tqem.22186>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Alcaligenes faecalis: A bacterium for sustainable management of environment

Rina Rani Ray, Smaranika Pattnaik

Version of Record online: 01 February 2024

<https://doi.org/10.1002/tqem.22189>

⁵ [Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

14

[Back](#)

Taísa Andrade Barbosa, Roberta Menezes Santos, Wenes Ramos da Silva, Mirele Santana de Sá, Miliana Gouveia da Silva, Sandro Navickiene, Raimundo Rodrigues Gomes Filho, Alberto Wisniewski Jr

Version of Record online: 31 January 2024

<https://doi.org/10.1002/tqem.22192>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

7

The impact of microplastics on yield and economic losses in selected agricultural food commodities

Adi Sutanto, Wahyu Widodo, Imbang Dwi Rahayu, Sustiyana Sustiyana, Fitrotin Nazizah, Iswahyudi Iswahyudi, Ary Bakhtiar

Version of Record online: 30 January 2024

<https://doi.org/10.1002/tqem.22188>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Organic farming in the improvement of soil health and productivity of tea cultivation: A pilot study

Debapriya Maitra, Bedaprana Roy, Debdatta Das, Archisman Chakraborti, Anirban Das, Indranath Chaudhuri, Sudeshna Shyam Choudhury, Arup Kumar Mitra

Version of Record online: 30 January 2024

<https://doi.org/10.1002/tqem.22193>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Heavy metal concentration in agricultural soil near industrial clusters around Raipur city: A geochemical appraisal

Manash Protim Baruah, Kiranjit Singha, Priyanka Jha

Version of Record online: 30 January 2024

<https://doi.org/10.1002/tqem.22190>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Encapsulation and application of cell-free extracts produced by *Penicillium chrysogenum* R1 in tomato plants for the control of *Fusarium oxysporum*

[< Back](#)

Version of Record online: 30 January 2024

<https://doi.org/10.1002/tqem.22182>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Biodegradation of 17 β -estradiol by drug-resistant *Stenotrophomonas maltophilia* MN08 and *Pseudomonas aeruginosa* KL10 isolated from the sediment sample

Dunia A. Al Farraj, Mohamed Ragab Abdel Gawwad, Mohamed S. Elshikh, Selvaraj Arokiyaraj, Ponnuswamy Vijayaraghavan

Version of Record online: 27 January 2024

<https://doi.org/10.1002/tqem.22183>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Air pollution, public health expenditure, and physical health: Evidence from China

Wei Jiang, Wei Li, Yunfei Chen

Version of Record online: 27 January 2024

<https://doi.org/10.1002/tqem.22185>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Groundwater contamination and sources of potentially toxic elements in Korba Basin, India

Khageshwar Singh Patel, Piyush Kant Pandey, Bharat Lal Sahu, Raj Kishore Patel, Irena Wysocka, Sema Yurdakul, Pablo Martín-Ramos, Prosun Bhattacharya

Version of Record online: 23 January 2024

<https://doi.org/10.1002/tqem.22177>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Growth performance, hematological and oxidative stress responses in Nile tilapia (*Oreochromis niloticus*) exposed to polypropylene microplastics

Haritha Thulaseedharan Nair, Siddhuraju Perumal

Version of Record online: 21 January 2024

<https://doi.org/10.1002/tqem.22179>

3

[Back](#)

Determination and quantification of microplastics in compost

Iswahyudi Iswahyudi, Wahyu Widodo, Warkoyo Warkoyo, Adi Sutanto, Marchel Putra Garfansa, Erfan Dani Septia

Version of Record online: 21 January 2024

<https://doi.org/10.1002/tqem.22184>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

Use of biokaolinite clay for the microbial removal of phenol from real industrial wastewater samples by *Dermaoccus nishinomiyaensis* and *Kocuria rosea*

Mohamed El-Kassem M. Hassouna, Marzooka Shaban Abdel-Tawab, Adel Ahmed Mohamed Abdel-Aleem

Version of Record online: 21 January 2024

<https://doi.org/10.1002/tqem.22181>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

REVIEW ARTICLE

Pharmaceutical emerging micropollutants potential in septic tanks: Its fate and transport study in Indonesia – A literature review

Widhowati Kesoema Wardhani, Eddy Setiadi Soedjono, Harmin Sulistyaning Titah, Mas Agus Mardyanto

Version of Record online: 17 January 2024

<https://doi.org/10.1002/tqem.22176>

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)

RESEARCH ARTICLES

Determination of dichlorvos pesticide residues in the groundwater of the environment surrounding Al-Sin Lake using a high-performance liquid chromatography

Deema Mohamed Ali Okdeh, Ibrahim Aziz Sakr, Tareq ARRAJ ARRAJ

RESEARCH ARTICLE

Determination and quantification of microplastics in compost

Iswahyudi Iswahyudi^{1,2} | Wahyu Widodo¹ | Warkoyo Warkoyo¹ | Adi Sutanto¹ |
Marchel Putra Garfansa² | Erfan Dani Septia³

¹Department of Agriculture Science,
University of Muhammadiyah Malang, East
Java, Indonesia

²Department of Agrotechnology, Faculty of
Agriculture, Universitas Islam Madura, East
Java, Indonesia

³Department of Agrotechnology, University of
Muhammadiyah Malang, East Java, Indonesia

Correspondence

Iswahyudi Iswahyudi and Adi Sutanto,
Department of Agriculture Science, University
of Muhammadiyah Malang, 65144 Malang,
East Java, Indonesia. Email:
iswahyudi@uim.ac.id and sutanto@umm.ac.id

Funding information

Universitas Islam Madura

Abstract

Although microplastics (MPs) in solid organic waste have been intensively studied, the presence of MPs in organic fertilizer and their potential as new emerging pollution to environment because of their use in agriculture has not been explained completely. Therefore, the identification and quantification of MPs in commercially available compost is important. This study aimed to estimate the quantity of MPs in commercial composts. The characteristics of MPs (shape, color, size, and type of polymers) were identified. This study found that MPs in commercial compost samples were found, reaching up to 160 particles/200 g of compost with various colors (blue, black, red, yellow, and white). The identified MPs had various sizes (0.1–1 mm) and shapes (81.8% fragment, 16.2% fiber, and 2% filament). The findings of this study are very important and significant to inform community and policymakers regarding the presence of MPs in commercial compost, hence, their intensive use in agriculture must be controlled and careful.

KEYWORDS

compost, environmental pollution, microplastics, organic fertilizers

1 | INTRODUCTION

Microplastics (MPs) are tiny plastic particles less than 5 mm (0.2 in.) in diameter (Sathish et al., 2022). MPs are one of the main contributors to environmental pollution (Bao et al., 2022). Due to their very small size, MPs can easily be carried by water and wind (Aini et al., 2022); thus, they can massively spread in environments such as wetlands, lakes, seas, and soil (Deng et al., 2023; Nirmala et al., 2023). The emergence of MPs has received considerable critical attention (Alimi et al., 2022). In farming soils, the presence of MPs is associated with the use of organic fertilizers (Zhang, Li, et al., 2022). MPs were found in conventional agricultural land (Piehl et al., 2018), resulting from the application of compost made from organic trash, livestock manure, and biosolids (Hernández-Arenas et al., 2021). Annual use of compost reaching up to 4.07 million tons in agriculture and horticulture in Germany is estimated to contribute 817 tons of MPs (Blanke, 2020).

Previous studies reported that MPs were detected in many compost products, including municipal biowaste compost (Prosenc et al., 2021), solid organic waste and organic compost (Zhou et al., 2023), and rural domestic waste (RDW) compost (Gui et al., 2021). Moreover, total amount of MPs in the composting field located in northeastern Spain was 10–30 particles/g at five sampling sites (Edo et al., 2022). In addition, 6433 ± 751 particles/kg MPs of green compost were found in the organic wastes of Kaunas and Alytus regional waste management centers in Lithuania (Sholokhova et al., 2022). Another research indicated that the long-term implementation of compost on maize fields in China contaminated 3.63×10^9 to 4.99×10^9 particles/ha (Zhang, Wang, et al., 2022), whereas maize is usually used as a food source for human consumption. These studies show that MPs strongly negatively affect the agricultural environment. Thus, MPs in agricultural and compost environments become interesting and important to inspect.

The properties of MPs in organic fertilizers are mostly influenced by their feedstocks (Rynk et al., 2022; Tang, 2023). The production

of fertilizers, which mostly involves aerobic composting and anaerobic digesting, significantly impacts the enrichment of MPs (Zhang, Li, et al., 2022). In several aerobic decomposition studies, the addition of plastics resulted in fragmentation, which was linked to a substantial increase in particle number (Andrady et al., 2022; Chamas et al., 2020; Dimassi et al., 2022; Liao & Chen, 2021). Furthermore, MPs can generate strong free radical reactions in the highly oxidizing environment of aerobic decomposition (Xing et al., 2022). Hydrolysis is added during anaerobic fermenting, resulting in the brittleness and fragmentation of plastics; however, the resultant plastic fragments do not completely vanish (Hale et al., 2022). The presence of MPs in the compost has the potential to cause soil contamination (Vithanage et al., 2021). Previously, MPs were reported in compost from various countries, such as southeastern Mexico and southern China (Pironti et al., 2021). It was revealed that it is possible that MPs can be consumed by humans at the same time as the consumption of agricultural products (Zhou et al., 2023). MPs can infiltrate the human body via inhalation and consumption of food and beverages. Consuming food contaminated with MPs can cause various immune system-related issues, including immunosuppression, immune activation, and aberrant inflammatory responses. In addition, it can cause stress, reproductive toxicity, and developmental problems (Wu et al., 2022). Consequently, additional research is required to investigate the potential effects of MPs on the environment and human health through more rigorous clinical investigations.

Enhancing soil fertility may be achieved using organic fertilizers, as opposed to chemical fertilizers, due to their higher organic carbon, nitrogen, and phosphorus content. Organic fertilizers are generally composed of animal dung or bacterial wastes, which are abundant in organic materials and plant nutrients, hence contributing to improved soil quality (Schwinghammer et al., 2020). However, these feedstocks frequently contain MPs (Rynk et al., 2022) and MPs experience a sequence of conditioning, breakdown, and processing steps that typically concentrate and enrich them in the final products. But threshold values for plastics are frequently absent, particularly for MPs concentrations in organic fertilizer (Braun et al., 2021).

Enhancing soil fertility may be achieved using organic fertilizers, as opposed to chemical fertilizers, due to their higher organic carbon, nitrogen, and phosphorus content

Insufficient data is describing the composition and distribution of MPs in organic fertilizers, limiting our understanding of the contributions of these fertilizers to soil pollution. In addition, the use of these fer-

tilizers varies significantly across provinces based on their unique environmental and economic conditions. There is an imperative need for additional research to characterize the MPs in organic fertilizers and control MPs contamination on farmlands. Thus, this study aimed to estimate the abundance of MPs in compost. The findings of this study are crucial to inform community and policy makers regarding the presence of MPs in commercial compost. Therefore, intensive use of compost containing MPs in agriculture must be minimized.

There is an imperative need for additional research to characterize the MPs in organic fertilizers and control MPs contamination on farmlands.

2 | MATERIALS AND METHODS

2.1 | Materials

The compost used in this study was purchased from a local agricultural store (Stand Flamboyan, Pamekasan City, East Java province, Indonesia), and the compost brand was Kompos Organik. Chemical, 30% hydrogen peroxide (H₂O₂) (UN2014), was purchased from Kimia Farma company (Pamekasan City, East Java province, Indonesia). Classification of compost with multiple raw materials with a complex composition (a mixture of manure and agricultural waste) often contains additional ingredients.

Stainless with a mesh size of 5 mm is used to first filter compost samples by removing leaves, roots, and other larger debris to facilitate the extraction of MPs. Filter stainless, 300 mesh for second stage filtration used to be carried out after the sample is centrifuged for the identification stage. Distilled water is used to rinse the sample after it has been placed in a strong acid solution. This research also uses glass equipment, including glass beakers, measuring flasks, pipettes, glass bottles, vials bottles, glass stirrers, Petri dishes, and mortar. It also uses aluminum foil for containers in drying ovens and covers for glassware. Some label paper is also needed for sample indication. A strong acid solution, H₂O₂, breaks down and releases organic matter from the MPs samples (Aini et al., 2023; Putri et al., 2023).

Stainless with a mesh size of 5 mm is used to first filter compost samples by removing

leaves, roots, and other larger debris to facilitate the extraction of MPs. A strong acid solution, H_2O_2 , breaks down and releases organic matter from the MPs samples

2.2 | Sampling method

The instrument used to collect the 50 g sample compost was a glass beaker with a diameter of 9 cm, and then first filtered using a stainless with a mesh size of 5 mm and second filtered using a stainless with a mesh of 300. Four multiple raw materials (same brand) used in this study were taken, namely sample 1 (C1), sample 2 (C2), sample 3 (C3), and sample 4 (C4). This brand of compost was chosen because it is often used by farmers, which is very crucial since MPs have the potential to contaminate the soil and be absorbed by roots. Another selection criterion is the availability of compost which can be easily purchased. The remained materials on the filter were mixed with 30% H_2O_2 solution and dried at room temperature for 1 h. The solution of H_2O_2 was used to degrade any organic residue so that targeted MPs could be freely from organic residue before observing by using a microscope. The method applied for MPs extraction from the compost sample was an adjustment of the method for extracting MPs from organic-rich environmental matrices (Zhang, Li, et al., 2022). The physicochemical properties of the organic fertilizers were similar to those of organic-rich soil and livestock manure, so the dried and sieved organic fertilizer samples were subjected to sequential flow separation and density flotation extraction for the identification of MPs (Corradini et al., 2021).

¹⁷ The method applied for MPs extraction from the compost sample was an adjustment of the method for extracting MPs from organic-rich environmental matrices. The physicochemical properties of the organic fertilizers were

similar to those of organic-rich soil and livestock manure

2.3 | MPs identification

Rinse water from a stainless filter, 300 mesh is lowered into a Petri dish, for MPs identification. The microscope with 40x magnification used in this study was Trinocular Digital Ways Dw-tc-y Black Edition, Kaisi Rotation LED Lamp K-D056 for microscope, and 51-megapixel microscope camera connected to Samsung Smart TV 32. Under the microscope, the sample was counted while its shape, size, and color were carefully observed. Following, the MPs samples were analyzed using fourier transform infrared spectroscopy (FTIR) ThermoScientific Nicolet iS10 to characterize a type of polymer. The selection of the FTIR was made due to its simplicity as a method for identifying the type of polymer by examination of its vibrational spectrum, which exhibits distinctive characteristics for each polymer type (Xu et al., 2019).

3 | RESULTS AND DISCUSSION

3.1 | Number of MPs

The presence of MPs and their characteristics observed in this study is presented in Exhibit 1. The total number of MPs found was 160 particles while in compost. It is noted that the MPs in C1, C2, C3, and C4 the MPs found were 58 particles/50 g, 48 particles/50 g, 41 particles/50 g, and 13 particles/50 g, respectively. Surprisingly, the number of MPs in the C1 compost was found to be the highest compared to the others. It is important to first understand the raw materials for composting to determine MP contamination in the compost.

It is important to first understand the raw materials for composting to determine MP contamination in the compost.

⁵ The findings of this study support previous works that also observed the presence of MPs in compost produced by using different materials, which are municipal biowaste compost (Prosenec et al., 2021), municipal organic waste, and garden and greenhouse waste (van Schothorst et al., 2021). The average contaminations of MPs in compost were

EXHIBIT 1 The presence of microplastics (MPs) in compost.

Sample	Shape	Number of MPs	Color	Size (mm)
C1	Fragment (52)	58	Blue, black, red, white, and yellow	0.1–1
	Fiber (6)			
C2	Fragment (31)	48	Black, red, and white	0.1–1
	Fiber (14)			
	Filament (3)			
C3	Fragment (35)	41	Black, red, yellow	0.1–1
	Fiber (6)			
C4	Fragment (13)	13	Red, yellow	0.06–0.6

EXHIBIT 2 Comparison of the characteristics of microplastics (MPs) in compost in Indonesia and other countries.

Sampling	Number/weight	Size (mm)	Shape	Polymer	Reference
Compost, Indonesia	13–58/50 g	0.1–1	Fragment, fiber, and filament	Polyethylene terephthalate (PET)	Present study
Compost, Spain	5–20/g	<5	Fragment and fiber	Polyethylene, polystyrene, polyester, polypropylene, and polyvinyl chloride	(Edo et al., 2022)
Compost, China	2400 ± 358/kg	0.05–5	Fiber, film	Polyester, polypropylene, and polyethylene	(Gui et al., 2021)
Compost, China	2–34/50 g	–	Fiber and fragment	Polypropylene and polyethylene	(Wu et al., 2021)
Compost, China	1500–6615/kg	0.5–1	Fragment, fiber, film	Polypropylene, polyethylene, and polyethylene terephthalate	(Zhang et al., 2023)

2800 ± 616 particles kg⁻¹ and 1253 ± 561 particles kg⁻¹ of compost for municipal organic waste and from garden and greenhouse waste, respectively. An alternative study also reported that MPs were identified in chicken manure, sludge, and domestic waste composts with the number of particles of 14,720 ± 2468, 8600 ± 1428, and 11,640 ± 3565 particles kg⁻¹, respectively (Zhang, Wang et al., 2022).

3.2 | Size of MPs

Sizes of MPs particles found in this study are shown in Exhibit 1. The current study found that identified MPs in compost have various sizes ranging from 0.06 to 1 mm. At C1, C2, and C3 MPs sizes measure around 0.1–1 mm, meanwhile, at C4, the sizes are 0.06–0.6 mm. It is witnessed that the bigger MPs are found at C1, C2, and C3, compared to C4. It is noted that smaller MPs have higher toxicity because they can easily be absorbed by the roots, impacting the inhibited nutrient uptake, reducing biomass, and contaminating fruit (Roy et al., 2022).

Exhibit 2 presents a comparison with other prior efforts. The size of MPs observed in the previous investigation conducted on compost exhibited a range covering from 0.1 to 5 mm. For instance, in the study conducted in Spain (Edo et al., 2022), MP sizes are not larger than 5 mm, while in China, the sizes are 0.05 to 5 mm (Gui et al.,

2021), and 0.5–1 mm (Zhang et al., 2023). The latest findings on MPs contamination originating from compost and its subsequent use in soil brought attention to the possible consequences of micropollutant transfer from compost (Le et al., 2023). Specifically, MPs accumulation in soils has been shown to have an impact on three key markers of soil health, namely, soil microbiological, chemical, and physical characteristics (Chia et al., 2022; Zhang, Wang et al., 2022). Therefore, the high-risk MPs sizes for the plant, especially for the root, photosynthetic pigments, and biomass are below 3 μm.

3.3 | Shape of MPs

The identification of MPs shapes obtained from compost is provided in Exhibit 3. Generally, there are three shapes of MPs, fragment, fiber, and filament. In compost, 81.8% of fragments, 16.2% of fiber, and 2% of filament were found. Similarly, several previous studies have reported that fragments and fibers are the predominant MPs morphologies in agricultural soil, thereby introducing this form of MPs into arable soil (Liu et al., 2018) and indicating that organic fertilizers contributed to the contamination of farmland soils with MPs (Yu, Song et al., 2021).

Previous work reported that the fiber shape of MPs was observed in municipal solid waste compost (Edo et al., 2022) and RDW compost

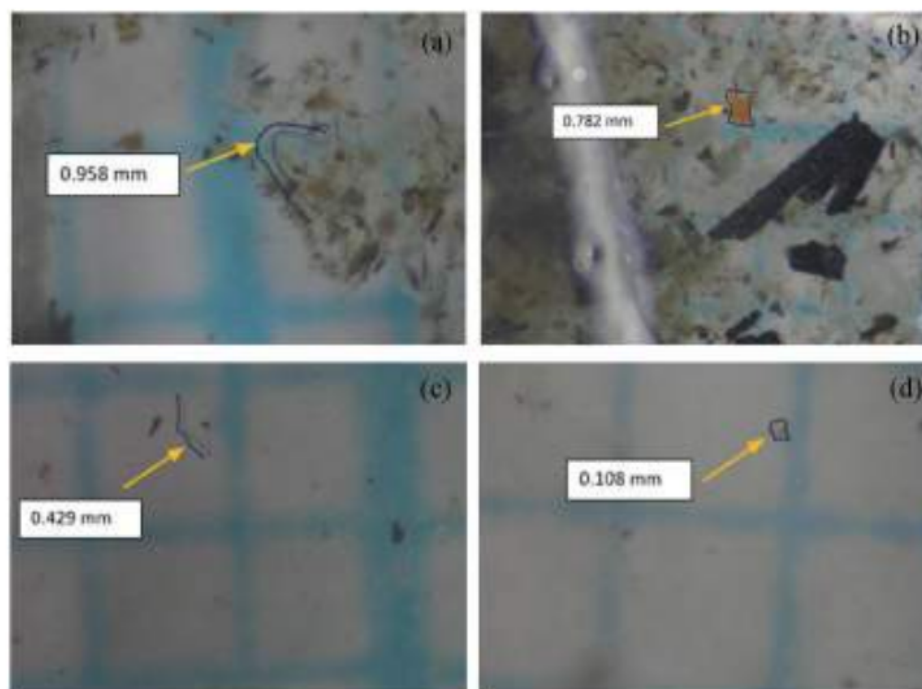


EXHIBIT 3 Microplastics (MPs) shapes of (a) fiber and blue, (b) fragment and yellow, (c) fiber and black, and (d) filament and white-red. [Color figure can be viewed at wileyonlinelibrary.com]

(Gui et al., 2021). The fragment shape of MPs particles was also found in livestock and poultry manure compost (Wu et al., 2021). It indicated that fiber and fragment shapes are easy to find in compost. Mostly, in composting, fragment shape was generated by the breakdown of larger pieces of MPs. Plastic fragmentation from larger size to smaller size, MPs, can occur in aerobic and anaerobic composting processes and other processes depending on environmental conditions (Zafiu et al., 2023). However, most of the MPs in organic fertilizers consisted of finer particles. Plastics are extremely difficult to degrade, and the production cycle of organic fertilizers (40 days) is frequently inadequate. Thus, MPs fragmentation during the production of organic fertilizer may be as significant as projected, and 0.1–1 mm plastic dominated the samples.

MPs in compost had various shapes due to the different sources of plastic waste that contributed to compost production. The shape of MPs in compost was influenced by the mechanical crushing, anaerobic, and aerobic processes involved in composting (Premarathna et al., 2023). The dominant shapes of MPs in compost samples were found to be fragments, fibers, and films (Sholokhova et al., 2022). These shapes were likely derived from plastic bags, packaging materials, and other plastic waste that entered the composting process (Vithanage et al., 2021). The presence of different shapes of MPs in compost highlighted the diverse types of plastic waste that were being processed and the potential for these MPs to contaminate the soil when the compost was used as a fertilizer (Schwinghammer et al., 2020).

3.4 | Color of MPs

Red was the most dominant color of the MPs found in compost, that is, 30, 29, and 8 particles, respectively, in C2, C3, and C4. In C1, the most dominant is yellow with 38 particles detected while in C3 is yellow with 16 MPs particles second dominant. The color of MPs found in the previous study was white and blue (Yu, Zhang et al., 2021). In China, Yang, Kang et al. (2022) witnessed MPs in transparent and white. Meanwhile, white, blue, and red were the colors of MPs found in Indonesia (Aini et al., 2023; Putri et al., 2023). Also in Brazil, the colors of MPs were transparent, red, and blue (Dantas Filho et al., 2023).

Color may also represent the presence of MPs in compost. Considering that plastics can degrade under environments with rich organic matter presented in Exhibit 3, MPs were categorized into five primary hues: red, yellow, blue, black, and white. These color categories were generally compatible with those reported by a wide number of research (Bertoldi et al., 2021; Grbić et al., 2020). Considering that plastics readily age in high organic matter conditions (Xiao et al., 2021). Yu, Zhang et al. (2021) also reported white MPs were the most prevalent in samples of fertilized soil, followed by blue MPs. The color of MPs may indicate their origin and the presence of contaminants, their colors can transform because of degradation and residence time in the terrestrial (Campanale et al., 2023). For example, white MPs are abundant in agriculture and orchards, which frequently require organic fertilizers (Chai et al., 2020). Furthermore, the color of MPs is closely related

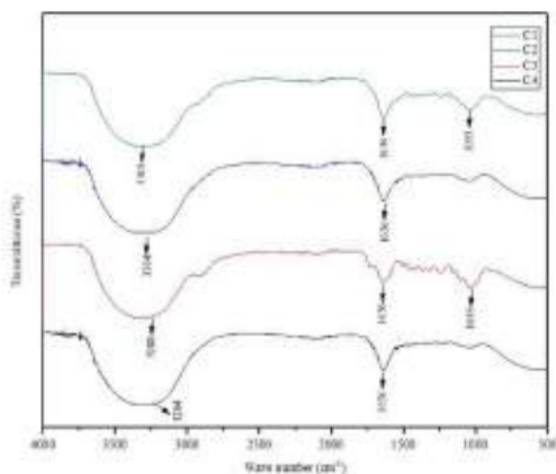


EXHIBIT 4 ¹⁴ Fourier transform infrared spectroscopy (FTIR) spectra for microplastics (MPs) detected in C1, C2, C3, and C4 (identified as polyethylene terephthalate for all). [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.com)]

to the contaminants on their surface. For example, black MPs are frequently associated with higher quantities of organic contaminants (Crawford & Quinn, 2017) than other MPs colors. Clear MPs had significant effects on the environment. It posed a threat to the ecological balance, water environment, food sustainability, and safety, ultimately impacting human health (Oleksiuk et al., 2023).

Materials such as anthraquinone, which could be produced quickly, had color intensity, and were transparent, were used to create yellow. Anthraquinones were frequently used in polymers including polypropylene (PP), polystyrene (PS), low-density polyethylene (LDPE), high-density polyethylene (HDPE), polymethyl methacrylate/acrylic, polycarbonate, polybutylene terephthalate, and polyethylene terephthalate (PET). ¹² In addition to yellow MPs, red MPs were found. Anthraquinone, which had medium to high color intensity and transparency, was the most common red pigment. This pigment was typically incorporated into PS, PP, LDPE, and HDPE polymers. Triphenylmethane, azo, anthraquinone, perylene, and indigoid were interesting and widely used categories of dyes, which were also the main focus of the study by (Fleischmann et al., 2015) because these compounds had a broad range of applications.

3.5 | Polymer type

The chemical components and arrangement of macromolecules determine the physical characteristics of polymeric materials. Numerous spectroscopic techniques are currently available to examine these properties, and FTIR-spectroscopy is one of the most popular techniques due to its versatility in determining composition; consequently, the polymer type can be determined by comparing the FTIR spectra of the polymer to the library data. Exhibit 4 shows the FTIR spectra of all compost-analyzed MPs.

It is interesting to note that the FTIR spectra for MPs from compost at local agriculture stores (see Exhibits 4 and 5) have similar characteristics. For samples C1, C2, C3, and C4 (see Exhibit 4), a peak in wavenumber 3316 cm^{-1} , 1636 cm^{-1} , and 1033 cm^{-1} ; 3336 cm^{-1} , 1636 cm^{-1} , and 1031 cm^{-1} ; 3288 cm^{-1} , 1636 cm^{-1} , and 1033 cm^{-1} ; and 3284 cm^{-1} , 2119 cm^{-1} , and 1031 cm^{-1} are related OH group (hydroxyl), stretching of C = O of carboxylic acid group, terephthalate group ($\text{OOC}_6\text{H}_4\text{-COO}$), methylene group, and vibrations of the ester C-O bond, respectively, and they are the typical characteristics of PET (Kankanige & Babel, 2020; Mei et al., 2022; Pereira et al., 2017; Putri et al., 2023).

Exhibit 4 demonstrates the polymer composition of MPs in the compost from a local agricultural store. This study found that there is one type of polymer, namely PET. PET is the most often used polymeric polyester. PET polymers are extensively used in the manufacture of textiles, clothes, and wool (Islam et al., 2020). It was hypothesized that the PET in the compost came from village household garbage (Gui et al., 2021). PET is a clear polymer with excellent mechanical qualities and dimensional stability under varied loads (Wang et al., 2018). Moreover, PET offers excellent gas barrier qualities and chemical resistance. PET is a material with good physical qualities and recycling capability (Asensio et al., 2020). It accounts for about 18% of all polymers manufactured globally. More than 60% of its output is for synthetic fibers and bottles, which accounts for around 30% of the worldwide demand for PET (Padhan et al., 2013).

3.6 | Possible impacts of MPs on compost for human health

Generally, MPs entered ¹² the human body concluded ¹² three main routes, namely—ingestion (via food and water), inhalation (indoor and outdoor air), skin contact (via personal care products, dust, and textiles), and dermal contact (Blackburn & Green, 2022; Prata et al., 2020). Human contact with MPs could cause physical and chemical toxic effects. The type of particle and individual susceptibility might have influenced the adverse effects. Their physical effects might have had varying impacts, including increased inflammatory response, oxidative stress, cellular damage, and size-related toxicity (Prata & Dias-Pereira, 2023). Therefore, this section was organized based on the health effects caused by MPs in compost.

The acceptance of MPs in plants has been detected and plastic particles are especially absorbed on root hairs (Azeem et al., 2021). Furthermore, MPs can observe on terrestrial plant surfaces, be absorbed, and transported by plants, and accumulate in the edible parts of plants, leading to the possibility of enhancement and transmission through the food chain and threatening human health (Li et al., 2020; Wang et al., 2022). However, the fundamental mechanism remains unclear. To calculate the impact of MP on humans, measurements were made of particles that might have entered the body through agricultural food according to the scenario described by Nor et al. (2021). This model probabilistically simulated MPs concentrations in the gut, body tissue, and feces, allowing validation against empirical data. From the findings of Aydin et al. (2023) in detecting MP in most consumed fruits

EXHIBIT 5 Comparison of the Fourier transform infrared spectroscopy (FTIR) data in compost and other studies.

Sampling	Wave number (cm ⁻¹)			Polymer	Reference
Compost, Indonesia	3.315	1.636	1.033	Polyethylene terephthalate (PET)	Present study
	3.288	1.636	1.033		
PET Composites, Brazil	3.323	1.713	1.089	PET	(Pereira et al., 2017)
Salt, Indonesia	3.352	2.915	1.692	PET	(Putri et al., 2023)
	3.336	2.915	1.643		
Bottled water, Thailand	2.982	2.906	1.285	PET	(Kankanige & Babel, 2020)
Tea filter bags, China	2.885	2.852	1.295	PET	(Mei et al., 2022)

and vegetables from Turkey, total 210 particles (2.9 ± 1.6 particle g⁻¹) MPs found in eight fruits and vegetables samples. If the main route of exposure to humans was through food consumption, then the estimated intake was 39,000–52,000 plastic particles/person/year (Mercogliano et al., 2020). Meanwhile, the average intake level of MPs (1–5000 μ m) was 553–883 particles/capita/day (Nor et al., 2021). While definitive evidence linking MPs consumption to human health was lacking, studies suggested that MPs could have provoked immune and stress responses, induced reproductive and developmental toxicity, and increased the risk of chronic inflammation and neoplasia (Yang, Man et al., 2022). Further research was needed to fully understand the potential implications of MPs in compost on human health.

4 | CONCLUSION

The objective of this was to estimate the number and characteristics of MPs in compost. The results indicated that the total number of MPs was 160 particles/200 g in compost. This study found that MPs were identified in compost with the colors of red (43.75%), yellow (38.13%), black (8.75%), white (8.75%), and blue (0.62%). The size MPs ranged from 0.06 to 1 mm and the shape of MPs was dominated by fragments (81.87%), fiber (15.36%), and filament (1.88%). FTIR analysis clarified that the types of polymers were PET. In general, this study has successfully identified the presence of MPs, and findings of this study are significant particularly to improve community awareness about MPs present in compost. Future research must be performed to develop a simple MPs removal in compost.

ACKNOWLEDGMENTS

The authors are grateful for all the resources provided by the Universitas Islam Madura to support this study. Collaboration from Universitas Muhammadiyah Malang is highly appreciated.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Iswahyudi Iswahyudi  <https://orcid.org/0000-0002-3576-7418>

Adi Sutanto  <https://orcid.org/0000-0002-6561-4420>

Marchel Putra Garfansa  <https://orcid.org/0000-0001-5950-9758>

REFERENCES

- Aini, S. A., Syafiuddin, A., & Bent, G. A. (2022). The presence of microplastics in air environment and their potential impacts on health. *Environmental and Toxicology Management*, 2(1), 31–39. <https://doi.org/10.33086/etm.v2i1.2900>
- Aini, S. A., Syafiuddin, A., & Kueh, A. B. H. (2023). Quantification, characteristics, and distribution of microplastics released from waste burning furnaces and their associated health impacts. *Environmental Quality Management*, 33(1), 303–310. <https://doi.org/10.1002/tqem.22056>
- Alimi, O. S., Claveau-Mallet, D., Kurusu, R. S., Lapointe, M., Bayen, S., & Tufenkji, N. (2022). Weathering pathways and protocols for environmentally relevant microplastics and nanoplastics: What are we missing? *Journal of Hazardous Materials*, 423, 126955. <https://doi.org/10.1016/j.jhazmat.2021.126955>
- Andrady, A. L., Barnes, P. W., Bornman, J. F., Gouin, T., Madronich, S., White, C. C., Zepp, R. G., & Jansen, M. A. K. (2022). Oxidation and fragmentation of plastics in a changing environment; from UV-radiation to biological degradation. *Science of The Total Environment*, 851, 158022. <https://doi.org/10.1016/j.scitotenv.2022.158022>
- Asensio, M., Esfandiari, P., Núñez, K., Silva, J. F., Marques, A., Merino, J. C., & Pastor, J. M. (2020). Processing of pre-impregnated thermoplastic towpreg reinforced by continuous glass fibre and recycled PET by pultrusion. *Composites Part B: Engineering*, 200, 108365. <https://doi.org/10.1016/j.compositesb.2020.108365>
- Aydin, R. B., Yozukmaz, A., Şener, İ., Temiz, F., & Giannetto, D. (2023). Occurrence of microplastics in most consumed fruits and vegetables from Turkey and public risk assessment for consumers. *Life*, 13(8). <https://doi.org/10.3390/life13081686>
- Azeem, I., Adeel, M., Ahmad, M. A., Shakoore, N., Jiangcuo, G. D., Azeem, K., Ishfaq, M., Shakoore, A., Ayaz, M., Xu, M., & Rui, Y. (2021). Uptake and accumulation of nano/microplastics in plants: A critical review. *Nanomaterials*, 11(11), 2935. <https://doi.org/10.3390/nano11112935>
- Bao, R., Wang, Z., Qi, H., Mehmood, T., Cai, M., Zhang, Y., Yang, R., Peng, L., & Liu, F. (2022). Occurrence and distribution of microplastics in wastewater treatment plant in a tropical region of China. *Journal of Cleaner Production*, 349, 131454. <https://doi.org/10.1016/j.jclepro.2022.131454>

- Bertoldi, C., Lara, L. Z., Mizushima, F. A. D. L., Martins, F. C. G., Battisti, M. A., Hinrichs, R., & Fernandes, A. N. (2021). First evidence of microplastic contamination in the freshwater of Lake Guaíba, Porto Alegre, Brazil. *Science of The Total Environment*, 759, 143503. <https://doi.org/10.1016/j.scitotenv.2020.143503>
- Blackburn, K., & Green, D. (2022). The potential effects of microplastics on human health: What is known and what is unknown. *Ambio*, 51(3), 518–530. <https://doi.org/10.1007/s13280-021-01589-9>
- Blanke, M. (2020). GKL Tagung zur Bestandesaufnahme von Mikro- und Makroplastik im Gartenbau. *Erwerbs-Obstbau*, 62(4), 489–497. <https://doi.org/10.1007/s10341-020-00529-3>
- Braun, M., Mail, M., Heyse, R., & Amelung, W. (2021). Plastic in compost: Prevalence and potential input into agricultural and horticultural soils. *Science of The Total Environment*, 760, 143335. <https://doi.org/10.1016/j.scitotenv.2020.143335>
- Campanale, C., Savino, I., Massarelli, C., & Uricchio, V. F. (2023). Fourier transform infrared spectroscopy to assess the degree of alteration of artificially aged and environmentally weathered microplastics. *Polymers*, 15(4), 911. <https://doi.org/10.3390/polym15040911>
- Chai, B., Wei, Q., She, Y., Lu, G., Dang, Z., & Yin, H. (2020). Soil microplastic pollution in an e-waste dismantling zone of China. *Waste Management*, 118, 291–301. <https://doi.org/10.1016/j.wasman.2020.08.048>
- Chamas, A., Moon, H., Zheng, J., Qiu, Y., Tabassum, T., Jang, J. H., Abu-Omar, M., Scott, S. L., & Suh, S. (2020). Degradation rates of plastics in the environment. *ACS Sustainable Chemistry & Engineering*, 8(9), 3494–3511. <https://doi.org/10.1021/acssuschemeng.9b06635>
- Chia, R. W., Lee, J.-Y., Jang, J., Kim, H., & Kwon, K. D. (2022). Soil health and microplastics: A review of the impacts of microplastic contamination on soil properties. *Journal of Soils and Sediments*, 22(10), 2690–2705. <https://doi.org/10.1007/s11368-022-03254-4>
- Corradini, F., Casado, F., Leiva, V., Huerta-Lwanga, E., & Geissen, V. (2021). Microplastics occurrence and frequency in soils under different land uses on a regional scale. *Science of The Total Environment*, 752, 141917. <https://doi.org/10.1016/j.scitotenv.2020.141917>
- Crawford, C. B., & Quinn, B. (2017). *Microplastic pollutants*: Elsevier. <https://doi.org/10.1016/C2015-0-04315-5>
- Dantas Filho, J. V., Pedroti, V. P., Santos, B. L. T., de Lima Pinheiro, M. M., de Mira, Á. B., da Silva, F. C., e Silva, E. C. S., Cavali, J., Guedes, E. A. C., & de Vargas Schons, S. (2023). First evidence of microplastics in freshwater from fish farms in Rondônia state, Brazil. *Heliyon*, 9(4), 1–11. <https://doi.org/10.1016/j.heliyon.2023.e15066>
- Deng, Y., Wu, J., Chen, J., & Kang, K. (2023). Overview of microplastic pollution and its influence on the health of organisms. *Journal of Environmental Science and Health, Part A*, 58(4), 412–422. <https://doi.org/10.1080/10934529.2023.2190715>
- Dimassi, S. N., Hahladakis, J. N., Yahia, M. N. D., Ahmad, M. I., Sayadi, S., & Al-Ghouti, M. A. (2022). Degradation-fragmentation of marine plastic waste and their environmental implications: A critical review. *Arabian Journal of Chemistry*, 15(11), 104262. <https://doi.org/10.1016/j.arabj.2022.104262>
- Edo, C., Fernández-Piñas, F., & Rosal, R. (2022). Microplastics identification and quantification in the composted organic fraction of municipal solid waste. *Science of The Total Environment*, 813, 151902. <https://doi.org/10.1016/j.scitotenv.2021.151902>
- Fleischmann, C., Lievenbrück, M., & Ritter, H. (2015). Polymers and dyes: Developments and applications. *Polymers*, 7(4), 717–746. doi:<https://doi.org/10.3390/polym7040717>
- Grbić, J., Helm, P., Athey, S., & Rochman, C. M. (2020). Microplastics entering northwestern Lake Ontario are diverse and linked to urban sources. *Water Research*, 174, 115623. <https://doi.org/10.1016/j.watres.2020.115623>
- Gui, J., Sun, Y., Wang, J., Chen, X., Zhang, S., & Wu, D. (2021). Microplastics in composting of rural domestic waste: Abundance, characteristics, and release from the surface of macroplastics. *Environmental Pollution*, 274, 116553. <https://doi.org/10.1016/j.envpol.2021.116553>
- Hale, R. C., King, A. E., Ramirez, J. M., La Guardia, M., & Nidel, C. (2022). Durable plastic goods: A Source of microplastics and chemical additives in the built and natural environments. *Environmental Science & Technology Letters*, 9(10), 798–807. <https://doi.org/10.1021/acs.estlett.2c00417>
- Hernández-Arenas, R., Beltrán-Sanahuja, A., Navarro-Quirant, P., & Sanz-Lazaro, C. (2021). The effect of sewage sludge containing microplastics on growth and fruit development of tomato plants. *Environmental Pollution*, 268, 115779. <https://doi.org/10.1016/j.envpol.2020.115779>
- Islam, M. T., Rahman, M. M., & Mazumder, N.-U.-S. (2020). Polymers for textile production. In M. Shabbir, S. Ahmed & J. N. Sheikh (Eds.), *Frontiers of textile materials* (pp. 13–59). Beverly, MA: Scrivener Publishing. <https://doi.org/10.1002/9781119620396.ch2>
- Kankanige, D., & Babel, S. (2020). Smaller-sized micro-plastics (MPs) contamination in single-use PET-bottled water in Thailand. *Science of The Total Environment*, 717, 137232. <https://doi.org/10.1016/j.scitotenv.2020.137232>
- Le, V. R., Nguyen, M. K., Nguyen, H. L., Lin, C., Rakib, M. R. J., Thai, V. A., Le, V. G., Malafaia, G., & Idris, A. M. (2023). Organic composts as a vehicle for the entry of microplastics into the environment: A comprehensive review. *Science of The Total Environment*, 892, 164758. <https://doi.org/10.1016/j.scitotenv.2023.164758>
- Li, L., Yang, J., Zhou, Q., Peijnenburg, W. J. G. M., & Luo, Y. (2020). Uptake of Microplastics and Their Effects on Plants. In D. He & Y. Luo (Eds.), *Microplastics in terrestrial environments: Emerging contaminants and major challenges* (pp. 279–298). Springer International Publishing. https://doi.org/10.1007/978-98-1-10-1007-6_98
- Liao, J., & Chen, Q. (2021). Biodegradable plastics in the air and soil environment: Low degradation rate and high microplastics formation. *Journal of Hazardous Materials*, 418, 126329. <https://doi.org/10.1016/j.jhazmat.2021.126329>
- Liu, M., Lu, S., Song, Y., Lei, L., Hu, J., Lv, W., Zhou, W., Cao, C., Shi, H., Yang, X., & He, D. (2018). Microplastic and mesoplastic pollution in farmland soils in suburbs of Shanghai, China. *Environmental Pollution*, 242, 855–862. <https://doi.org/10.1016/j.envpol.2018.07.051>
- Mei, T., Wang, J., Xiao, X., Lv, J., Li, Q., Dai, H., Liu, X., & Pi, F. (2022). Identification and evaluation of microplastics from tea filter bags based on Raman imaging. *Foods*, 11(18). <https://doi.org/10.3390/foods11182871>
- Mercogliano, R., Avio, C. G., Regoli, F., Anastasio, A., Colavita, G., & Santonicola, S. (2020). Occurrence of microplastics in commercial seafood under the perspective of the human food chain. A review. *Journal of Agricultural and Food Chemistry*, 68(19), 5296–5301. <https://doi.org/10.1021/acs.jafc.0c01209>
- Nirmala, K., Rangasamy, G., Ramya, M., Shankar, V. U., & Rajesh, G. (2023). A critical review on recent research progress on microplastic pollutants in drinking water. *Environmental Research*, 222, 115312. <https://doi.org/10.1016/j.envres.2023.115312>
- Nor, N. H. M., Kooi, M., Diepens, N. J., & Koelmans, A. A. (2021). Lifetime accumulation of microplastic in children and adults. *Environmental Science & Technology*, 55(8), 5084–5096. <https://doi.org/10.1021/acs.est.0c07384>
- Oleksiuk, K., Krupa-Kotara, K., Grajek, M., Wypych-Ślusarska, A., Głogowska-Ligus, J., & Stowiński, J. (2023). Health risks of environmental exposure to microplastics. *Journal of Education, Health and Sport*, 13(1), 79–84. <https://doi.org/10.12775/JEHS.2023.13.01.012>
- Padhan, R. K., Gupta, A. A., Badoni, R. P., & Bhatnagar, A. K. (2013). Poly(ethylene terephthalate) waste derived chemicals as an antistripping additive for bitumen—An environment friendly approach for disposal of environmentally hazardous material. *Polymer Degradation and Stability*, 98(12), 2592–2601. <https://doi.org/10.1016/j.polydegradstab.2013.09.019>

- Pereira, A. P. D. S., Silva, M. H. P. D., Lima, É. P., Paula, A. D. S., & Tommasini, F. J. (2017). Processing and characterization of PET composites reinforced with geopolymer concrete waste. *Materials Research*, 20, 411–420. <https://doi.org/10.1590/1980-5373-MR-2017-0734>
- Piehl, S., Leibner, A., Löder, M. G. J., Dris, R., Bogner, C., & Laforsch, C. (2018). Identification and quantification of macro- and microplastics on an agricultural farmland. *Scientific Reports*, 8(1), 17950. <https://doi.org/10.1038/s41598-018-36172-y>
- Pironti, C., Ricciardi, M., Motta, O., Miele, Y., Proto, A., & Montano, L. (2021). Microplastics in the environment: Intake through the food web, human exposure and toxicological effects. *Toxics*, 9(9), 224. <https://doi.org/10.3390/toxics9090224>
- Prata, J. C., da Costa, J. P., Lopes, I., Duarte, A. C., & Rocha-Santos, T. (2020). Environmental exposure to microplastics: An overview on possible human health effects. *Science of The Total Environment*, 702, 134455. <https://doi.org/10.1016/j.scitotenv.2019.134455>
- Prata, J. C., & Dias-Pereira, P. (2023). Microplastics in terrestrial domestic animals and human health: Implications for food security and food safety and their role as sentinels. *Animals*, 13(4), 661. <https://doi.org/10.3390/ani13040661>
- Premarathna, K. S. D., Ramanayaka, S., Navaratne, A., Wijesekara, H., Jayasanka, J., & Vithanage, M. (2023). Compost-hosted microplastics—Municipal solid waste compost. In M. Vithanage & M. N. V. Prasad (Eds.), *Microplastics in the ecosphere* (pp. 433–448). Hoboken, NJ: John Wiley & Sons. <https://doi.org/10.1002/9781119879534.ch27>
- Prosenč, F., Leban, P., Šunta, U., & Bavcon Kralj, M. (2021). Extraction and identification of a wide range of microplastic polymers in soil and compost. *Polymers*, 13(23), 4069. <https://doi.org/10.3390/polym13234069>
- Putri, E. B. P., Syafiuddin, A., Aini, S. A., Iswahyudi, I., & Garfansa, M. P. (2023). Identification and quantification of microplastics in sea water and sea salt collected from sea salt ponds. *Desalination and Water Treatment*, 300, 130–135. <https://doi.org/10.5004/dwt.2023.29719>
- Roy, T., Dey, T. K., & Jamal, M. (2022). Microplastic/nanoplastic toxicity in plants: An imminent concern. *Environmental Monitoring and Assessment*, 195(1), 27. <https://doi.org/10.1007/s10661-022-10654-z>
- Rynk, R., Schwarz, M., Richard, T. L., Cotton, M., Halbach, T., & Siebert, S. (2022). Chapter 4 - Compost feedstocks. In R. Rynk (Ed.), *The composting handbook* (pp. 103–157). Academic Press. <https://doi.org/10.1016/B978-0-323-85602-7.00005-4>
- Sathish, T., Sabarirajan, N., Ravichandran, S., Moorthy, G. M., & Dinesh kumar, S. (2022). Novel study on improvement of plastics properties by blending of waste micro plastics into ABS plastics. *Chemosphere*, 303, 134997. <https://doi.org/10.1016/j.chemosphere.2022.134997>
- Schwinghammer, L., Krause, S., & Schaum, C. (2020). Determination of large microplastics: Wet-sieving of dewatered digested sludge, co-substrates, and compost. *Water Science and Technology*, 84(2), 384–392. <https://doi.org/10.2166/wst.2020.582>
- Sholokhova, A., Ceponkus, J., Sablinskas, V., & Denafas, G. (2022). Abundance and characteristics of microplastics in treated organic wastes of Kaunas and Alytus regional waste management centres, Lithuania. *Environmental Science and Pollution Research*, 29(14), 20665–20674. <https://doi.org/10.1007/s11356-021-17378-6>
- Tang, K. H. D. (2023). Microplastics in agricultural soils in China: Sources, impacts and solutions. *Environmental Pollution*, 322, 121235. <https://doi.org/10.1016/j.envpol.2023.121235>
- van Schothorst, B., Beriot, N., Huerta Lwanga, E., & Geissen, V. (2021). Sources of light density microplastic related to two agricultural practices: The use of compost and plastic mulch. *Environments*, 8(4), 36. Retrieved from <https://www.mdpi.com/2076-3298/8/4/36>
- Vithanage, M., Ramanayaka, S., Hasinthara, S., & Navaratne, A. (2021). Compost as a carrier for microplastics and plastic-bound toxic metals into agroecosystems. *Current Opinion in Environmental Science & Health*, 24, 100297. <https://doi.org/10.1016/j.coesh.2021.100297>
- Wang, F., Feng, X., Liu, Y., Adams, C. A., Sun, Y., & Zhang, S. (2022). Micro(nano)plastics and terrestrial plants: Up-to-date knowledge on uptake, translocation, and phytotoxicity. *Resources, Conservation and Recycling*, 185, 106503. <https://doi.org/10.1016/j.resconrec.2022.106503>
- Wang, W., Yuan, W., Chen, Y., & Wang, J. (2018). Microplastics in surface waters of Dongting Lake and Hong Lake, China. *Science of The Total Environment*, 633, 539–545. <https://doi.org/10.1016/j.scitotenv.2018.03.211>
- Wu, P., Lin, S., Cao, G., Wu, J., Jin, H., Wang, C., Wong, M. H., Yang, Z., & Cai, Z. (2022). Absorption, distribution, metabolism, excretion and toxicity of microplastics in the human body and health implications. *Journal of Hazardous Materials*, 437, 129361. <https://doi.org/10.1016/j.jhazmat.2022.129361>
- Wu, R. T., Cai, Y. F., Chen, Y. X., Yang, Y. W., Xing, S. C., & Liao, X. D. (2021). Occurrence of microplastic in livestock and poultry manure in South China. *Environmental Pollution*, 277, 116790. <https://doi.org/10.1016/j.envpol.2021.116790>
- Xiao, M., Shahbaz, M., Liang, Y., Yang, J., Wang, S., Chadwick, D. R., Jones, D., Chen, J., & Ge, T. (2021). Effect of microplastics on organic matter decomposition in paddy soil amended with crop residues and labile C: A three-source-partitioning study. *Journal of Hazardous Materials*, 416, 126221. <https://doi.org/10.1016/j.jhazmat.2021.126221>
- Xing, R., Chen, Z., Sun, H., Liao, H., Qin, S., Liu, W., Zhang, Y., Chen, Z., & Zhou, S. (2022). Free radicals accelerate in situ ageing of microplastics during sludge composting. *Journal of Hazardous Materials*, 429, 128405. <https://doi.org/10.1016/j.jhazmat.2022.128405>
- Xu, J. L., Thomas, K. V., Luo, Z., & Gowen, A. A. (2019). FTIR and Raman imaging for microplastics analysis: State of the art, challenges and prospects. *TrAC Trends in Analytical Chemistry*, 119, 115629. <https://doi.org/10.1016/j.trac.2019.115629>
- Yang, L., Kang, S., Wang, Z., Luo, X., Guo, J., Gao, T., Chen, P., Yang, C., & Zhang, Y. (2022). Microplastic characteristic in the soil across the Tibetan Plateau. *Science of The Total Environment*, 828, 154518. <https://doi.org/10.1016/j.scitotenv.2022.154518>
- Yang, X., Man, Y. B., Wong, M. H., Owen, R. B., & Chow, K. L. (2022). Environmental health impacts of microplastics exposure on structural organization levels in the human body. *Science of The Total Environment*, 825, 154025. <https://doi.org/10.1016/j.scitotenv.2022.154025>
- Yu, L., Zhang, J., Liu, Y., Chen, L., Tao, S., & Liu, W. (2021). Distribution characteristics of microplastics in agricultural soils from the largest vegetable production base in China. *Science of The Total Environment*, 756, 143860. <https://doi.org/10.1016/j.scitotenv.2020.143860>
- Yu, Z. F., Song, S., Xu, X. L., Ma, Q., & Lu, Y. (2021). Sources, migration, accumulation and influence of microplastics in terrestrial plant communities. *Environmental and Experimental Botany*, 192, 104635. <https://doi.org/10.1016/j.envexpbot.2021.104635>
- Zafiu, C., Binner, E., Beigl, P., Vay, B., Ebmer, J., & Huber-Humer, M. (2023). The dynamics of macro- and microplastic quantity and size changes during the composting process. *Waste Management*, 162, 18–26. <https://doi.org/10.1016/j.wasman.2023.03.002>
- Zhang, J., Guo, N., Ding, W., Han, B., Zhao, M., Wang, X., Wang, J., Cao, B., Zou, G., & Chen, Y. (2023). Microplastic pollution and the related ecological risks of organic composts from different raw materials. *Journal of Hazardous Materials*, 458, 131911. <https://doi.org/10.1016/j.jhazmat.2023.131911>
- Zhang, J., Wang, X., Xue, W., Xu, L., Ding, W., Zhao, M., Liu, S., Zou, G., & Chen, Y. (2022). Microplastics pollution in soil increases dramatically with long-term application of organic composts in a wheat-maize rotation. *Journal of Cleaner Production*, 356, 131889. <https://doi.org/10.1016/j.jclepro.2022.131889>
- Zhang, S., Li, Y., Chen, X., Jiang, X., Li, J., Yang, L., Yin, X., & Zhang, X. (2022). Occurrence and distribution of microplastics in organic fertilizers in

China. *Science of The Total Environment*, 844, 157061. <https://doi.org/10.1016/j.scitotenv.2022.157061>

Zhou, Y., Ren, X., Tsui, T.-H., Barcelo, D., Wang, Q., Zhang, Z., & Yongzhen, D. (2023). Microplastics as an underestimated emerging contaminant in solid organic waste and their biological products: Occurrence, fate and ecological risks. *Journal of Hazardous Materials*, 445, 130596. <https://doi.org/10.1016/j.jhazmat.2022.130596>

How to cite this article: Iswahyudi, I., Widodo, W., Warkoyo, W., Sutanto, A., Garfansa, M. P., & Septia, E. D. (2024). Determination and quantification of microplastics in compost. *Environmental Quality Management*, 1–10. <https://doi.org/10.1002/tqem.22184>

Determination and quantification of microplastics in compost

by Imam Wahyudi

Submission date: 21-Feb-2024 08:02AM (UTC+0700)

Submission ID: 2300084622

File name: Iswahyudi_Compost_Wiley_17904629.pdf (2.59M)

Word count: 7677

Character count: 40682

Determination and quantification of microplastics in compost

Iswahyudi Iswahyudi^{1,2} | Wahyu Widodo¹ | Warkoyo Warkoyo¹ | Adi Sutanto¹ |
Marchel Putra Garfansa² | Erfan Dani Septia³

¹Department of Agriculture Science,
University of Muhammadiyah Malang, East
Java, Indonesia

²Department of Agrotechnology, Faculty of
Agriculture, Universitas Islam Madura, East
Java, Indonesia

³Department of Agrotechnology, University of
Muhammadiyah Malang, East Java, Indonesia

Correspondence
Iswahyudi Iswahyudi and Adi Sutanto,
Department of Agriculture Science, University
of Muhammadiyah Malang, 65144 Malang,
East Java, Indonesia. Email
iswahyudi@um.ac.id and sutanto@um.ac.id

Funding information
Universitas Islam Madura

Abstract

Although microplastics (MPs) in solid organic waste have been intensively studied, the presence of MPs in organic fertilizer and their potential as new emerging pollution to environment because of their use in agriculture has not been explained completely. Therefore, the identification and quantification of MPs in commercially available compost is important. This study aimed to estimate the quantity of MPs in commercial composts. The characteristics of MPs (shape, color, size, and type of polymers) were identified. This study found that MPs in commercial compost samples were found, reaching up to 160 particles/200 g of compost with various colors (blue, black, red, yellow, and white). The identified MPs had various sizes (0.1–1 mm) and shapes (81.8% fragment, 16.2% fiber, and 2% filament). The findings of this study are very important and significant to inform community and policymakers regarding the presence of MPs in commercial compost, hence, their intensive use in agriculture must be controlled and careful.

KEYWORDS

compost, environmental pollution, microplastics, organic fertilizers

1 | INTRODUCTION

Microplastics [MPs] are tiny plastic particles less than 5 mm (0.2 in.) in diameter (Sathish et al., 2022). MPs are one of the main contributors to environmental pollution (Bao et al., 2022). Due to their very small size, MPs can easily be carried by water and wind (Aini et al., 2022); thus, they can massively spread in environments such as wetlands, lakes, seas, and soil (Deng et al., 2023; Nirmala et al., 2023). The emergence of MPs has received considerable critical attention (Alimi et al., 2022). In farming soils, the presence of MPs is associated with the use of organic fertilizers (Zhang, Li, et al., 2022). MPs were found in conventional agricultural land (Piehl et al., 2018), resulting from the application of compost made from organic trash, livestock manure, and biosolids (Hernández-Arenas et al., 2021). Annual use of compost reaching up to 4.07 million tons in agriculture and horticulture in Germany is estimated to contribute 817 tons of MPs (Blanke, 2020).

Previous studies reported that MPs were detected in many compost products, including municipal biowaste compost (Prosenic et al., 2021), solid organic waste and organic compost (Zhou et al., 2023), and rural domestic waste (RDW) compost (Gui et al., 2021). Moreover, total amount of MPs in the composting field located in northeastern Spain was 10–30 particles/g at five sampling sites (Edo et al., 2022). In addition, 6430 ± 751 particles/kg MPs of green compost were found in the organic wastes of Kaunas and Alytus regional waste management centers in Lithuania (Sholokhova et al., 2022). Another research indicated that the long-term implementation of compost on maize fields in China contaminated 3.63 × 10⁹ to 4.99 × 10⁹ particles/ha (Zhang, Wang, et al., 2022), whereas maize is usually used as a food source for human consumption. These studies show that MPs strongly negatively affect the agricultural environment. Thus, MPs in agricultural and compost environments become interesting and important to inspect.

The properties of MPs in organic fertilizers are mostly influenced by their feedstocks (Rynk et al., 2022; Tang, 2023). The production

of fertilizers, which mostly involves aerobic composting and anaerobic digesting, significantly impacts the enrichment of MPs (Zhang, Li et al., 2022). In several aerobic decomposition studies, the addition of plastics resulted in fragmentation, which was linked to a substantial increase in particle number (Andrady et al., 2022; Chamas et al., 2020; Dimassi et al., 2022; Liao & Chen, 2021). Furthermore, MPs can generate strong free radical reactions in the highly oxidizing environment of aerobic decomposition (Qing et al., 2022). Hydrolysis is added during anaerobic fermenting, resulting in the brittleness and fragmentation of plastics; however, the resultant plastic fragments do not completely vanish (Hale et al., 2022). The presence of MPs in the compost has the potential to cause soil contamination (Vithanage et al., 2021). Previously, MPs were reported in compost from various countries, such as southeastern Mexico and southern China (Fronti et al., 2021). It was revealed that it is possible that MPs can be consumed by humans at the same time as the consumption of agricultural products (Zhou et al., 2023). MPs can infiltrate the human body via inhalation and consumption of food and beverages. Consuming food contaminated with MPs can cause various immune system-related issues, including immunosuppression, immune activation, and aberrant inflammatory responses. In addition, it can cause stress, reproductive toxicity, and developmental problems (Wu et al., 2022). Consequently, additional research is required to investigate the potential effects of MPs on the environment and human health through more rigorous clinical investigations.

Enhancing soil fertility may be achieved using organic fertilizers, as opposed to chemical fertilizers, due to their higher organic carbon, nitrogen, and phosphorus content. Organic fertilizers are generally composed of animal dung or bacterial wastes, which are abundant in organic materials and plant nutrients, hence contributing to improved soil quality (Schwinghammer et al., 2020). However, these feedstocks frequently contain MPs (Ryek et al., 2022) and MPs experience a sequence of conditioning, breakdowns, and processing steps that typically concentrate and enrich them in the final products. But threshold values for plastics are frequently absent, particularly for MPs concentrations in organic fertilizer (Braun et al., 2021).

Enhancing soil fertility may be achieved using organic fertilizers, as opposed to chemical fertilizers, due to their higher organic carbon, nitrogen, and phosphorus content

Insufficient data is describing the composition and distribution of MPs in organic fertilizers, limiting our understanding of the contributions of these fertilizers to soil pollution. In addition, the use of these fer-

tilizers varies significantly across provinces based on their unique environmental and economic conditions. There is an imperative need for additional research to characterize the MPs in organic fertilizers and control MPs contamination on farmlands. Thus, this study aimed to estimate the abundance of MPs in compost. The findings of this study are crucial to inform community and policy makers regarding the presence of MPs in commercial compost. Therefore, intensive use of compost containing MPs in agriculture must be minimized.

There is an imperative need for additional research to characterize the MPs in organic fertilizers and control MPs contamination on farmlands.

2 | MATERIALS AND METHODS

2.1 | Materials

The compost used in this study was purchased from a local agricultural store (Stand Flamboyan, Pamekasan City, East Java province, Indonesia), and the compost brand was Kompos Organik. Chemical, 30% hydrogen peroxide (H_2O_2) (UN2014), was purchased from KimiaFarma company (Pamekasan City, East Java province, Indonesia). Classification of compost with multiple raw materials with a complex composition (a mixture of manure and agricultural waste) often contains additional ingredients.

Stainless with a mesh size of 5 mm is used to first filter compost samples by removing leaves, roots, and other larger debris to facilitate the extraction of MPs. Filter stainless, 300 mesh for second stage filtration used to be carried out after the sample is centrifuged for the identification stage. Distilled water is used to rinse the sample after it has been placed in a strong acid solution. This research also uses glass equipment, including glass beakers, measuring flasks, pipettes, glass bottles, vials bottles, glass stirrers, Petri dishes, and mortar. It also uses aluminum foil for containers in drying, covers and covers for glassware. Some label paper is also needed for sample indication. A strong acid solution, H_2O_2 , breaks down and releases organic matter from the MPs samples (Aini et al., 2023; Putri et al., 2023).

Stainless with a mesh size of 5 mm is used to first filter compost samples by removing

leaves, roots, and other larger debris to facilitate the extraction of MPs. A strong acid solution, H_2O_2 , breaks down and releases organic matter from the MPs samples

2.2 | Sampling method

The instrument used to collect the 50 g sample compost was a glass beaker with a diameter of 9 cm, and then first filtered using a stainless with a mesh size of 5 mm and second filtered using a stainless with a mesh of 300. Four multiple raw materials (same brand) used in this study were taken, namely sample 1 (C1), sample 2 (C2), sample 3 (C3), and sample 4 (C4). This brand of compost was chosen because it is often used by farmers, which is very crucial since MPs have the potential to contaminate the soil and be absorbed by roots. Another selection criterion is the availability of compost which can be easily purchased. The remained materials on the filter were mixed with 30% H_2O_2 solution and dried at room temperature for 1 h. The solution of H_2O_2 was used to degrade any organic residue so that targeted MPs could be freely from organic residue before observing by using a microscope. The method applied for MPs extraction from the compost sample was an adjustment of the method for extracting MPs from organic-rich environmental matrices (Zhang, Li, et al., 2022). The physicochemical properties of the organic fertilizers were similar to those of organic-rich soil and livestock manure, so the dried and sieved organic fertilizer samples were subjected to sequential flow separation and density flotation extraction for the identification of MPs (Cerradini et al., 2021).

The method applied for MPs extraction from the compost sample was an adjustment of the method for extracting MPs from organic-rich environmental matrices. The physicochemical properties of the organic fertilizers were

similar to those of organic-rich soil and livestock manure

2.3 | MPs identification

Rinse water from a stainless filter, 300 mesh is lowered into a Petri dish, for MPs identification. The microscope with 40x magnification used in this study was Trinocular Digital Ways Dwt-ty Black Edition, Kaisi Rotation LED Lamp K-D056 for microscope, and 51-megapixel microscope camera connected to Samsung Smart TV 32. Under the microscope, the sample was counted while its shape, size, and color were carefully observed. Following, the MPs samples were analyzed using fourier transform infrared spectroscopy (FTIR) Thermo Scientific Nicolet iS10 to characterize a type of polymer. The selection of the FTIR was made due to its simplicity as a method for identifying the type of polymer by examination of its vibrational spectrum, which exhibits distinctive characteristics for each polymer type (Xu et al., 2019).

3 | RESULTS AND DISCUSSION

3.1 | Number of MPs

The presence of MPs and their characteristics observed in this study is presented in Exhibit 1. The total number of MPs found was 160 particles while in compost. It is noted that the MPs in C1, C2, C3, and C4 the MPs found were 58 particles/50 g, 48 particles/50 g, 41 particles/50 g, and 13 particles/50 g, respectively. Surprisingly, the number of MPs in the C1 compost was found to be the highest compared to the others. It is important to first understand the raw materials for composting to determine MP contamination in the compost.

It is important to first understand the raw materials for composting to determine MP contamination in the compost.

The findings of this study support previous works that also observed the presence of MPs in compost produced by using different materials, which are municipal biowaste compost (Proenc et al., 2021), municipal organic waste, and garden and greenhouse waste (van Schothorst et al., 2021). The average contaminations of MPs in compost were

EXHIBIT 1 The presence of microplastics (MPs) in compost.

Sample	Shape	Number of MPs	Color	Size (mm)
C1	Fragment (52)	56	Blue, black, red, white, and yellow	0.1–1
	Fiber (6)			
C2	Fragment (31)	46	Black, red, and white	0.1–1
	Fiber (14)			
	Filament (3)			
C3	Fragment (35)	41	Black, red, yellow	0.1–1
	Fiber (6)			
C4	Fragment (13)	13	Red, yellow	0.06–0.6

EXHIBIT 2 Comparison of the characteristics of microplastics (MPs) in compost in Indonesia and other countries.

Sampling	Number/weight	Size (mm)	Shape	Polymer	Reference
Compost, Indonesia	13–58/50 g	0.1–1	Fragment, fiber, and filament	Polyethylene terephthalate (PET)	Present study
Compost, Spain	5–20/g	<5	Fragment and fiber	Polyethylene, polystyrene, polyester, polypropylene, and polyvinyl chloride	(Edo et al., 2022)
Compost, China	2400 ± 358/kg	0.05–5	Fiber, film	Polyester, polypropylene, and polyethylene	(Gui et al., 2021)
Compost, China	2–34/50 g	-	Fiber and fragment	Polypropylene and polyethylene	(Wu et al., 2021)
Compost, China	1500–6615/kg	0.5–1	Fragment, fiber, film	Polypropylene, polyethylene, and polyethylene terephthalate	(Zhang et al., 2023)

2800 ± 616 particles kg⁻¹ and 1253 ± 561 particles kg⁻¹ of compost for municipal organic waste and from garden and greenhouse waste, respectively. An alternative study also reported that MPs were identified in chicken manure, sludge, and domestic waste compost with the number of particles of 14,720 ± 2468, 8600 ± 1428, and 11,640 ± 3565 particles kg⁻¹, respectively (Zhang, Wang et al., 2022).

3.2 | Size of MPs

Sizes of MPs particles found in this study are shown in Exhibit 1. The current study found that identified MPs in compost have various sizes ranging from 0.06 to 1 mm. At C1, C2, and C3 MPs sizes measure around 0.1–1 mm, meanwhile, at C4, the sizes are 0.06–0.6 mm. It is witnessed that the bigger MPs are found at C1, C2, and C3, compared to C4. It is noted that smaller MPs have higher toxicity because they can easily be absorbed by the roots, impacting the inhibited nutrient uptake, reducing biomass, and contaminating fruit (Roy et al., 2022).

Exhibit 2 presents a comparison with other prior efforts. The size of MPs observed in the previous investigation conducted on compost exhibited a range covering from 0.1 to 5 mm. For instance, in the study conducted in Spain (Edo et al., 2022), MP sizes are not larger than 5 mm, while in China, the sizes are 0.05 to 5 mm (Gui et al.,

2021), and 0.5–1 mm (Zhang et al., 2023). The latest findings on MPs contamination originating from compost and its subsequent use in soil brought attention to the possible consequences of micropollutant transfer from compost (Lu et al., 2023). Specifically, MPs accumulation in soils has been shown to have an impact on three key markers of soil health, namely, soil microbiological, chemical and physical characteristics (Chia et al., 2012; Zhang, Wang et al., 2022). Therefore, the high-risk MPs sizes for the plant, especially for the root, photosynthetic pigments, and biomass are below 3 µm.

3.3 | Shape of MPs

The identification of MPs shapes obtained from compost is provided in Exhibit 3. Generally, there are three shapes of MPs, fragment, fiber, and filament. In compost, 81.8% of fragments, 16.2% of fiber, and 2% of filament were found. Similarly, several previous studies have reported that fragments and fibers are the predominant MPs morphologies in agricultural soil, thereby introducing this form of MPs into arable soil (Liu et al., 2018) and indicating that organic fertilizers contributed to the contamination of farmland soils with MPs (Yu, Song et al., 2021).

Previous work reported that the fiber shape of MPs was observed in municipal solid waste compost (Edo et al., 2022) and RDW compost

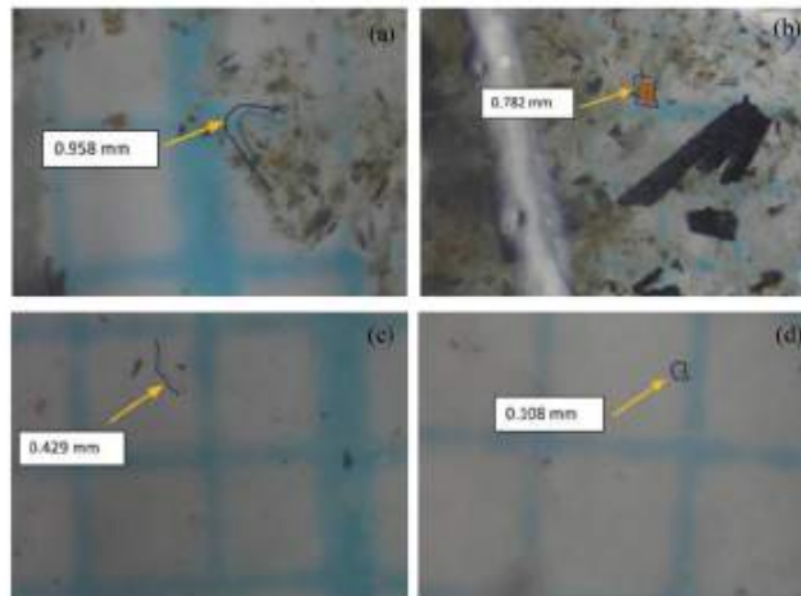


EXHIBIT 3 Microplastics (MPs) shapes of (a) fiber and blue, (b) fragment and yellow, (c) fiber and black, and (d) filament and white-red. [Color figure can be viewed at *wileyonlinelibrary.com*](#)

(Gui et al., 2021). The fragment shape of MPs particles was also found in livestock and poultry manure compost (Wu et al., 2021). It indicated that fiber and fragment shapes are easy to find in compost. Mostly in composting, fragment shape was generated by the breakdown of larger pieces of MPs. Plastic fragmentation from larger size to smaller size, MPs can occur in aerobic and anaerobic composting processes and other processes depending on environmental conditions (Zafiu et al., 2023). However, most of the MPs in organic fertilizers consisted of finer particles. Plastics are extremely difficult to degrade, and the production cycle of organic fertilizers (40 days) is frequently inadequate. Thus, MPs fragmentation during the production of organic fertilizer may be as significant as projected, and 0.1–1 mm plastic dominated the samples.

MPs in compost had various shapes due to the different sources of plastic waste that contributed to compost production. The shape of MPs in compost was influenced by the mechanical crushing, anaerobic, and aerobic processes involved in composting (Premaratna et al., 2023). The dominant shapes of MPs in compost samples were found to be fragments, fibers, and films (Sholokhova et al., 2022). These shapes were likely derived from plastic bags, packaging materials, and other plastic waste that entered the composting process (Vithanage et al., 2021). The presence of different shapes of MPs in compost highlighted the diverse types of plastic waste that were being processed and the potential for these MPs to contaminate the soil when the compost was used as a fertilizer (Schwinghammer et al., 2020).

3.4 | Color of MPs

Red was the most dominant color of the MPs found in compost, that is, 30, 29, and 8 particles, respectively, in C2, C3, and C4. In C1, the most dominant is yellow with 38 particles detected while in C3 is yellow with 16 MPs particles second dominant. The color of MPs found in the previous study was white and blue (Yu, Zhang et al., 2021). In China, Yang, Kang et al. (2022) witnessed MPs in transparent and white. Meanwhile, white, blue, and red were the colors of MPs found in Indonesia (Aini et al., 2023; Putri et al., 2023). Also in Brazil, the colors of MPs were transparent, red, and blue (Dantas Filho et al., 2023).

Color may also represent the presence of MPs in compost. Considering that plastics can degrade under environments with rich organic matter presented in Exhibit 3, MPs were categorized into five primary hues: red, yellow, blue, black, and white. These color categories were generally compatible with those reported by a wide number of research (Bertoldi et al., 2021; Grbić et al., 2020). Considering that plastics readily age in high organic matter conditions (Xiao et al., 2021). Yu, Zhang et al. (2021) also reported white MPs were the most prevalent in samples of fertilized soil, followed by blue MPs. The color of MPs may indicate their origin and the presence of contaminants, their colors can transform because of degradation and residence time in the terrestrial (Campanale et al., 2023). For example, white MPs are abundant in agriculture and orchards, which frequently require organic fertilizers (Chai et al., 2020). Furthermore, the color of MPs is closely related

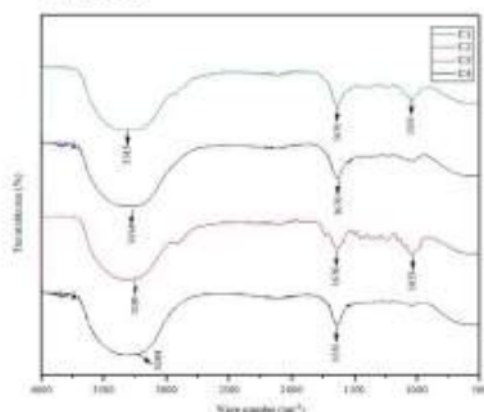


EXHIBIT 4 Fourier transform infrared spectroscopy (FTIR) spectra for microplastics (MPs) detected in C1, C2, C3, and C4 (identified as polyethylene terephthalate for all). [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

to the contaminants on their surface. For example, black MPs are frequently associated with higher quantities of organic contaminants (Crawford & Quinn, 2017) than other MPs colors. Clear MPs had significant effects on the environment. It posed a threat to the ecological balance, water environment, food sustainability, and safety, ultimately impacting human health (Olokoik et al., 2023).

Materials such as anthraquinone, which could be produced quickly had color intensity, and were transparent, were used to create yellow. Anthraquinones were frequently used in polymers including polypropylene (PP), polystyrene (PS), low-density polyethylene (LDPE), high-density polyethylene (HDPE), polymethyl methacrylate/acrylic, polycarbonate, polybutylene terephthalate, and polyethylene terephthalate (PET). In addition to yellow MPs, red MPs were found. Anthraquinone, which had medium to high color intensity and transparency, was the most common red pigment. This pigment was typically incorporated into PS, PP, LDPE, and HDPE polymers. Triphenylmethane, azo, anthraquinone, perylene, and indigoid were interesting and widely used categories of dyes, which were also the main focus of the study by (Fleischmann et al., 2015) because these compounds had a broad range of applications.

3.5 | Polymer type

The chemical components and arrangement of macromolecules determine the physical characteristics of polymeric materials. Numerous spectroscopic techniques are currently available to examine these properties, and FTIR-spectroscopy is one of the most popular techniques due to its versatility in determining composition; consequently, the polymer type can be determined by comparing the FTIR spectra of the polymer to the library data. Exhibit 4 shows the FTIR spectra of all compost-analyzed MPs.

It is interesting to note that the FTIR spectra for MPs from compost at local agriculture stores (see Exhibits 4 and 5) have similar characteristics. For samples C1, C2, C3, and C4 (see Exhibit 4), a peak in wavenumber 3316 cm^{-1} , 1636 cm^{-1} , and 1033 cm^{-1} ; 3336 cm^{-1} , 1636 cm^{-1} , and 1031 cm^{-1} ; 3288 cm^{-1} , 1636 cm^{-1} , and 1033 cm^{-1} ; and 3284 cm^{-1} , 2119 cm^{-1} , and 1031 cm^{-1} are related OH group (hydroxyl), stretching of C=O of carboxylic acid group, terephthalate group ($\text{OOC}_6\text{H}_4\text{-COO}$), methylene group, and vibrations of the ester C-O bond, respectively, and they are the typical characteristics of PET (Kankanige & Babel, 2020; Mei et al., 2022; Pereira et al., 2017; Putri et al., 2023).

Exhibit 4 demonstrates the polymer composition of MPs in the compost from a local agricultural store. This study found that there is one type of polymer, namely PET. PET is the most often used polymeric polyester. PET polymers are extensively used in the manufacture of textiles, clothes, and wool (Islam et al., 2020). It was hypothesized that the PET in the compost came from village household garbage (Gui et al., 2021). PET is a clear polymer with excellent mechanical qualities and dimensional stability under varied loads (Wang et al., 2018). Moreover, PET offers excellent gas barrier qualities and chemical resistance. PET is a material with good physical qualities and recycling capability (Asensio et al., 2020). It accounts for about 18% of all polymers manufactured globally. More than 60% of its output is for synthetic fibers and bottles, which accounts for around 30% of the worldwide demand for PET (Padhan et al., 2013).

3.6 | Possible impacts of MPs on compost for human health

Generally, MPs entered the human body concluded three main routes, namely—ingestion (via food and water), inhalation (indoor and outdoor air), skin contact (via personal care products, dust, and textiles), and dermal contact (Blackburn & Green, 2022; Prata et al., 2020). Human contact with MPs could cause physical and chemical toxic effects. The type of particle and individual susceptibility might have influenced the adverse effects. Their physical effects might have had varying impacts, including increased inflammatory response, oxidative stress, cellular damage, and size-related toxicity (Prata & Dias-Pereira, 2023). Therefore, this section was organized based on the health effects caused by MPs in compost.

The acceptance of MPs in plants has been detected and plastic particles are especially absorbed on root hairs (Azeem et al., 2021). Furthermore, MPs can observe on terrestrial plant surfaces, be absorbed, and transported by plants, and accumulate in the edible parts of plants, leading to the possibility of enhancement and transmission through the food chain and threatening human health (Li et al., 2020; Wang et al., 2022). However, the fundamental mechanism remains unclear. To calculate the impact of MP on humans, measurements were made of particles that might have entered the body through agricultural food according to the scenario described by Nor et al. (2021). This model probabilistically simulated MPs concentrations in the gut, body tissue, and feces, allowing validation against empirical data. From the findings of Aydın et al. (2023) in detecting MP in most consumed fruits

EXHIBIT 5 Comparison of the Fourier transform infrared spectroscopy (FTIR) data in compost and other studies.

Sampling	Wave number (cm ⁻¹)	Polymer	Reference		
Compost, Indonesia	3.315	1.636	1.033	Polyethylene terephthalate (PET)	Present study
	3.288	1.636	1.033		
PET Composites, Brazil	3.325	1.713	1.089	PET	(Pereira et al., 2017)
Salt, Indonesia	3.352	2.915	1.692	PET	(Putri et al., 2023)
	3.336	2.915	1.643		
Bottled water, Thailand	2.982	2.906	1.285	PET	(Korkanigje & Bobel, 2020)
Tea filter bags, China	2.885	2.852	1.295	PET	(Mei et al., 2022)

and vegetables from Turkey, total 210 particles (2.9 ± 1.6 particle g^{-1}) MPs found in eight fruits and vegetables samples. If the main route of exposure to humans was through food consumption, then the estimated intake was 39,000–52,000 plastic particles/person/year (Mercogliano et al., 2020). Meanwhile, the average intake level of MPs (1–5000 μm) was 553–883 particles/capita/day (Nor et al., 2021). While definitive evidence linking MPs consumption to human health was lacking, studies suggested that MPs could have provoked immune and stress responses, induced reproductive and developmental toxicity, and increased the risk of chronic inflammation and neoplasia (Yang, Man et al., 2022). Further research was needed to fully understand the potential implications of MPs in compost on human health.

4 | CONCLUSION

The objective of this was to estimate the number and characteristics of MPs in compost. The results indicated that the total number of MPs was 160 particles/200 g in compost. This study found that MPs were identified in compost with the colors of red (43.75%), yellow (38.13%), black (8.75%), white (8.75%), and blue (10.62%). The size MPs ranged from 0.06 to 1 mm and the shape of MPs was dominated by fragments (81.87%), fiber (15.36%), and filament (1.88%). FTIR analysis clarified that the types of polymers were PET. In general, this study has successfully identified the presence of MPs, and findings of this study are significant particularly to improve community awareness about MPs present in compost. Future research must be performed to develop a simple MPs removal in compost.

ACKNOWLEDGMENTS

The authors are grateful for all the resources provided by the Universitas Islam Madura to support this study. Collaboration from Universitas Muhammadiyah Malang is highly appreciated.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Iswahyudi Iswahyudi <https://orcid.org/0000-0002-3576-7418>

Aidi Sulanto <https://orcid.org/0000-0002-6561-4420>

Marchel Putra Garfata <https://orcid.org/0000-0001-5950-9758>

REFERENCES

- Aini, S. A., Syafluddin, A., & Bent, G. A. (2022). The presence of microplastics in air environment and their potential impacts on health. *Environmental and Toxicology Management*, 2(3), 31–39. <https://doi.org/10.33088/etm.v2i3.2990>
- Aini, S. A., Syafluddin, A., & Kueh, A. B. H. (2023). Quantification, characteristics, and distribution of microplastics released from waste burning furnaces and their associated health impacts. *Environmental Quality Management*, 33(1), 303–310. <https://doi.org/10.1002/eqem.22056>
- Aimi, D. S., Clavau-Mallet, D., Kunisu, R. S., Lapointe, M., Bayon, S., & Tufenkji, N. (2022). Weathering pathways and protocols for environmentally relevant microplastics and nanoplastics: What are we missing? *Journal of Hazardous Materials*, 423, 126955. <https://doi.org/10.1016/j.jhazmat.2021.126955>
- Andrady, A. L., Barnes, P. W., Bowman, J. F., Gouin, T., Madroski, S., White, C. C., Zepp, R. G., & Jansen, M. A. K. (2022). Oxidation and fragmentation of plastics in a changing environment: from UV-radiation to biological degradation. *Science of The Total Environment*, 851, 158022. <https://doi.org/10.1016/j.scitotenv.2022.158022>
- Asensio, M., Estanlier, P., Núñez, K., Silva, J. F., Marques, A., Merino, J. C., & Pastor, J. M. (2020). Processing of pre-impregnated thermoplastic tow-preg reinforced by continuous glass fibre and recycled PET by pultrusion. *Composites Part B: Engineering*, 200, 108365. <https://doi.org/10.1016/j.compositesb.2020.108365>
- Aydes, R. B., Yozukmaz, A., Şener, İ., Temiz, F., & Giannetto, D. (2023). Occurrence of microplastics in most consumed fruits and vegetables from Turkey and public risk assessment for consumers. *Life*, 13(8). <https://doi.org/10.3390/13081686>
- Azizm, I., Adeel, M., Ahmad, M. A., Shakoob, N., Jiangou, G. D., Azizm, K., Ishfaq, M., Shakoob, A., Ayaz, M., Xu, M., & Rui, Y. (2021). Uptake and accumulation of nano/microplastics in plants: A critical review. *Nanomaterials*, 11(11), 2995. <https://doi.org/10.3390/nano11112995>
- Bao, R., Wang, Z., Qi, H., Mehmood, T., Cai, M., Zhang, Y., Yang, R., Peng, L., & Liu, F. (2022). Occurrence and distribution of microplastics in wastewater treatment plant in a tropical region of China. *Journal of Cleaner Production*, 349, 131454. <https://doi.org/10.1016/j.jclepro.2022.131454>

- Bertoldi, C., Lara, L. Z., Mizushima, F. A. D. L., Martins, F. C. G., Battisti, M. A., Hinrichs, R., & Fernandes, A. N. (2023). First evidence of microplastic contamination in the freshwater of Lake Guaíba, Porto Alegre, Brazil. *Science of The Total Environment*, 759, 143503. <https://doi.org/10.1016/j.scitotenv.2020.143503>
- Blackburn, K., & Green, D. (2022). The potential effects of microplastics on human health: What is known and what is unknown. *Ambio*, 51(3), 518–530. <https://doi.org/10.1007/s13280-021-01569-9>
- Blanke, M. (2020). GfK. Tägung zur Bestandaufnahme von Mikro- und Makroplastik im Gartenbau. *Erwerbs-Obstbau*, 62(4), 489–497. <https://doi.org/10.1007/s10341-020-00529-3>
- Braun, M., Maß, M., Heysse, R., & Amelung, W. (2021). Plastic in compost: Prevalence and potential input into agricultural and horticultural soils. *Science of The Total Environment*, 760, 143335. <https://doi.org/10.1016/j.scitotenv.2020.143335>
- Campanale, C., Savino, I., Massarelli, C., & Uricchio, V. F. (2023). Fourier transform infrared spectroscopy to assess the degree of alteration of artificially aged and environmentally weathered microplastics. *Polymers*, 15(4), 911. <https://doi.org/10.3390/polym15040911>
- Chai, B., Wei, Q., She, Y., Lu, G., Dang, Z., & Yin, H. (2020). Soil microplastic pollution in an e-waste dismantling zone of China. *Waste Management*, 118, 291–301. <https://doi.org/10.1016/j.wasman.2020.08.048>
- Chamas, A., Moen, H., Zheng, J., Qiu, Y., Tabassum, T., Jang, J. H., Abu-Omar, M., Scott, S. L., & Suh, S. (2020). Degradation rates of plastics in the environment. *ACS Sustainable Chemistry & Engineering*, 8(9), 3494–3511. <https://doi.org/10.1021/acssuschemeng.9b06635>
- Chia, R. W., Lee, J.-Y., Jang, J., Kim, H., & Kwon, K. D. (2022). Soil health and microplastics: A review of the impacts of microplastic contamination on soil properties. *Journal of Soils and Sediments*, 22(10), 2690–2705. <https://doi.org/10.1007/s11368-022-03254-4>
- Corradini, F., Casado, F., Leiva, V., Huerta-Lwanga, E., & Geissen, V. (2021). Microplastics occurrence and frequency in soils under different land uses on a regional scale. *Science of The Total Environment*, 752, 141917. <https://doi.org/10.1016/j.scitotenv.2020.141917>
- Crawford, C. B., & Quinn, B. (2017). *Microplastic pollutants*: Elsevier. <https://doi.org/10.1016/C2015-0-04215-5>
- Dantas Filho, J. V., Pedroti, V. R., Santos, B. L. T., de Lima Pinheiro, M. M., de Miva, A. B., da Silva, F. C., e Silva, E. C. S., Cavali, J., Guedes, E. A. C., & de Vargas Sobos, S. (2023). First evidence of microplastics in freshwater from fish farms in Rondônia state, Brazil. *Heliyon*, 9(4), 1–11. <https://doi.org/10.1016/j.heliyon.2023.e15066>
- Deng, Y., Wu, J., Chen, J., & Kang, K. (2023). Overview of microplastic pollution and its influence on the health of organisms. *Journal of Environmental Science and Health, Part A*, 58(4), 412–422. <https://doi.org/10.1080/10934529.2023.2190715>
- Dimazi, S. N., Hahladakis, J. N., Yafia, M. N. D., Almod, M. I., Sayadi, S., & Al-Ghouti, M. A. (2022). Degradation-fragmentation of marine plastic waste and their environmental implications: A critical review. *Arabian Journal of Chemistry*, 15(11), 104262. <https://doi.org/10.1016/j.arabj.2022.104262>
- Edo, C., Fernández-Piñas, F., & Rosal, R. (2022). Microplastics identification and quantification in the composted organic fraction of municipal solid waste. *Science of The Total Environment*, 813, 151902. <https://doi.org/10.1016/j.scitotenv.2021.151902>
- Fleischmann, C., Lieverbrück, M., & Ritter, H. (2015). Polymers and dyes: Developments and applications. *Polymers*, 7(4), 717–746. <https://doi.org/10.3390/polym7040717>
- Grbić, J., Helm, P., Achey, S., & Rochman, C. M. (2020). Microplastics entering northwestern Lake Ontario are diverse and linked to urban sources. *Water Research*, 174, 115623. <https://doi.org/10.1016/j.watres.2020.115623>
- Gui, J., Sun, Y., Wang, J., Chen, X., Zhang, S., & Wu, D. (2021). Microplastics in composting of rural domestic waste: Abundance, characteristics, and release from the surface of macroplastics. *Environmental Pollution*, 274, 116553. <https://doi.org/10.1016/j.envpol.2021.116553>
- Hale, B. C., King, A. E., Ramirez, J. M., La Guardia, M., & Nidel, C. (2022). Durable plastic goods: A source of microplastics and chemical additives in the built and natural environments. *Environmental Science & Technology Letters*, 9(10), 798–807. <https://doi.org/10.1021/acs.estlett.2c00417>
- Hernández-Arenas, R., Beltrán-Sánchez, A., Navarro-Quiñan, R., & Sanz-Lázaro, C. (2021). The effect of sewage sludge containing microplastics on growth and fruit development of tomato plants. *Environmental Pollution*, 268, 115779. <https://doi.org/10.1016/j.envpol.2020.115779>
- Islam, M. T., Rahman, M. M., & Mazumder, N.-U.-S. (2020). Polymers for textile production. In M. Shabbir, S. Ahmed & J. N. Sheikh (Eds.), *Frontiers of textile materials* (pp. 13–59). Beverly, MA: Scrivener Publishing. <https://doi.org/10.1002/9781119620396.ch2>
- Kankariga, D., & Babel, S. (2020). Smaller-sized micro-plastics (MPs) contamination in single-use PET bottled water in Thailand. *Science of The Total Environment*, 717, 137232. <https://doi.org/10.1016/j.scitotenv.2020.137232>
- Le, V. R., Nguyen, M. K., Nguyen, H. L., Lin, C., Rakib, M. R. J., Thai, V. A., Le, V. G., Malabala, G., & Idris, A. M. (2023). Organic compost as a vehicle for the entry of microplastics into the environment: A comprehensive review. *Science of The Total Environment*, 892, 164758. <https://doi.org/10.1016/j.scitotenv.2023.164758>
- Li, L., Yang, J., Zhou, Q., Peinenburg, W. J. G. M., & Luo, Y. (2020). Uptake of Microplastics and Their Effects on Plants. In D. He & Y. Luo (Eds.), *Microplastics in terrestrial environments: Emerging contaminants and major challenges* (pp. 279–298). Springer International Publishing. <https://doi.org/10.1007/978-92-020-465>
- Liao, J., & Chen, Q. (2021). Biodegradable plastics in the air and soil environment: Low degradation rate and high microplastics formation. *Journal of Hazardous Materials*, 418, 126329. <https://doi.org/10.1016/j.jhazmat.2021.126329>
- Lu, M., Lu, S., Song, Y., Lei, L., Hu, J., Lv, W., Zhou, W., Cao, C., Shi, H., Yang, X., & He, D. (2018). Microplastic and mesoplastic pollution in farmland soils in suburbs of Shanghai, China. *Environmental Pollution*, 242, 855–862. <https://doi.org/10.1016/j.envpol.2018.07.051>
- Mei, T., Wang, J., Xiao, X., Lv, J., Li, Q., Dai, H., Liu, X., & Pei, F. (2022). Identification and evaluation of microplastics from tea filter bags based on Raman imaging. *Foods*, 11(18). <https://doi.org/10.3390/foods11182871>
- Mercogliano, R., Avio, C. G., Regoli, F., Anastasio, A., Colavita, G., & Santariccola, S. (2020). Occurrence of microplastics in commercial seafood under the perspective of the human food chain: A review. *Journal of Agricultural and Food Chemistry*, 68(19), 5296–5301. <https://doi.org/10.1021/acs.jafc.0c01209>
- Nirmala, K., Rangasamy, G., Ramya, M., Shankar, V. U., & Rajesh, G. (2023). A critical review on recent research progress on microplastic pollutants in drinking water. *Environmental Research*, 222, 115312. <https://doi.org/10.1016/j.envres.2023.115312>
- Nor, N. H. M., Kool, M., Dijkers, N. J., & Koelmans, A. A. (2021). Lifetime accumulation of microplastic in children and adults. *Environmental Science & Technology*, 55(8), 5084–5096. <https://doi.org/10.1021/acs.est.0c07384>
- Oleksuk, K., Krupa-Kotara, K., Grajek, M., Wypych-Susanska, A., Glopowska-Ligas, J., & Slowinski, J. (2023). Health risks of environmental exposure to microplastics. *Journal of Education, Health and Sport*, 13(1), 79–84. <https://doi.org/10.12775/JEHS.2023.13.01.012>
- Padhan, R. K., Gupta, A. A., Badoni, R. P., & Bhatnagar, A. K. (2013). Poly(ethylene terephthalate) waste derived chemicals as an anti-stripping additive for bitumen—An environment friendly approach for disposal of environmentally hazardous material. *Polymer Degradation and Stability*, 98(12), 2592–2601. <https://doi.org/10.1016/j.polydegradstab.2013.09.019>

- Pereira, A. P. D. S., Silva, M. H. P. D., Lima, É. P., Paula, A. D. S., & Tommasini, F. J. (2017). Processing and characterization of PET composites reinforced with geopolymers concrete waste. *Materials Research*, 20, 411–420. <https://doi.org/10.1590/1980-5373-MR-2017-0734>
- Plehl, S., Leibner, A., Löder, M. G. J., Dris, R., Bogner, C., & Laforsch, C. (2018). Identification and quantification of macro- and microplastics on an agricultural farmland. *Scientific Reports*, 8(1), 17950. <https://doi.org/10.1038/s41598-018-36172-y>
- Pirone, C., Ricciardi, M., Motta, O., Mele, Y., Proto, A., & Montano, L. (2021). Microplastics in the environment: Intake through the food web, human exposure and toxicological effects. *Toxics*, 9(9), 224. <https://doi.org/10.3390/toxics9090224>
- Prata, J. C., da Costa, J. P., Lopes, I., Duarte, A. C., & Rocha-Santos, T. (2020). Environmental exposure to microplastics: An overview on possible human health effects. *Science of The Total Environment*, 702, 134455. <https://doi.org/10.1016/j.scitotenv.2019.134455>
- Prata, J. C., & Dias-Pereira, P. (2023). Microplastics in terrestrial domestic animals and human health: Implications for food security and food safety and their role as sentinels. *Animals*, 13(4), 661. <https://doi.org/10.3390/ani13040661>
- Premaratne, K. S. D., Ramanyaka, S., Navaratne, A., Wijesekera, H., Jayasekka, J., & Vithanage, M. (2023). Compost-hosted microplastics – Municipal solid waste compost. In M. Vithanage & M. N. V. Prasad (Eds.), *Microplastics in the ecosystem* (pp. 433–448). Hoboken, NJ: John Wiley & Sons. <https://doi.org/10.1002/9781119879534.ch27>
- Prosen, F., Tešan, P., Senta, U., & Bawcen Kraj, M. (2021). Extraction and identification of a wide range of microplastic polymers in soil and compost. *Polymers*, 13(23), 4069. <https://doi.org/10.3390/polym13234069>
- Putri, E. B. P., Syafuddin, A., Anis, S. A., Iswahyudi, I., & Garfana, M. R. (2023). Identification and quantification of microplastics in sea water and sea salt collected from sea salt ponds. *Desalination and Water Treatment*, 300, 130–135. <https://doi.org/10.5004/dwt.2023.29719>
- Roy, T., Dey, T. K., & Jamal, M. (2022). Microplastic/nanoplastic toxicity in plants: An imminent concern. *Environmental Monitoring and Assessment*, 195(11), 27. <https://doi.org/10.1007/s10661-022-10654-z>
- Rynk, R., Schwarz, M., Richard, T. L., Cotton, M., Halbach, T., & Skibert, S. (2021). Chapter 4 – Compost feedstocks. In R. Rynk (Ed.), *The composting handbook* (pp. 103–157). Academic Press. <https://doi.org/10.1016/B978-0-323-85402-7.00005-4>
- Sathish, T., Sabarinajan, N., Ravichandran, S., Moorthy, G. M., & Dinesh kumar, S. (2021). Novel study on improvement of plastics properties by blending of waste micro plastics into ABS plastics. *Chemosphere*, 303, 134997. <https://doi.org/10.1016/j.chemosphere.2022.134997>
- Schweighammer, L., Krause, S., & Schaum, C. (2020). Determination of large microplastics: Wet-sieving of dewatered digested sludge, co-substrates, and compost. *Water Science and Technology*, 84(2), 384–392. <https://doi.org/10.2166/wst.2020.562>
- Shotokhova, A., Ceponkus, J., Sablinskas, V., & Demato, G. (2022). Abundance and characteristics of microplastics in treated organic wastes of Kaunas and Alytus regional waste management centres, Lithuania. *Environmental Science and Pollution Research*, 29(14), 20665–20674. <https://doi.org/10.1007/s11356-021-17378-6>
- Tang, K. H. D. (2023). Microplastics in agricultural soils in China: Sources, impacts and solutions. *Environmental Pollution*, 322, 121235. <https://doi.org/10.1016/j.envpol.2023.121235>
- van Schothorst, B., Berlot, N., Huerta Lwanga, E., & Geissen, V. (2021). Sources of light density microplastic related to two agricultural practices: The use of compost and plastic mulch. *Environmetrics*, 8(4), 36. Retrieved from <https://www.rjmi.com/2075-3298/8/4/36>
- Vithanage, M., Ramanyaka, S., Hasinthera, S., & Navaratne, A. (2021). Compost as a carrier for microplastics and plastic-bound toxic metals into agroecosystems. *Current Opinion in Environmental Science & Health*, 24, 100297. <https://doi.org/10.1016/j.coesh.2021.100297>
- Wang, F., Feng, X., Liu, Y., Adams, C. A., Sun, Y., & Zhang, S. (2022). Micro/nanoplastics and terrestrial plants: Up-to-date knowledge on uptake, translocation, and phytotoxicity. *Resources, Conservation and Recycling*, 185, 106503. <https://doi.org/10.1016/j.resconrec.2022.106503>
- Wang, W., Yuan, W., Chen, Y., & Wang, J. (2018). Microplastics in surface waters of Dongting Lake and Hong Lake, China. *Science of The Total Environment*, 635, 539–545. <https://doi.org/10.1016/j.scitotenv.2018.03.211>
- Wu, P., Lin, S., Cao, G., Wu, J., Jin, H., Wang, C., Wang, M. H., Yang, Z., & Cai, Z. (2022). Absorption, distribution, metabolism, excretion and toxicity of microplastics in the human body and health implications. *Journal of Hazardous Materials*, 437, 129361. <https://doi.org/10.1016/j.jhazmat.2022.129361>
- Wu, R. T., Cai, Y. F., Chen, Y. X., Yang, Y. W., Xing, S. C., & Liao, X. D. (2021). Occurrence of microplastic in livestock and poultry manure in South China. *Environmental Pollution*, 277, 116790. <https://doi.org/10.1016/j.envpol.2021.116790>
- Xiao, M., Shaibaz, M., Liang, Y., Yang, J., Wang, S., Chadwick, D. R., Jones, D., Chen, J., & Ge, T. (2021). Effect of microplastics on organic matter decomposition in paddy soil amended with crop residues and tillable C: A three-source partitioning study. *Journal of Hazardous Materials*, 416, 126221. <https://doi.org/10.1016/j.jhazmat.2021.126221>
- Xing, R., Chen, Z., Sun, H., Liao, H., Qin, S., Liu, W., Zhang, Y., Chen, Z., & Zhou, S. (2022). Free radicals accelerate in situ ageing of microplastics during sludge composting. *Journal of Hazardous Materials*, 429, 128405. <https://doi.org/10.1016/j.jhazmat.2022.128405>
- Xu, J. L., Thomas, K. V., Luo, Z., & Gowen, A. A. (2019). FTIR and Raman imaging for microplastics analysis: State of the art, challenges and prospects. *Trends in Analytical Chemistry*, 119, 115629. <https://doi.org/10.1016/j.trac.2019.115629>
- Yang, L., Kang, S., Wang, Z., Luo, X., Guo, J., Gao, T., Chen, P., Yang, C., & Zhang, Y. (2022). Microplastic characteristic in the soil across the Tibetan Plateau. *Science of The Total Environment*, 828, 154518. <https://doi.org/10.1016/j.scitotenv.2022.154518>
- Yang, X., Man, Y. B., Wong, M. H., Owen, R. B., & Chow, K. L. (2022). Environmental health impacts of microplastics exposure on structural organization levels in the human body. *Science of The Total Environment*, 825, 154025. <https://doi.org/10.1016/j.scitotenv.2022.154025>
- Yu, L., Zhang, J., Liu, Y., Chen, L., Tao, S., & Liu, W. (2021). Distribution characteristics of microplastics in agricultural soils from the largest vegetable production base in China. *Science of The Total Environment*, 756, 143860. <https://doi.org/10.1016/j.scitotenv.2020.143860>
- Yu, Z. F., Song, S., Xu, X. L., Ma, Q., & Lu, Y. (2021). Sources, migration, accumulation and influence of microplastics in terrestrial plant communities. *Environmental and Experimental Botany*, 192, 104635. <https://doi.org/10.1016/j.envexpbot.2021.104635>
- Zafiu, C., Binner, E., Belgil, P., Vay, B., Ebner, J., & Huber-Humer, M. (2023). The dynamics of macro- and microplastic quantity and size changes during the composting process. *Waste Management*, 162, 18–26. <https://doi.org/10.1016/j.wasman.2023.03.002>
- Zhang, J., Guo, N., Ding, W., Han, B., Zhao, M., Wang, X., Wang, J., Cao, B., Zou, G., & Chen, Y. (2023). Microplastic pollution and the related ecological risks of organic composts from different raw materials. *Journal of Hazardous Materials*, 458, 131911. <https://doi.org/10.1016/j.jhazmat.2023.131911>
- Zhang, J., Wang, X., Xue, W., Xu, L., Ding, W., Zhao, M., Liu, S., Zou, G., & Chen, Y. (2022). Microplastics pollution in soil increases dramatically with long-term application of organic composts in a wheat-maize rotation. *Journal of Cleaner Production*, 356, 131889. <https://doi.org/10.1016/j.jclepro.2022.131889>
- Zhang, S., Li, Y., Chen, X., Jiang, X., Li, J., Yang, L., Yin, X., & Zhang, X. (2022). Occurrence and distribution of microplastics in organic fertilizers in

China. *Science of The Total Environment*, 844, 157061. <https://doi.org/10.1016/j.scotenv.2022.157061>

Zhou, Y., Ren, X., Tsai, T-H., Barcelo, D., Wang, Q., Zhang, Z., & Yongzhen, D. (2023). Microplastics as an underestimated emerging contaminant in solid organic waste and their biological products: Occurrence, fate and ecological risks. *Journal of Hazardous Materials*, 445, 130596. <https://doi.org/10.1016/j.jhazmat.2022.130596>

How to cite this article: Iswahyudi, I., Widodo, W., Warkoyo, W., Sutanto, A., Garfansa, M. P., & Septia, E. D. (2024).

Determination and quantification of microplastics in compost. *Environmental Quality Management*, 1–10.

<https://doi.org/10.1002/tqem.22184>

Determination and quantification of microplastics in compost

ORIGINALITY REPORT

9%

SIMILARITY INDEX

5%

INTERNET SOURCES

10%

PUBLICATIONS

1%

STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

2% 7

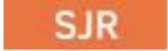
★ **Adi Sutanto, Wahyu Widodo, Imbang Dwi Rahayu, Sustiyana Sustiyana, Fitrotin Nazizah, Iswahyudi Iswahyudi, Ary Bakhtiar.** "The impact of microplastics on yield and economic losses in selected agricultural food commodities", **Environmental Quality Management, 2024**

Publication

Exclude quotes On

Exclude matches < 15 words

Exclude bibliography On



Research Paper Editing

Nature Research Editing

0

Environmental Quality Management ¹⁰

COUNTRY

United States



Universities and research institutions in United States



Media Ranking in United States

SUBJECT AREA AND CATEGORY

Environmental Science
Management, Monitoring, Policy and Law
Pollution
Waste Management and Disposal

Medicine
Public Health, Environmental and Occupational Health

PUBLISHER

John Wiley & Sons Inc.

H-INDEX

31

PUBLICATION TYPE

Journals

ISSN

15206483, 10881913

COVERAGE

1991-2022

INFORMATION

[Homepage](#)
[How to publish in this journal](#)
jega.jegatheesan@rmit.edu.au

SCOPE

Environmental Quality Management's focus is on theories, applications, and social systems of resource recovery and concentrate management for a sustainable future. The Journal welcomes manuscripts on the utilization of natural resources such as water, minerals, fossil fuels and others, the management and reuse of wastes associated with these resources, and what is necessary to bring practices of recovery into reality in an economical manner. The Journal seeks

FBS Manfaatkan ketentuan trading menguntungkan

Join the conversation about this journal

Quartiles

Research Paper Editing

Op

FIND SIMILAR JOURNALS

<p>1</p> <p>International Journal of Environmental Technology</p> <p>GBR</p> <p>56% similarity</p>	<p>2</p> <p>Clean Technologies and Environmental Policy</p> <p>DEU</p> <p>54% similarity</p>	<p>3</p> <p>International Journal of Sustainable Engineering</p> <p>GBR</p> <p>54% similarity</p>	<p>4</p> <p>Nature Envir Pollution Tex</p> <p>IND</p> <p>5 si</p>
--	--	---	---

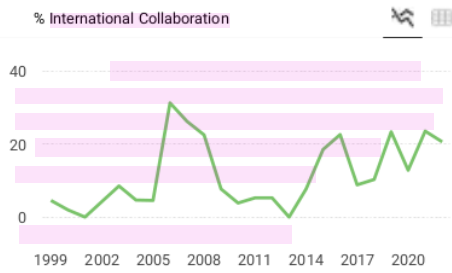
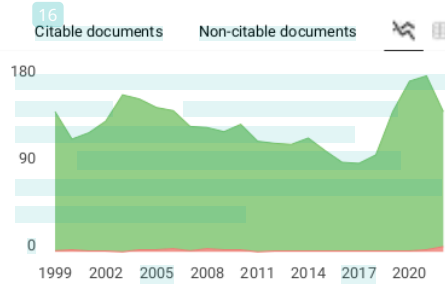
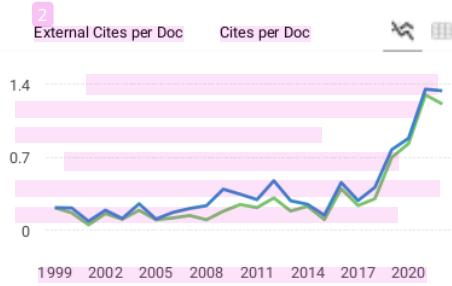
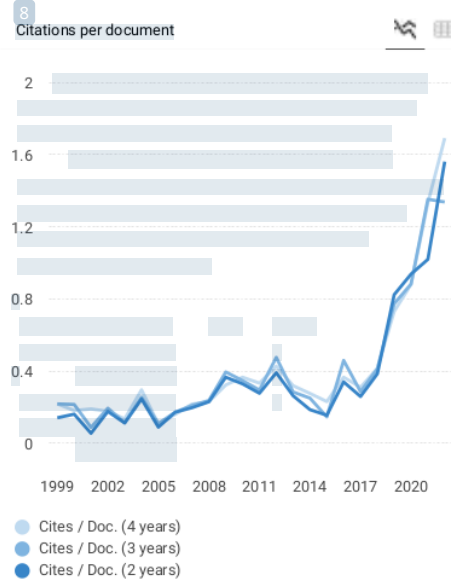
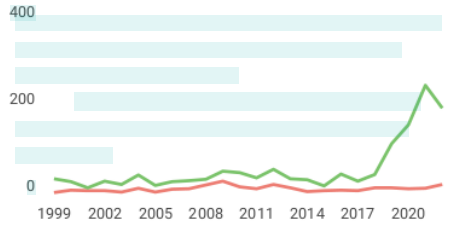
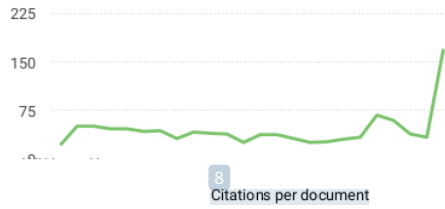
Research Paper Editing

Nature Research Editing

Op

01/04/24, 08.51

Environmental Quality Management



Environmental Quality Management
Q3 Management, Monitoring, Policy and Law
SJR 2022 0.29
 powered by scimagojr.com

← Show this widget in your own website

Just copy the code below and paste within your html code:

```
<a href="https://www.scimag
```



Explore, visually communicate and make sense of data with our **new data visualization tool.**



Source details

Environmental Quality Management

Scopus coverage years: from 1991 to Present

Publisher: Wiley-Blackwell

ISSN: 1088-1913 E-ISSN: 1520-6483

Subject area: Environmental Science: Management, Monitoring, Policy and Law

Medicine: Public Health, Environmental and Occupational Health Environmental Science: Pollution

Environmental Science: Waste Management and Disposal

Source type: **Journal**

[View all documents >](#) [Set document alert](#) [Save to source list](#)

CiteScore 2022

1.8



SJR 2022

0.291



SNIP 2022

0.284



[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

i [Improved CiteScore methodology](#) ×

CiteScore 2022 counts the citations received in 2019-2022 to articles, reviews, conference papers, book chapters and data papers published in 2019-2022, and divides this by the number of publications published in 2019-2022. [Learn more >](#)

CiteScore 2022 ⌵

$$1.8 = \frac{466 \text{ Citations 2019 - 2022}}{256 \text{ Documents 2019 - 2022}}$$

Calculated on 05 May, 2023

CiteScoreTracker 2023 ⓘ

$$2.1 = \frac{742 \text{ Citations to date}}{351 \text{ Documents to date}}$$

Last updated on 05 March, 2024 • Updated monthly

CiteScore rank 2022 ⓘ

Category	Rank	Percentile
Environmental Science		
Management, Monitoring, Policy and Law	#247/384	35th
Medicine		
Public Health, Environmental and Occupational Health	#388/577	32nd

[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site ↗](#)

Master Journal List

Search Journals

Match Manuscript

Downloads

Help Center

Settings



The power of the Web of Science™ on your mobile device, wherever inspiration strikes.

Dismiss

Learn More

General Information

Web of Science Coverage

Peer Review Information



Return to Search Results

ENVIRONMENTAL QUALITY MANAGEMENT

Share This Journal

ISSN / eISSN 1088-1913 / 1520-6483

Publisher WILEY, 111 RIVER ST, HOBOKEN, USA, NJ, 07030-5774

General Information

Journal Website

Visit Site

Publisher Website

Visit Site

Frequency

Quarterly

Issues Per Year

4

Country / Region

UNITED STATES OF AMERICA

Web of Science Coverage

Collection	Index	Category	Similar Journals ¹
Core Collection	Emerging Sources Citation Index (ESCI)	Engineering, Environmental Green & Sustainable Science & Technology Environmental Sciences	Find Similar Journals

Search a topic within this journal

Search ⁵



Peer Review Information

Web of Science Reviewer Recognition ⓘ	No
Claimed Reviews on Web of Science ⓘ	395
Public Reports on Web of Science ⓘ	No
Signed Reports on Web of Science ⓘ	No
Transparent Peer Review on ScholarOne ⓘ	No

Create a free [Web of Science profile](#) to track your publications, citation metrics, peer reviews and editing work for this journal

Editorial Disclaimer: As an independent organization, Clarivate does not become involved in and is not responsible for the editorial management of any journal or the business practices of any publisher. Publishers are accountable for their journal performance and compliance with ethical publishing standards. The views and opinions expressed in any journal are those of the author(s) and do not necessarily reflect the views or opinions of Clarivate. Clarivate remains neutral in relation to territorial disputes, and allows journals, publishers, institutes and authors to specify their address and affiliation details including territory.

Criteria for selection of newly submitted titles and re-evaluation of existing titles in the Web of Science are determined by the Web of Science Editors in their sole discretion. If a publisher's editorial policy or business practices negatively impact the quality of a journal, or its role in the surrounding literature of the subject, the Web of Science Editors may decline to include the journal in any Clarivate product or service. The Web of Science Editors, in their sole discretion, may remove titles from coverage at any point if the titles fail to maintain our standard of quality, do not comply with ethical standards, or otherwise do not meet the criteria determined by the Web of Science Editors. If a journal is deselected or removed from coverage, the journal will cease to be indexed in the Web of Science from a date determined by the Web of Science Editors in their sole discretion – articles published after that date will not be indexed. The Web of Science Editors' decision on all matters relating to journal coverage will be final.

Clarivate.™ Accelerating innovation.

© 2024 Clarivate

[Legal center](#)

[Privacy notice](#)

[Cookie policy](#)

[Manage cookie preferences](#)

[Copyright notice](#)

[Help](#)



Environmental Quality Management

[JOURNAL HOME](#)[AUTHOR GUIDELINES](#)[EDITORIAL CONTACT](#)

Submission Overview

Initial Submission


[> Show versions](#)[✉ Review decision letter](#)

This manuscript has been submitted to the editorial office for review. Changes cannot be made during editorial review, but you can view the information and files you submitted, below.

Article Type	Research Article		
Title	Determination and quantification of a wide range of microplastics polymers in compost		
Manuscript Files	Name	Type of File	Size
	Manuscript_Compost23_wiley.docx	Main Document - MS Word	5.3 MB
	Cover letter_kompos_Wiley.docx	Cover letter / Comments	14.3 KB
Abstract	The presence of microplastics (MPs) in compost has the potential to contaminate the plants it produces. Therefore, the identification and quantification of MP in commercially available compost is important. This study aims to estimate MP abundance in commercially sold compost. The identified MP properties in terms of shape, color, size, and type of polymer		

were characterized. This study found that in commercial compost samples, there was MP with a content of 160 particles. The colors for identified MPs are blue, black, red, yellow, and white depending on the sampling point and sample. In addition, MP size ranged from 0.1 to 1 mm and the MPs shape was dominated by 81.8% fragment, 16.2 % fiber and 2 % filament in commercial compost. The findings of this study are very important and significant for ensuring the presence of MP in commercially sold compost before being used for agricultural land.

Authors

Name	Email	Country/Location
Iswahyudi Iswahyudi ^{1, 2} Corresponding Author  0000-0002-3576-7418	iswahyudi@uim.ac.id	Indonesia
Wahyu Widodo ¹	wahyu@umm.ac.id	Indonesia
Warkoyo Warkoyo ¹	warkoyo@umm.ac.id	Indonesia
Adi Sutanto ¹	sutanto@umm.ac.id	Indonesia
Marchel Putra Garfansa ²	marchel@uim.ac.id	Indonesia
Erfan Dani Septia ³	erfandani@umm.ac.id	Indonesia

Affiliations

We will use the best match from our database to determine if your manuscript is eligible for special benefits. Matched organizations are for internal purposes and will not be published.

1. Department of Agriculture Science, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization

Universitas Muhammadiyah Malang Fakultas Pertanian dan Peternakan
MALANG, Indonesia

2. Department of Agrotechnology, Faculty of Agriculture, Universitas Islam Madura, 699317 Pamekasan, East Java, Indonesia

Matched organization
Universitas Islam Madura
PAMEKASAN, Indonesia

3. Department of Agrotechnology, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization
Universitas Muhammadiyah Malang Program Studi Agroteknologi
MALANG, Indonesia

Additional Information

Funders

universitas islam madura

Keywords

Agriculture; Agricultural residues

Manuscript Section

Research Translation and Impact

Is this submission for a special issue?

Yes, this is for a special issue

ICONASET-2023: Complexity and impact of emerging contaminants on environment and human health [SI-2023-000744]

Has this manuscript been submitted previously to this journal?

No, it wasn't submitted previously

Suggested Reviewers

Alinea Dwi Elisanti
alinea@polije.ac.id
Politeknik Negeri Jember
Globila Nurika
nurikaglobila@unej.ac.id
Universitas Jember
Farrah Aini Dahalan
farrahaini@unimap.edu.my

Universiti Malaysia Perlis

Opposed Reviewers

No response provided

Cover letter / Comments

Yes, I'd like to add a cover letter or comments

(see [Manuscript Files](#))

History

Submitted On 4 September 2023 by Iswahyudi
Iswahyudi

[Show this version history](#)

Submission Started 4 September 2023 by Iswahyudi
Iswahyudi

[Privacy policy](#) | [Terms & Conditions](#) | [Contact us](#) | [Help](#) | [Cookie Preferences](#)

©Atypon Systems, LLC [Atypon ReX](#)

Environmental Quality Management

[JOURNAL HOME](#)[AUTHOR GUIDELINES](#)[EDITORIAL CONTACT](#)

Submission Overview

Revision 1

[> Show versions](#)[✉ Review decision letter](#)

This manuscript has been submitted to the editorial office for review. Changes cannot be made during editorial review, but you can view the information and files you submitted, below.

Article Type

Research Article

Title

Determination and quantification of microplastics in compost

Manuscript Files


Name	Type of File	Size	Last Modified
Manuscript Compost revisi 2151123.doc x	Main Document - MS Word	5.2 MB	Revision 1
Manuscript Compost revisi 151123.docx	Main Document - Tracked Changes	5.2 MB	Revision 1
Menjawab Reviewer MP Kompos	Author Response	20.8 KB	Revision 1

Name	Type of File	Size	Last Modified
Wiley 151123.docx			

Abstract

Although microplastics (MPs) in solid organic waste have been intensively studied, the presence of MPs in organic fertilizer and their potential as new emerging pollution to environment because of their use in agriculture has not been explained completely. Therefore, the identification and quantification of MPs in commercially available compost is important. This study aimed to estimate the quantity of MPs in commercial composts. The characteristics of MPs (shape, color, size, and type of polymers) were identified. This study found that MPs in commercial compost samples were found, reaching up to 160 particles / 200 g of compost with various colors (blue, black, red, yellow, and white). The identified MPs had various sizes (0.1 - 1 mm) and shapes (81.8% fragment, 16.2% fiber, and 2% filament). The findings of this study are very important and significant to inform community and policy makers regarding the presence of MPs in commercial compost, hence, their intensive use in agriculture must be controlled and be careful.

Authors

Name	Email	Country/Location
Iswahyudi Iswahyudi ^{1, 2} Corresponding Author  0000-0002-3576-7418	iswahyudi@uim.ac.id	Indonesia
Wahyu Widodo ¹	wahyu@umm.ac.id	Indonesia
Warkoyo Warkoyo ¹	warkoyo@umm.ac.id	Indonesia
Adi Sutanto ¹	sutanto@umm.ac.id	Indonesia
Marchel Putra Garfansa ²	marchel@uim.ac.id	Indonesia
Erfan Dani Septia ³	erfandani@umm.ac.id	Indonesia

Affiliations

We will use the best match from our database to determine if your manuscript is eligible for special benefits. Matched organizations are for internal purposes and will not be published.

1. Department of Agriculture Science, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization

Universitas Muhammadiyah Malang Fakultas Pertanian dan Peternakan
MALANG, Indonesia

2. Department of Agrotechnology, Faculty of Agriculture, Universitas Islam Madura, 699317 Pamekasan, East Java, Indonesia

Matched organization

Universitas Islam Madura
PAMEKASAN, Indonesia

3. Department of Agrotechnology, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization

Universitas Muhammadiyah Malang Program Studi Agroteknologi
MALANG, Indonesia

Additional Information

Is your data available?

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funders

universitas islam madura

Keywords

Agriculture; Agricultural residues

Manuscript Section

Research Translation and Impact

Is this submission for a special issue?

Yes, this is for a special issue

ICONASET-2023: Complexity and impact of emerging contaminants on environment and human health [SI-2023-000744]

Cover letter / Comments

No, I don't have additional comments

History

Revised On 16 November 2023 by Iswahyudi Iswahyudi

[> Show this version history](#)

In Revision 10 October 2023 by Iswahyudi Iswahyudi

[Privacy policy](#) | [Terms & Conditions](#) | [Contact us](#) | [Help](#) | [Cookie Preferences](#)

©Atypon Systems, LLC [Atypon ReX](#)

Environmental Quality Management

[JOURNAL HOME](#)[AUTHOR GUIDELINES](#)[EDITORIAL CONTACT](#)

Submission Overview

Revision 2 - Accepted

▾ [Hide versions](#)*Revision 2 - Accepted (this version)*[Revision 1](#)

Revised on 16 November 2023

[Initial Submission](#)

Submitted on 4 September 2023

[Learn about what happens](#) once your article has been accepted.✉ [Review decision letter](#)

Article Type

Research Article

Title

Determination and quantification of microplastics in compost

Manuscript Files

Name

Type of File

Size

Last Modified

[Manuscript
Compost
revisi
b051223.doc
x](#)Main
Document - MS
Word

1.6 MB


Revision 2

Name	Type of File	Size	Last Modified
Manuscript Compost revisi 051223.docx	Main Document - Tracked Changes	1.6 MB	Revision 2
Menjawab Reviewer 45 MP Kompos Wiley 051223.docx	Author Response	19 KB	Revision 2

Abstract

Although microplastics (MPs) in solid organic waste have been intensively studied, the presence of MPs in organic fertilizer and their potential as new emerging pollution to environment because of their use in agriculture has not been explained completely. Therefore, the identification and quantification of MPs in commercially available compost is important. This study aimed to estimate the quantity of MPs in commercial composts. The characteristics of MPs (shape, color, size, and type of polymers) were identified. This study found that MPs in commercial compost samples were found, reaching up to 160 particles / 200 g of compost with various colors (blue, black, red, yellow, and white). The identified MPs had various sizes (0.1 - 1 mm) and shapes (81.8% fragment, 16.2% fiber, and 2% filament). The findings of this study are very important and significant to inform community and policy makers regarding the presence of MPs in commercial compost, hence, their intensive use in agriculture must be controlled and be careful.

Authors

Name	Email	Country/Location
Iswahyudi Iswahyudi ^{1, 2} Corresponding Author  0000-0002-3576-7418	iswahyudi@uim.ac.id	Indonesia
Wahyu Widodo ¹	wahyu@umm.ac.id	Indonesia
Warkoyo Warkoyo ¹	warkoyo@umm.ac.id	Indonesia

Name	Email	Country/Location
Adi Sutanto ¹	sutanto@umm.ac.id	Indonesia
Marchel Putra Garfansa ²	marchel@uim.ac.id	Indonesia
Erfan Dani Septia ³	erfandani@umm.ac.id	Indonesia

Affiliations

We will use the best match from our database to determine if your manuscript is eligible for special benefits. Matched organizations are for internal purposes and will not be published.

1. Department of Agriculture Science, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization

Universitas Muhammadiyah Malang Fakultas Pertanian dan Peternakan
MALANG, Indonesia

2. Department of Agrotechnology, Faculty of Agriculture, Universitas Islam Madura, 699317 Pamekasan, East Java, Indonesia

Matched organization

Universitas Islam Madura
PAMEKASAN, Indonesia

3. Department of Agrotechnology, University of Muhammadiyah Malang, 65144 Malang, East Java, Indonesia

Matched organization

Universitas Muhammadiyah Malang Program Studi Agroteknologi
MALANG, Indonesia

Additional Information

Is your data available?

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funders

universitas islam madura

Keywords

Agriculture; Agricultural residues

Manuscript Section

Research Translation and Impact

Is this submission for a special issue?

Yes, this is for a special issue

ICONASET-2023: Complexity and impact of emerging contaminants on environment and human health [SI-2023-000744]

Cover letter / Comments

No, I don't have additional comments

History

Accepted On 8 January 2024 by Editorial Office

[Privacy policy](#) | [Terms & Conditions](#) | [Contact us](#) | [Help](#) | [Cookie Preferences](#)

©Atypon Systems, LLC [Atypon ReX](#)

- ORCID - Do not reply [ORCID] Adi Sutanto you have new notifications - 1 - **Determination and quantification** of microplastics in compost [2024-03-19] * Production scheduling method for multi
- ORCID - Do not reply [ORCID] Adi Sutanto you have new notifications - 2) **Determination and quantification** of microplastics in compost <https://doi.org/10.1002/eqem.22184> (doi: 10.1002
- ORCID - Do not reply [ORCID] Adi Sutanto you have new notifications - 1 - **Determination and quantification** of microplastics in compost [2024-03-19] * Developing organic feed stuff as the main
- Plant Science Conf. **Determination and quantification** of microplastics in compost - * **Determination and quantification** of microplastics in compost - * published in the scientific journal, which
- cs-author Published: Your article is now published online! - Your article **Determination and quantification** of microplastics in compost in Environmental Quality Management has the
- ORCID - Do not reply [ORCID] Adi Sutanto you have new notifications - 1) **Determination and quantification** of microplastics in compost <https://doi.org/10.1002/eqem.22184> (doi: 10.1002
- cs-author Your article has been accepted! Here's what comes next - Title: **Determination and quantification** of microplastics in compost. Journal Title: Environmental Quality Management
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R2 [email ref: DL-RW-1-a] - entitled **Determination and quantification** of microplastics in compost - in its current form for public...
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R2 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: DL-RW-3-a] - entitled **Determination and quantification** of microplastics in compost - which you submitted to Enw...
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Environmental Qual. **Determination and quantification** of microplastics in compost. Manuscript ID EQM-2023-09-0356.R1 [email ref: SE-8-a] - entitled **Determination and quantification** of microplastics in compost - has been received by the editorial office
- Submission Received by Environmental Quality Management - entitled **Determination and quantification** of a wide range of microplastics polymers in compost - has been received

Materi Jamu

ADI 2019 DEVE... ADI 2020 PENG... APRILIA 2019 E... 9+

Diikuti - Ok

Publisasi Artikel 2 - Assalamu alaikum.wr.wb mohon maaf saya kirim bertahap matur nuwun

Adi Sutanto - Im... Adi Sutanto - Wa... Adi Sutanto - Im... -2

Matthya PT - Slip

Mary Evans - Kl...

7/7/20

8/6/19

2/2/19

Determination and quantification of microplastics in compost

ORIGINALITY REPORT

19%

SIMILARITY INDEX

14%

INTERNET SOURCES

10%

PUBLICATIONS

11%

STUDENT PAPERS

PRIMARY SOURCES

1	"Issue Information", Environmental Quality Management, 2023 Publication	2%
2	rrs.mmu.edu.my Internet Source	2%
3	www.umassmed.edu Internet Source	2%
4	eprints.uad.ac.id Internet Source	1%
5	Submitted to Konsorsium Turnitin Relawan Jurnal Indonesia Student Paper	1%
6	Submitted to Pennsylvania State System of Higher Education Student Paper	1%
7	Adi Sutanto, Wahyu Widodo, Imbang Dwi Rahayu, Sustiyana Sustiyana, Fitrotin Nazizah, Iswahyudi Iswahyudi, Ary Bakhtiar. "The impact of microplastics on yield and economic losses in selected agricultural food	1%

commodities", Environmental Quality Management, 2024

Publication

8	Submitted to urjc Student Paper	1 %
9	Submitted to Suffolk University Student Paper	1 %
10	repositori.iain-bone.ac.id Internet Source	1 %
11	lintar.untar.ac.id Internet Source	1 %
12	"Microplastics in the Ecosphere", Wiley, 2023 Publication	1 %
13	Indumathi Shanmugam Mahadevan, Madurai Kathiravan Harsha Vardhan, Rajkumar Sheeja Rejith Kumar, Mourougavel Rohinth et al. "Biotechnological interventions for monitoring and mitigating microplastic pollution and development of alternatives to single-use plastics", Environmental Quality Management, 2024 Publication	1 %
14	Taísa Andrade Barbosa, Roberta Menezes Santos, Wenes Ramos da Silva, Mirele Santana de Sá et al. "Biochar from sewage sludge: Effect of pyrolysis on functional	1 %

properties and pollutants fate",
Environmental Quality Management, 2024

Publication

15 microbiologyjournal.org 1 %
Internet Source

16 Submitted to SDM Universitas Gadjah Mada 1 %
Student Paper

17 Jiaxi Gui, Yue Sun, Jingli Wang, Xu Chen,
Shuchi Zhang, Donglei Wu. "Microplastics in
composting of rural domestic waste:
abundance, characteristics, and release from
the surface of macroplastics", Environmental
Pollution, 2021 1 %
Publication

18 Pragyandeepti Behera, Pabitra Mohan
Mahapatra, Gayatri Sabat, Achyut K. Panda. 1 %
"Effect of beeswax and petroleum wax on the
thermal degradation behavior, kinetics, and
thermodynamics of low-grade coal",
Environmental Quality Management, 2024
Publication

19 irep.iium.edu.my 1 %
Internet Source

20 "Issue Information", Journal of Biochemical
and Molecular Toxicology, 2014. 1 %
Publication

Exclude quotes On

Exclude matches < 1%

Exclude bibliography On