
Title

Microplastics in marine ecosystems: A comprehensive review of biological and ecological implications and its mitigation approach using nanotechnology for the sustainable environment

Abstract

Microplastic contamination has rapidly become a serious environmental issue, threatening marine ecosystems and human health. This review aims to not only understand the distribution, impacts, and transfer mechanisms of microplastic contamination but also to explore potential solutions for mitigating its widespread impact. This review encompasses the categorisation, origins, and worldwide prevalence of microplastics and methodically navigates the complicated structure of microplastics. Understanding the sources of minute plastic particles infiltrating water bodies worldwide is critical for successful removal. The presence and accumulation of microplastics has far reaching negative impacts on various marine creatures, eventually extending its implications to human health. Microplastics are known to affect the metabolic activities and the survival of microbial communities, phytoplankton, zooplankton, and fauna present in marine environments. Moreover, these microplastics cause developmental abnormalities, endocrine disruption, and several metabolic disorders in humans. These microplastics accumulates in aquatic environments through trophic transfer mechanisms and biomagnification, thereby disrupting the delicate balance of these ecosystems. The review also addresses the tactics for minimising the widespread impact of microplastics by suggesting practical alternatives. These include increasing public awareness, fostering international cooperation, developing novel cleanup solutions, and encouraging the use of environment-friendly materials. In conclusion, this review examines the sources and prevalence of microplastic contamination in marine environment, its

impacts on living organisms and ecosystems. It also proposes various sustainable strategies to mitigate the problem of microplastics pollution. Also, the current challenges associated with the mitigation of these pollutants have been discussed and addressing these challenges require immediate and collective action for restoring the balance in marine ecosystems. © 2024 Elsevier Inc.

Authors

Marcharla E.; Vinayagam S.; Gnanasekaran L.; Soto-Moscoso M.; Chen W.-H.;
Thanigaivel S.; Ganesan S.

Author full names

Marcharla, Eswar (58758495900); Vinayagam, Saranya (56096762500);
Gnanasekaran, Lalitha (56650900600); Soto-Moscoso, Matias (57201979021); Chen,
Wei-Hsin (58983438700); Thanigaivel, Sundaram (55624925900); Ganesan,
Swamynathan (57382255400)

Author(s) ID

58758495900; 56096762500; 56650900600; 57201979021; 58983438700;
55624925900; 57382255400

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Affiliations

Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Chengalpattu District, Tamil Nadu, Kattankulathur, 603203, India; Department of Biosciences, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (SIMATS), Tamil Nadu,

Chennai, 602 105, India; Instituto de Alta Investigación, Universidad de Tarapacá, Arica, 1000000, Chile; Universidad Autónoma de Chile, Chile; Department of Aeronautics and Astronautics, National Cheng Kung University, 701, Tainan, Taiwan; Research Center for Smart Sustainable Circular Economy, Tunghai University, 407, Taichung, Taiwan; Department of Mechanical Engineering, National Chin-Yi University of Technology, 411, Taichung, Taiwan

Authors with affiliations

Marcharla E., Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Chengalpattu District, Tamil Nadu, Kattankulathur, 603203, India; Vinayagam S., Department of Biosciences, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (SIMATS), Tamil Nadu, Chennai, 602 105, India; Gnanasekaran L., Instituto de Alta Investigación, Universidad de Tarapacá, Arica, 1000000, Chile; Soto-Moscoso M., Universidad Autónoma de Chile, Chile; Chen W.-H., Department of Aeronautics and Astronautics, National Cheng Kung University, 701, Tainan, Taiwan, Research Center for Smart Sustainable Circular Economy, Tunghai University, 407, Taichung, Taiwan, Department of Mechanical Engineering, National Chin-Yi University of Technology, 411, Taichung, Taiwan; Thanigaivel S., Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Chengalpattu District, Tamil Nadu, Kattankulathur, 603203, India; Ganesan S., Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Chengalpattu District, Tamil Nadu, Kattankulathur, 603203, India

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Aquatic ecosystems; Contamination; International cooperation; Metabolism; Microplastic; Sustainable development; microplastic; nanoparticle; Aquatic health; Distribution mechanism; Ecological implication; Ecosystem health; Environmental issues; Human health; Marine environment; Microplastics; Sustainable environment; Transfer mechanisms; collective action; marine ecosystem; marine pollution; mitigation; nanotechnology; plastic; public health; adsorption; aquatic environment; aquatic species; bioaccumulation; ecosystem; environmental impact; environmental monitoring; fauna; feeding behavior; health hazard; human; infestation; landfill leachate; marine environment; microbial community; microplastic pollution; nanofiltration; nanotechnology; nonhuman; ocean current; phytoplankton; Review; sea pollution; seagrass; sustainable development; trophic system; water filtration; water management; Marine pollution

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Correspondence Address

S. Thanigaivel; Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamil Nadu, 603203, India; email: thanigaivel092@gmail.com; S. Ganesan; Department of Biotechnology, Faculty of Science & Humanities, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamil Nadu, 603203, India; email: swamynag@srmist.edu.in; L. Gnanasekaran; Instituto de Alta Investigación, Universidad de Tarapacá, Arica, 1000000, Chile; email: lalitha1887@gmail.com

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