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Trends in the Research of Microplastics Related to Indonesia: A Bibliometric Approach

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Abstract
Microplastic pollution has attracted attention among Indonesian researchers and has become the topic of extensive study. However, these studies and the progress therein have not been properly mapped out. This present study provided a science mapping and an overview of research trends related to microplastics in Indonesia from 489 published works mined from the Scopus database during 2015-2025 by using the bibliometric approach. Microplastic studies began to receive attention among Indonesian researchers in 2016, and the year 2019 marked a higher interest in this topic with the increased of publication numbers. These research mainly focused on (1) microplastics contamination (abundance, distribution, type of microplastics, etc.) in various aquatic and terrestrial ecosystems, (2) the impact of microplastics on plant, animal, and human health, and (3) mitigation and degradation of microplastics. Various terrestrial and aquatic ecosystems in Indonesia, ranging from the surface water and water bodies to the sediment, of coastal, bay, mangrove, river, estuary, lake, reservoir, and soils, are reported to be polluted with microplastics in various forms and types. The contamination has also been reported within animals living in water, and those are consumed by human beings. These findings were a warning of how polluted our environment has become with microplastics and highlight the importance of all stakeholders, particularly policymakers, getting involved in solving this problem. This study also suggests that future research should prioritize mitigation strategies and degradation of microplastics, especially practical and scalable solutions applicable in Indonesia, since this topic is still limited.

Keywords:
Environment, mitigation, pollution, science mapping, VosViewer

1. Introduction

Microplastics, a term defined as plastics in size less than 5 mm, can be formed as a result of abiotic and biotic degradation of plastic polymers. It has been reported to pollute various aquatic and terrestrial ecosystems, and is found in various plants, animals, and human tissues [1]. Their hydrophobic nature, surface morphology, particle size, and ability to absorb and transport various contaminants to organisms make microplastic contamination harmful. Microplastics are also reported to be vectors for heavy metals (i.e. Zn, Pb, Mn, Fe, Cu, Al, Ag) and many persistent organic pollutants (i.e. hydrophobic organic contaminants, organochlorine pesticides, polyaromatic hydrocarbons, and polychlorinated biphenyls) through various types of bonds and interactions (i.e. hydrogen bonds, halogen bonds, hydrophobic interactions, π-π interactions, electrostatic attraction or repulsion, Vander Waals forces, and partitioning effects). These interactions are harmful as they exhibit carcinogenic, mutagenic, and teratogenic effects on organisms [2]. In humans, these compounds can cause cytotoxicity, impairments in immune function and metabolism, oxidative stress, as well as neurotoxicity and neurodegenerative diseases [3]. Given its concerning impact, not only on the environment but also on living things, microplastic pollution has become a serious concern at the local and global levels.

By 2025, global plastic pollution had reached critical levels, with 130 million metric tonnes of plastic entering the environment annually. This amount is predicted to continue rising unless preventative actions are taken. Of the total global plastic waste, an estimated 4.8-12.7 million metric tonnes of plastic enter the oceans each year [4]. The Philippines, India, Malaysia, China, and Indonesia are the five largest sources of ocean plastics. These are all countries with large populations, significant quantities of mismanaged waste, and geographical attributes that mean plastics can easily reach coastlines via rivers [5].

Indonesia is one of the major contributors to global plastic waste, with an estimated 45.22% mismanaged waste index (MWI) [4]. MWI is the sum of uncollected and improperly managed waste, divided by the waste generated. Higher MWI percentages indicate greater mismanagement of plastic waste. In 2025, total waste generation in Indonesia reaches 28.03 million tonnes per year; 34.06% of waste is managed, and 65.94% is unmanaged. Of the total waste, 20.04% (or 5.62 million tonnes) is plastic [6]. Improper management and processing of plastic waste can lead to plastic polluting terrestrial and aquatic ecosystems. As a result of both biotic and abiotic processes, these plastics can degrade into smaller fragments, including microplastics, which pose a significant harm to the environment and living beings.

However, Indonesia's strategic position is important in relation to the removal of marine microplastics. The country is an archipelago flanked by two major oceans, the Indian Ocean and the Pacific Ocean. Sherman and van Sebille [7] conducted modelling to investigate where in the ocean marine microplastics (particularly those floating on the surface) can be most effectively removed. The model was based on observations of satellite-tracked buoys and scaled to a large dataset of microplastic observations from surface trawls. The simulations showed that the optimal removal sites are mainly located off the coast of China and in the Indonesian archipelago.

Microplastic pollution has become a concern for researchers in Indonesia. Studies related to microplastics were conducted, including those related to microplastic transport, distribution and abundance in various ecosystems, microplastic contamination in living things, as well as in foods and drinking water, and microplastic mitigation and degradation. However, the current state of study on microplastics in Indonesia is still indefinite. Hence, conducting a bibliometric analysis and an overview related to microplastics studies in Indonesia published in the last ten years in Scopus-indexed journals is a notable novelty of this paper.

2. Material and Methods

Bibliometric analysis of microplastic studies related to Indonesia was conducted using Publish or Perish (version 8.2.3944.8118) and VoSViewer (version 1.6.18) software to gather the data and determine relationships among research components, respectively. In this study, the Scopus database was chosen for data mining, as it is one of the major online databases for citations and academic publications [8]. The data were mined on 1 January 2026, and a total of 669 published articles were successfully extracted from the Scopus database. These published articles were collected by combining 'microplastic', 'microplastics', 'micro plastic', 'micro plastics', in the title words and 'Indonesia' in the keywords or affiliations menu, and inserting '2015-2025' in the year menu in the Publish or Perish application system. The year 2015 was chosen as the starting year for the analysis to cover the first year (2016) in which microplastic research related to Indonesia was published in a Scopus-indexed journal.

All paper data (title, authors, year of publication, number of citations, journal/proceeding name, etc.) were then saved in the form of Microsoft Excel, and the same data was then deleted to avoid duplication. The number of articles after removing irrelevant and duplicate entries was 489. All articles were then analysed descriptively for the type of article, annual publication growth trend, and the top ten most-cited journal articles. The research hotspots (keywords) were visualized by utilizing VoSViewer in terms of network, overlay, and density visualization. This paper also inventoried microplastic abundance in various aquatic and terrestrial environments in Indonesia. This science mapping and overview of microplastics research in Indonesia will provide insight into the future direction of research, the development of sustainable environmental management in Indonesia, and recommendations for policy-making to relevant authorities.

3. Results and Discussion

3.1 Publications on microplastics study related to Indonesia: A bibliometric analysis

A total of 489 published articles related to microplastics research in Indonesia have been successfully extracted from the Scopus database, composed of 299 research articles (61.15%), 154 conference papers (31.49%), 25 reviews (5.11%), 7 book chapters (1.43%), and 4 others (0.82%) (Figure 1a). These studies were published in 173 reputable journals and proceedings. In Indonesia, research topics related to microplastics began to receive attention in 2016, and the year 2019 marked a higher interest in the research topic of microplastics, with the increased number of publications (Figure 1b).

The annual publications show steady growth, ranging from 1 to 82 articles during the recent ten years, with the peak number of publications reaching 126 articles in 2023. During the 2015-2018 period, only 9 articles on microplastics in Indonesia were recorded in the Scopus database. The first publication was in 2016, discussing where on Earth are the effective removal sites of ocean marine microplastics. The study was conducted by a modelling approach based on observations of satellite-tracked buoys and scaled to a large dataset of microplastic observations from surface trawls. The simulations showed that off the coast of China and in the Indonesian archipelago were the optimal removal sites of marine microplastics [7]. Research topic related to microplastics is relatively new and emerging in Indonesia. This topic began to raise attention among Indonesian researchers in 2019 (marked by the increased number of publications) and has grown steadily since 2019, demonstrating the increasing importance of this issue in the research landscape in Indonesia. This would have a good impact as the microplastics issues need greater awareness from researchers, the community, policymakers, etc.

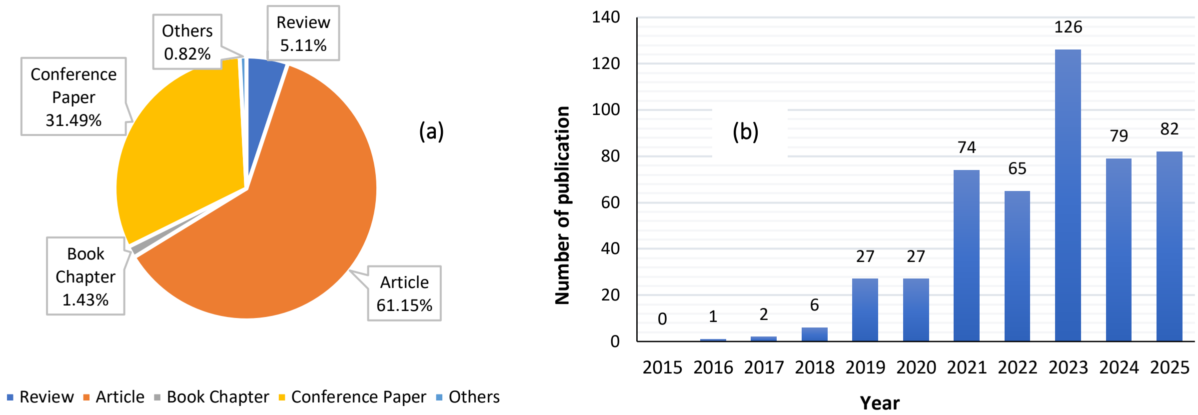

Figure 1
(a) Type of article and (b) Publication growth trend per year during 2015-2025 on microplastic research related to Indonesia (interpolation of the Scopus database)

Research related to microplastics in Indonesia can be divided into 13 clusters (Table 1) with a total of 90 keywords (Figure 2a), and Table 2 shows the 10 most cited articles on the study of microplastics in Indonesia. Figure 2 shows the network, overlay, and density visualizations of all microplastics research topics in Indonesia during 2015-2025. The overlay visualization illustrates how intensely the keywords appear in the most recent research, where the brighter the color, the more frequently the keyword appears. The density visualization illustrates the most frequently used keywords in publications. The density map indicates that the brighter the color and the larger the circle, the more frequently the keyword appears.

Table 1
Research clusters related to microplastics in Indonesia

Cluster	Items/keywords
1	Characteristic, fish, growth pattern, Kahayan river, Malang, microplastic accumulation, microplastic particle, North Sumatra province, sediment, spatial distribution, water
2	Bali, Benoa Bay, commercial fish, exposure, Jakarta Bay, marine fish, microplastic ingetion, Pramuka Island, Seribu Islands, toxicity
3	Accumulation, aquatic fauna, Central Java, health risk assessment, heavy metal, heavy metal interaction, microplastic removal, Rawa Jombor reservoir, salinity
4	Assessment, Brantas river, determination, distribution, East Java, mangrove ecosystem, microplastic characterization, Surabaya, water quality
5	Human stool, identification, Java, microplastic pollution, microplastic waste, public health, sea salt, source, threat
6	Bintan Island, intertidal zone, Jenebereng river, Makassar city, microplastic abundance, microplastic concentration, sea cucumber, seagrass ecosystem, South Sulawesi
7	Banten, biodegradation, *Chanos chano*, coastal water, gill, microplastic, milkfish
8	Jakarta, Kepulauan Seribu, Makassar, microplastic occurrence, sea urchin, seagrass bed
9	Jambi, microplastic contamination, Pangkal Babu mangrove, Surabaya city, Tanjung Jabung Barat district
10	Lampung, microplastic distribution, sediments, surface water, West Java
11	*Anadara granosa*, coastal area, microplastic exposure, microplastic identification
12	Detection, Padang city, West Sumatra
13	Marine ecosystem, occurrence

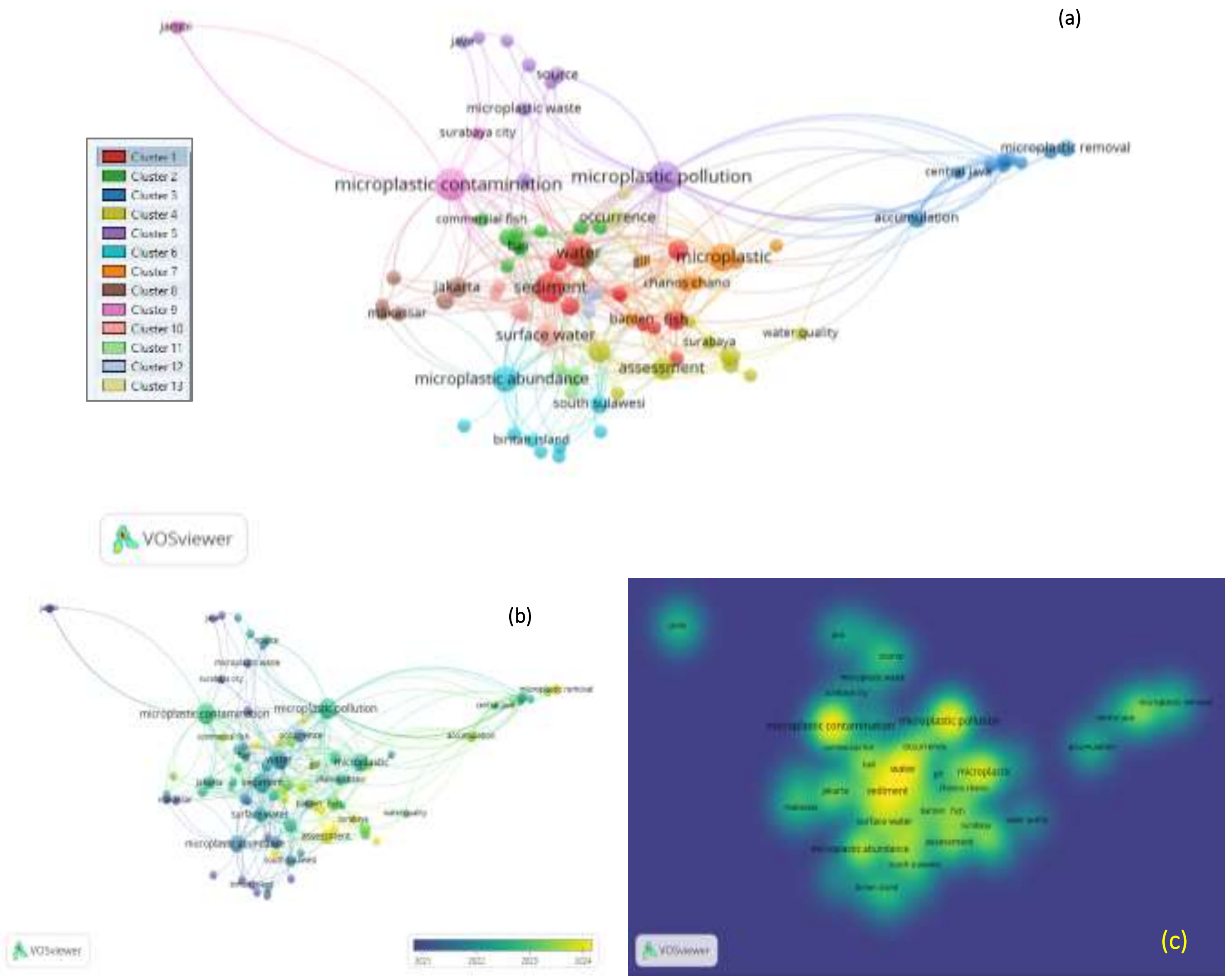

Figure 2
(a) Network visualization, (b) Overlay visualization, and (c) Density visualization, of microplastics research topics in Indonesia during 2015-2025 extracted from the Scopus database. The science mapping was performed utilizing VOSViewer.

Table 1 shows that studies on microplastics in Indonesia included many topics such as microplastic accumulation, abundance, distribution, characterization, contamination, exposure, toxicity, etc, in various terrestrial and aquatic ecosystems, as well as in animal and human beings. Figure 2c shows that some topics, such as microplastic contamination, microplastic pollution, microplastic abundance, water, sediment, surface water, and microplastic removal, are the most frequently used keywords in publications conducted on the study of microplastics in Indonesia. Meanwhile, research topic related to the microplastics exposure in human foods chain gain most citations (Table 2). Meanwhile, research topics related to the microplastics exposure in the human food chain gain the most citations (Table 2).

Table 2
The 10 most cited articles on the study of microplastic related to Indonesia

No.	Title	Year	Source	Cites*	Ref.
1.	Microplastics in human food chains: Food becoming a threat to health safety	2023	Science of the Total Environment	526	[9]
2.	Microplastic distribution in surface water and sediment river around slum and industrial area (case study: Ciwalengke River, Majalaya district, Indonesia)	2019	Chemosphere	410	[10]
3.	Microplastics in coastal areas and seafood: Implications for food safety	2019	Food Additives and Contaminants - Part A	242	[11]
4.	Concentration and adsorption of Pb and Cu in microplastics: Case study in aquatic environment	2020	Marine Pollution Bulletin	194	[12]
5.	Abundance and characteristics of microplastics in the northern coastal waters of Surabaya, Indonesia	2019	Marine Pollution Bulletin	175	[13]
6.	Beach macro-litter monitoring and floating microplastic in a coastal area of Indonesia	2017	Marine Pollution Bulletin	175	[14]
7.	Evaluation of polypropylene plastic degradation and microplastic identification in sediments at Tambak Lorok coastal area, Semarang, Indonesia	2020	Marine Pollution Bulletin	156	[15]
8.	Microplastic pollution in the sediment of Jagir Estuary, Surabaya City, Indonesia	2020	Marine Pollution Bulletin	151	[16]
9.	Microplastic contamination in human stools, foods, and drinking water associated with Indonesian coastal population	2021	Environments MDPI	137	[17]
10.	Distribution of microplastic in relation to water quality parameters in the Brantas River, East Java, Indonesia	2021	Environmental Technology and Innovation	128	[18]

*Accessed on 1 January 2026

3.2 Analysis of the research trends on microplastic study related to Indonesia

The first published article on the study of microplastics related to Indonesia was "Modeling marine surface microplastics transport to assess optimal removal locations," conducted by Sherman and van Sebille [7] from the Grantham Institute and the Department of Physics, Imperial College London, London, UK. Meanwhile, the very first Indonesian researchers whose articles related to microplastic studies recorded on the Scopus database were Syakti et al. [14], who conducted a study on beach macro-litter monitoring and floating microplastics in a coastal area of Indonesia, and Manalu et al. [19], who conducted a study on microplastics abundance in coastal sediments of Jakarta Bay, Indonesia.

By reading the research articles (excluded reviews, book chapters, and others), the focus of the microplastics study related to Indonesia were varied and can be classified into three clusters: (1) studies focusing on microplastics contamination (concentration, abundance, distribution, and identification) in various environments, such as terrestrial ecosystems and aquatic ecosystems, (2) impact of microplastics on plant, animal, and human health, and (3) mitigation and degradation of microplastic. Among all topics, those related to the mitigation and degradation of microplastics are still very limited to be studied by Indonesian researchers.

Many studies have been conducted to measure the level of microplastics pollution in the soil or sediment environments, including the sediment of coastal, bay, lake, sea, river, estuary, as well as dumping site soils, in almost all islands in Indonesia: Sumatra, Java, Bali, Kalimantan, Sulawesi, and Papua (Table 3). Similar studies have also been conducted in a variety of aquatic ecosystems (both surface and water bodies), including rivers, lakes, estuaries, coastal, sea, and mangrove, in several regions of Indonesia (Table 4). Studying both terrestrial and aquatic ecosystems is important, since most microplastics released into terrestrial ecosystems will end up in marine ecosystems. In coastal areas, these terrestrial microplastics are a major contributor to marine plastic debris, with 1.15-2.41 million tonnes of plastic waste being transported to the ocean annually from rivers. Rivers are estimated to transport 70-80% of the plastics that eventually reach the oceans, with major inputs being unmanaged plastic waste, agricultural waste, and wastewater treatment plant effluent [20].

Microplastic pollution in some of the sediment environments studied varied from a lowest level of 13.23 particles kg-1 (coastal sediment, Muaro Lasak, Padang) to the highest level of >34000 particles kg-1 in Jakarta Bay, covering Tanjung Priok, Ancol Beach, and Sunda Kelapa Port. The types of microplastics found in the sediment environment are very diverse, according to their shape, including fragment, fiber, film, pellet, and foam, while according to their chemical composition, PE, PP, PET, PA, PU, PTFE, PVC, etc., microplastics are found. These kinds of microplastics were also found in some aquatic ecosystems in Indonesia. Studies on the microplastic characteristics (shape and chemical composition or polymer type) are important since they determine the environmental behavior of microplastics, such as their bioavailability, toxicity, etc.

The high contamination of microplastics in terrestrial and aquatic ecosystems in Indonesia must receive serious attention because it not only pollutes the environment but also has an impact on socio-economic and human life itself, such as soil and plant productivity, fisheries, food safety, and public health risk. Several studies show that microplastics have been found in Gonggong snails (*Laevistrombus turturella*), mud crabs, sea cucumbers, sea urchins, green mussels, anchovies, oysters, sandfish, and various species of marine and freshwater fish in Indonesia. Another study on plants showed microplastics can cause bleaching and necrosis on staghorn coral (*Acropora formosa*) [21]. Microplastics have also been reported to affect the quality of *Spirulina sp*. [22], the growth of Chlorella in aquatic systems [23], and also the seeding of paddy [24].

Microplastics can bioaccumulate into biological systems and have toxic effects, such as damaging the digestive and immune systems, and even being cytotoxic to human brain cells. In vivo studies on marine organisms show that microplastics have toxic effects through various routes of exposure, such as intravenous, intraperitoneal, subcutaneous, dermal, and oral exposure. The effects of microplastics vary depending on the exposure route: direct exposure causes short-term acute toxicity, while indirect exposure generally causes chronic organ toxicity. The effects of microplastics are also toxic to plants, including inhibiting plant growth and development, which in turn can reduce crop productivity [1].

Table 3
Inventory of microplastic abundance in sediment/soil environments in Indonesia

Ecosystem	Location	Sampling depth/area	Abundance (particle kg^{-1})	Type of microplastics	Ref.
Coastal sediment	Bengkalis Island, Riau	0-10 cm	71.39	Fiber and film	[25]
	Pantai Carocok, West Sumatra	<10 cm and 10-20 cm	70.84-109.16	Fragment, fiber, film	[26]
	Muaro Lasak, Padang City, West Sumatera	600 cm	13.23	Fiber, film, fragment. PE, PP, PA	[27]
	Pariaman City, West Sumatera	Gandariah (G) and Cermin (C) beaches. 0 - 10 cm depth.	17675 (G), 10825 (C)	Fragment, film, fiber. PE, PA, PU, PTFE, PVC	[28]
	Jakarta Bay	Pluit and Ancol areas. Close to the sea (CS) and away from the sea (AS). Depth: NR	Pluit: 38.59-38.79 (CS), 37.44-38.11 (AS); Ancol:19.23-27.28 (CS), 18.41-22.20 (AS)	Fiber, fragment, pellet.	[19]
	Semak Daun Island, Jakarta Bay	5-10 cm	15200 ± 4932	Fiber, fragment, film, foam	[29]
	Bama resort, Baluran National Park, East Java	0-10 cm, 10-20 cm, 20-30 cm	116.41 ± 80.78 (average of all depth)	Fiber, film, fragment, foam	[30]
	Anday Beach, West Papua	2.5 cm	0.28 (<5mm) to 1617.4 (<1mm)	Fragment, foam, film, fiber	[31]
Bay sediment	Banten Bay	1-28 m	267 ± 98	Foam, fragment, granule, fiber. CP, PP, PE, PET, diphenyl sulfide	[32]
	Jakarta Bay	Tanjung Priok (TP), Ancol Beach (AB), and Sunda Kelapa Port (SK). Depth: NR	40533.33 ± 2444.04 (TP), 34666.67 ± 2444.04 (AB), 45066.67 ± 5205.13 (SK)	Fragment, fiber, film, pellet. PP, PE, PS, PA	[33]
	Palu Bay, Central Sulawesi	0-10 cm	165.50 ± 60.51 to 217.21 ± 55.41	Film, fiber, fragment.	[34]
Mangrove sediment	Muara Angke Wildlife Reserve, Jakarta	4-8 cm	28.09 ± 10.28	Fiber, fragment, foam. PS, PP, PE	[35]
	Surabaya mangrove	Depth: NR	1.5×10^9 particles km^{-2}	Fragment, fiber, film, granule. PVA, PVC, PP, PS, PE	[36])
Lake sediment	Lake Beratan, Bali	Depth: NR	NR	Fragment, fiber.	[37]
Sea sediment	Dumai City, Riau	0-10 cm	193.33-746.67	Fiber, fragment, filament.	[38]
	Eastern waters of Java Sea, Gresik, East Java	Surface [S1], mangrove [S2], shrimp pond [S3], river [S4], open sea [S5])	772.00 ± 336.75 [S1], 896.96±160.28 [S2], 206.04±84.49 [S3], 215.54± 64.58	Fragment, fiber, film.	[39]

			[S4], 639.51±121.58 [S5]		
	Kampung Atas Air, Balikpapan, East Kalimantan	Depth: NR	2010	Film, fragment, fiber, granule.	[40]
	Maluku Sea	Deep sea	304.23 ± 168.56	Fragment, fiber. PE and tire-related polymers.	[41]
	Flores Sea	Depth: NR	0.84-2.75 particles g^{-1}	Filament, fragment. PET, PE.	[42]
River sediment	Way Belau River, Lampung	Depth: NR	210.3 ± 119.2	Fragment, fiber. PE, PP	[43]
	Ciwalengke River, West Java	Depth: NR	30.3 ± 15.9	Fiber, fragment. PA, polyester, cotton.	[10]
	Citarum River, West Java	Depth: NR	166.66 ± 5.77	Fragment, fiber. PE, PP	[44]
	Citanduy River, West Java	Depth: NR	18190–70405	Fragments, films, fibers.	[45]
	Krukut River, Jakarta	0 - 30 cm	112-150	Fiber, film, fragment, pellet.	[46]
	Ciliwung River, Jakarta	0-5 cm	6560-10630	Fragment, fiber, pellet.	[47]
	Progo River, Yogyakarta	0-10 cm	209.37-1173.25	Fiber, film, fragment, pellet. PE.	[48]
	Code River, Yogyakarta	0-10 cm	550-1646	Fragment, film, pellet, fiber. Polyacetylene, PEI, PET, PA, PVC	[49]
Estuary sediment	Jagir estuary, Surabaya	Depth: NR	217.33	Fiber, film, fragment. Polyester, PE, PP	[16]
	Miri River estuary, Borneo Island	0-20 cm	283.7 - 456.2	Fiber, fragment, pellet, foam. PE, PP, PU, ethylene vinyl acetate	[50]
Other soils	Bintan Island, Riau	Transect quadrat 1 x 1 m	27000-37300	Fragment, film, foam, fiber.	[51]
	Tidung Kecil Island, Jakarta Bay	Transect quadrat 5 x 5 m	142	NR	[52]
	Pari Island, Seribu Islands, Jakarta	NR	173.3-436.7	Fiber, fragment, film.	[53]
	East Surabaya	Surface sediment (0-2 cm)	598	Fragment, foam, pellet, fiber. PP, PE.	[54]
	Dumping site soil (Bantar Gebang, Jakarta)	Surface soil, metal trowl method	10929 ± 13547	Fragment, film, fiber. PE, PP, PET	[55]

Note: NR: Not reported, PE: polyethylene, PET: polyethylene terephthalate, PP: polypropylene, PA: polyamide, PVC: polyvinyl chloride, PU: polyurethane, PS: polystyrene, PTFE: polytetrafluoroethylene, PVA: polyvinyl alcohol, PEI: polyetherimide, CP: cellophane

Table 4
Inventory of microplastic abundance in aquatic environments in Indonesia

Ecosystem	Location	Sampling depth/area	Abundance (particle m^{-3})	Type of microplastics	Ref.
[a]River	Way Belau River, Lampung	Horizontal water sampler with a 500 ml glass bottle	73.52 ± 43.62 particles L^{-1}	Fragment, fiber. PE, PP	[43]
	Ciwalengke River, Majalaya district, West Java	45 cm from the surface	5.85 ± 3.28 particles L^{-1}	Fiber, fragment. PA, PES, cotton.	[10]
	Banger River, Pekalongan City	Plankton net (pore size of 0.3mm)	0.10 ± 0.02 to 0.61 ± 0.47	Fragment, film, fiber, pellet, foam. PP, PE, HDPE, PET.	[56]
	Bango River, Malang	3L-water sampler	85.4 ± 36.3 particles L^{-1}	Film, fiber, fragment. PS, PVC, PP, HDPE.	[57]
	Tambakoso River, Surabaya	NR	91.80 particles L^{-1}	Fragment. PVC, nylon polymers.	[58]
	Jeneberang River, South Sulawesi	Neuston net 15x60 cm	2.00 ± 1.30 to 5.77 ± 1.25 p L^{-1}	Fiber, fragment, film.	[59]
[b]River	Citarum River (downstream), West Java	8 m^3 of water (Manta trawl)	0.0574 ± 0.025	Fragment, fiber. PE, PP	[44]
	Citarum River (Muara Gembong)	8 m^3 of water (Manta trawl)	0.057	Fragment, fiber.	[60]
	Krukut River, Jakarta	15 L (plankton net method)	2150-2650 particles L^{-1}	Fiber, film, fragment, pellet.	[46]
	Ciliwung River, Jakarta	Plankton net method. Sample volume: NR	320-741 particles L^{-1}	Fragment, fiber, pellet.	[47]
[a]Lake	Lake Singkarak, West Sumatera	Plankton net (mouth diameter of 40 m; mesh size of 140 µm)	2.49 ± 0.17 to 9.23 ± 2.14	Foam, fragment.	[61]
	Maninjau Lake, West Sumatera	Plankton net no. 25	177.50 - 332.50 particle L^{-1}	Fragment, fiber, film, pellet. PA, PP, PES.	[27]
[a]Urban-lakes	Cibeureum lake, Bekasi Regency	Plankton net (mesh size: 120 µm)	25.0 ± 3.4	Foam, sheet, fiber, fragment.	[62]
	Cipondoh lake, Tangerang City		129.0 ± 5.1	Foam, fiber, sheet, fragment.	
	Gede lake, Tangerang City		3463 ± 420	Sheet, foam, fragment, fiber.	
	T. Gong lake, Jakarta City		7138 ± 1547	Foam, fiber, sheet, fragment.	
	Pluit lake, Jakarta City		30600 ± 6176	Foam, sheet, fragment, fiber.	
	Cincin lake, Jakarta City		3942 ± 259	Foam, sheet, fiber, fragment.	
[a]Estuary	Tallo estuary, Makassar, South Sulawesi	60x15 cm mouth-size, 330 µm mesh-size, 300 mL	1.78±0.25	Fragment.	[63]

	Jeneberang estuary, Makassar, South Sulawesi	cod-end volume (Neuston net method)	1.83±0.17	Fragment.	
	Benoa Bay, Bali	Mesh size 300 μ m, net length 1.5 m, opening area 0.45 m^2 (Manta trawl method)	0.54±0.47 to 0.70±0.63	Fragment, foam, fiber, pellet. PS, PP, PE.	[64]
[b]Estuary	Miri River estuary, Borneo Island	10 L of surface water (0-20 cm depth)	10.7 - 14.3 particle L^{-1}	Fiber, fragment, pellet, foam. PE, PP, PU, ethylene propylene diene monomer, etc.	[50]
[b]Coastal	Pariaman City, West Sumatra	Gandariah and Cermin beaches. Plankton net (200 m in size).	6.62 (Gandariah beach) 15.86 (Cermin beach)	Fragment, film, fiber. PA, PU, PVC	[28]
[a]Sea	Maluku Sea	Vacuum filtering	7.60 ± 3.18 particles L^{-1}	Fragment, fiber. PE and tire-related polymers	[41]
	Flores Sea	Neuston net; 20-30 L of seawater	0.84 – 2.24 particles L^{-1}	Filament, pellet, fragment, film. PET, PE.	[42]
[b]Sea	Dumai City, Riau	Plankton net (size of 0.40 mm)	0.13-0.20 particles L^{-1}	Fiber, fragment, filament.	[38]
	Semak Daun Island, Jakarta Bay	Plankton net; 30 L of seawater	8.2 ± 2.19 particles L^{-1}	Fiber, fragment, film, foam	[29]
[b]Mangrove	Surabaya mangrove	Manta net method (pulled by the boat as far as 30 m)	8×10^6 particles km^{-2}	Fragment, fiber, film, granule. PVA, PVC, PP, PS, PE	[36]
[a]Reservoir	Gajah Mungkur reservoir	Plankton net; 20 L of water	340-820	Fiber, fragment, filament. PP, PS.	[65]

Note: [a]surface water, [b]water body, NR: Not reported, PE: Polyethylene, PET: polyethylene terephthalate, PP: polypropylene, PA: polyamide, PVC: polyvinyl chloride, PU: polyurethane, PS: polystyrene, PES: polyester, PTFE: polytetrafluoroethylene, PVA: polyvinyl alcohol, CP: cellophan

From the research published on the Scopus database (for the period spanning 2015-2025) related to microplastics in Indonesia, there are still very few studies regarding the mitigation or degradation of microplastics. Among the studies that have been conducted are biodegradation of PE using culturable coral-associated bacteria isolated from corals of Karimunjawa National Park [66], biodegradation of PVC by indigenous bacteria isolated from Supit Urang Landfill, Malang [67], and the utilization of *Bacillus subtilis* as microplastic bioremediation agents [68]. Research topics related to microplastic mitigation and biodegradation, which have so far been significantly under-researched in Indonesia, are important to be taken seriously in the future. Unless action is taken to both prevent and address microplastic contamination in the environment, the decline in environmental quality -and subsequently human health- will continue.

4. Conclusion

Many studies on microplastics in Indonesia have been conducted and published in various scientific journals. The bibliometric analysis on these publications has been successfully conducted and revealed the main topic focusing on abundance/distribution of microplastics in terrestrial and aquatic environments in Indonesia, impact of microplastics on living things, and the mitigation and biodegradation of microplastics. This study revealed how polluted our environment has become with microplastics, and it needs the attention of all stakeholders, particularly policymakers, to solve this problem. This study suggests that future research should prioritize mitigation strategies and biodegradation of microplastics, especially practical and scalable solutions applicable in Indonesia, since this topic is still limited to being studied in Indonesia.

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