Commentary
Volume 12:5, 2022

Journal of Civil & Environmental Engineering

ISSN: 2165-784X **Open Access**

Microplastic Occurrence in Wastewater Treatment Facilities

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Introduction

Depending on the quality of the influent water and the effluent discharge standard, wastewater treatment plants are built to have various water treatment facilities and distinct water treatment process combinations. Pre-treatment, main treatment and secondary treatment are all parts of conventional wastewater treatment. There are several different treatment methods used, including bar screening, degreasing, air flotation, primary sedimentation, biofilm process/activated sludge process, and secondary sedimentation. Tertiary treatment methods like enhanced oxidation and membrane filtering are utilised to further enhance the effluent quality. The detailed removal efficiencies of MPs at various phases of WWTPs have only been briefly examined in a few studies, and no treatment method has been specifically developed to date to remove MPs [1].

Various treatment methods result in different removal efficiencies of MPs. In general, primary treatment is more effective than secondary treatment and tertiary treatment is more effective than all other stages of MP elimination. The various treatment processes and sampling/identification techniques make it challenging to compare the precise removal efficiencies.

The first examination into MP fate in a WWTP using influent and effluent wastewater analyses. The primary treatment used by the WWTP included screening, grit and oil removal, which was followed by a primary settling tank and biological treatment. In the third step, when MPs were completely removed from the sludge, biofilters were employed. 1000–5000 m MPs made up 45% of the total amount in the influent but were entirely eliminated following tertiary treatment. On the other hand, the final effluent included only tiny MPs (100–1000 m). It should be emphasised that the majority of the MPs in this WWTP were fibres rather than pieces [2].

This WWTP's influence contains about 430 synthetic particles and 180 textile fibres per litre. Primary sedimentation primarily eliminated microplastic fibres, and secondary sedimentation primarily settled MP particles. In tertiary treatment, biological filtration increased the removal effectiveness of MPs even further. Final effluent included an average of 8.6 (2.5) particles and 4.9 (1.4) fibres per litre following treatment. In order to confirm the involvement of the WWTP as a pathway for MPs entering the sea, artificial textile fibres and synthetic plastic particles were found as the predominant MPs following a similar pattern in the WWTP effluent and receiving sea water.

There was little information available on the concentration of MPs or the movement of MPs in a tertiary wastewater reclamation plant. The study also proved that primary treatment and pretreatment both worked well to get rid of MPs. The bulk of the MPs in this WWTP resembled the blue polyethylene particles used in toothpaste formulations in terms of colour, shape, and size, suggesting that the additives in cosmetic and personal care items were the predominant sources of MPs in WWTPs. Remember that during biological treatment, MPs were transported from wastewater to activated sludge, as evidenced by the concentration of MPs reaching 50 particles L-1 in return activated sludge [3].

The effect of wastewater treatment facilities on climate change globally

Wastewater treatment plants (WWTP) are essential for protecting the environment. It may be possible to remove numerous contaminants from wastewaters, such as organic matter, nitrogen, and phosphorus, without having a negative influence on the environment through the use of appropriate technology and operating procedures. Despite the advantages of using a WWTP, its operations can have negative environmental repercussions, particularly when greenhouse gases like carbon dioxide (CO_2), methane (CH_4), and nitrous oxide are released (N_2O). While energy consumption inside the WWTP borders is primarily responsible for contributions to CO_2 generation, biological carbon and nitrogen conversion processes such methanogenesis, nitrification, and denitrification are responsible for CH_4 and N_2O emissions [4].

The contribution of several processes to GHG production is evaluated. Additionally, operational measures to reduce GHG emissions from WWTP are discussed, including the management of a number of factors within the plant's facilities, including temperature, pH, applied load, dissolved oxygen concentration, and solids retention time. Innovative processes, such as Anammox, coupled aerobic-anoxic nitrous decomposition operation and co-cultures of bacteria and microalgae, capable of generating less GHG and allowing better use of wastewater resources, are also described. Treatment methods for naturally occurring GHG streams are also discussed. Finally, the performance and operation of current wastewater treatment facilities are discussed in relation to climate change and the accompanying repercussions (such as higher temperature and rainfall intensity) [5].

The design of a wastewater treatment plant is based on the choice and order of different unit operations. A diagram demonstrating the fusion of methods for treating various types of wastewater. The characteristics of the wastewaters, the needed effluent quality (including any potential future restrictions), costs, and land availability all play a role in the decision of which combination of procedures to use. Pre-treatment/primary treatment, secondary treatment, tertiary treatment, sludge treatment/stabilization, and ultimate disposition or reuse treatment technologies for residuals are the several categories under which treatment methods can be divided.

Acknowledgement

None.

Conflict of interest

The author shows no conflict of interest towards the manuscript.

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Received: 06 May, 2022, Manuscript No. jcde-22-69489; **Editor Assigned:** 08 May, 2022, PreQC No. P-69489; **Reviewed:** 23 May, 2022, QC No. Q-69489; **Revised:** 28 May, 2022, Manuscript No.R-69489; **Published:** 05 June, 2022, DOI: 10.37421/2165-784X.2022.12.453

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How to cite this article: Thomas, Kevin. “Microplastic Occurrence in Wastewater Treatment Facilities.” J Civil Environ Eng 12 (2022): 453.