IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **Volume 11, Sp.Iss 7 , 2022**

Microplastic Segregation from Sewage Water

B Kiran Kumar[1],M Sridevi Madhumitha[2], S Sailaja Madhu Sri[3], A Jwalitha[4]

[1,2,3,4] Department of Mechanical Engineering, Koneru Lakshmaiah Education Foundation (KLEF), Deemed to be University, Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India -522302

Email Id: buragaddakirankumar15@gmail.com

DOI : 10.48047/IJFANS/11/S7/018

Abstract.

A growing volume of microplastics is found in the environment, including the sea, and in food and drinking water. Once in the environment, microplastics do not biodegrade and tend to accumulate - Unless they are made particularly to biodegrade in the open environment. Hence there is an intense need to recycle them. But to recycle, the disposed microplastics should be collected and segregated from all the other wastes. The collection process is highly challenging in the present generation with available technology. This project seeks for giving a solution that might be easily implemented in larger level segregation on microplastics. Oil-Spill Residueis proved to adsorb free microplastics that are suspended in water. When Ferrous Oxide powder is also added to this mixture, it creates a surface for the Oil Mixture to be accommodated. Since Ferrous Oxide is magnetic in nature, it will be removed using Magnet with which the Oil- Spill Residue is also be removed.

Keywords: Microplastics, Microplastic Segregation, Plastic Pollution.

1. Introduction

In many kinds of synthetic chemicals used in daily life of humans, plastics take up the most part and humans have become inseparable from plastic. While plastic is rather a good invention, it is also hazardous. When not disposed of properly, plastics can also cause many risks. A growing body of evidence points to the health risks posed by plastic additives. These include endocrine disrupting chemicals (EDCs), which are linked to infertility, obesity, diabetes, prostate or breast cancer, thyroid problems and increased risk of cardiovascular disease and stroke, among others.

Examining the other instance, we typically find that a large amount of garbage is disposed of in Indian drainage and sewage systems in combination with the sewage water. Most of this garbage is made up of plastics, which is dangerous in a variety of ways for the aquatic life as it is for humans. Fig.1 shows the increasing range of micro plastics in Eastern Tropical Pacific with respect to the passing time.

ISSN PRINT 2319 1775 Online 2320 7876
 Volume 11, Sp.Iss 7 , 2022

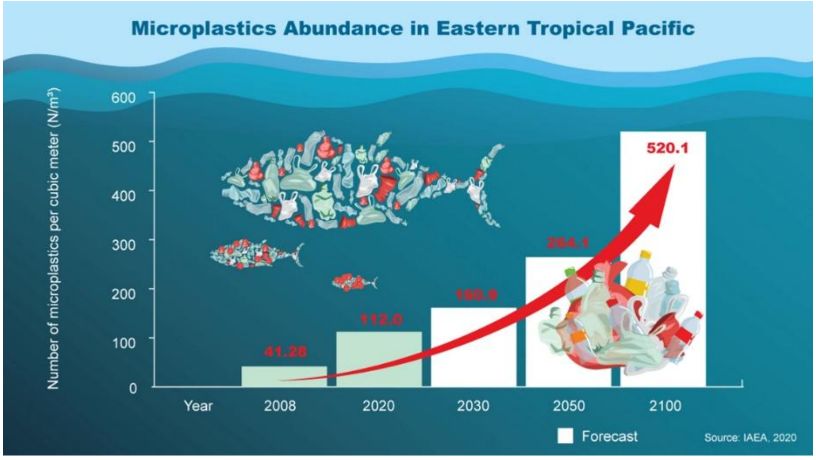


Fig. 1 Graphical representation of increasing abundance of micro plastics in ocean

Plastics also differ in many types with reference to the size of the particle. Plastics with particles less than 5mm in size are known as microplastics (MP) as shown Fig.2. Nano plastics are interpreted as involuntarilyproduced particles (i.e., from the decomposition and production of plastic objects) and are of colloidal behaviour with a size that rangesfrom 1–1000nm [3]. The adverse implications of Micro plastics are currently increasing importance [5]. Micro plastics possess higher capacity for toxicants absorption and desorption, which include PAHs, PCBs, and metals, owing because of their substantial specific surface area, in addition to their physical and chemical properties. The manufacture of plastics involves the incorporation of various additives, including PBDEs, PAEs, and others. [3]

Fig.2 Microplastics of size less than 5mm

Microplastics manufactured by living or industrial processes have simple access to WWTPs. Similarly, waste plastics generated from equipment, fillers,and other sources in WWTPs can decompose into microplastics. WWTPs, are an essential component of urban water systems, are thought to be possible sources of MPs in the environment. [2]. The term “micro-nano plastics” (M-NPs) was first introduced by Thompson [10]. M-NPs are plastics with size lower than 5mm and include plastic particles, fragments, fibres, and other similar materials [8].Just recently, some achievements in checkingand identifying the presence of microplastics in wastewater and sludge were noted. Thus, this paper begins by reviewing the advancementof methods in detection of microplastics in wastewater and sludge samples. Microplastics' impact on wastewater and sludge treatment, furthermore their mechanisms, are

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Sp.Iss 7 , 2022

then thoroughly discussed. Also summarised are the procedures for the elimination of microplastics from wastewater and sludge. Finally, the critical issues that should be discussed in the near futureare addressed here.

2.Methodology, Design and Modelling

Especially in a time in which global warming and depletion of natural resources are alarming concerns, plastic can create much more pollution when combined with the former. While plastic is disadvantageous and harmful in all of its types, Microplastic is the most important concern which is to be addressed.

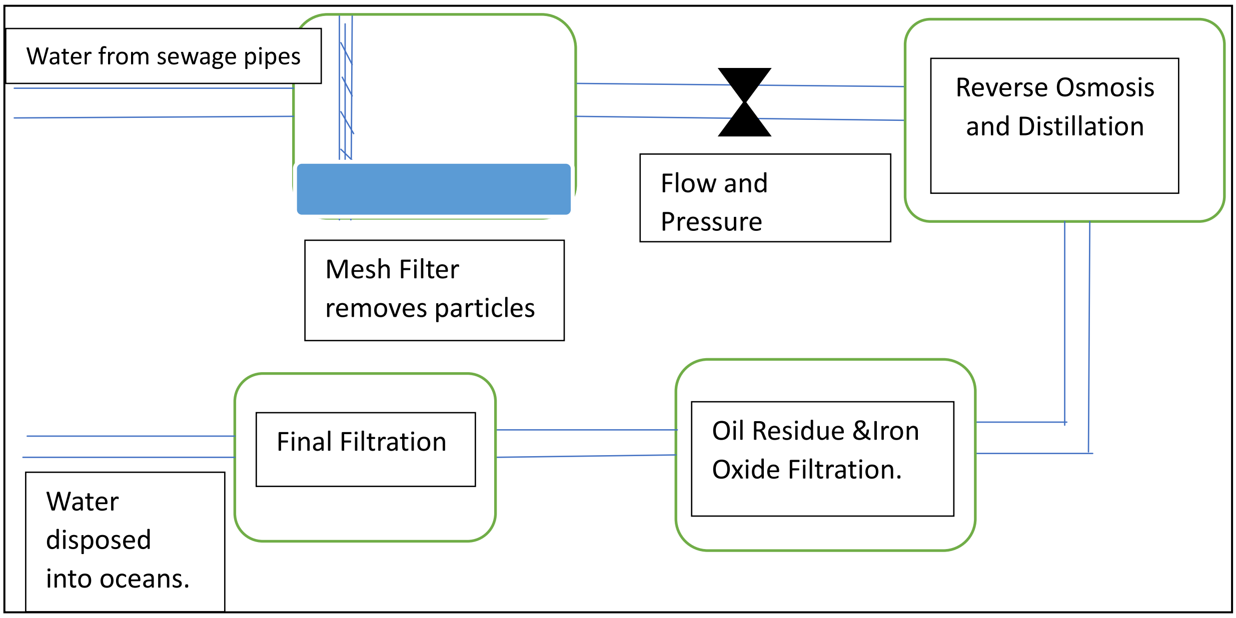
Additionally, when microplastics are disposed improperly in drainages and sewage systems because they are seldom visibleto the naked eye, there is more chance of problems for living organisms. These microplastics are not purified in water purification systems. When this not totally pure water is left into water bodies, there are furtherpossibilities for aquatic animals to consume these microplastics, which are indeed harmful for human life also.

Method

Oil-spill residues are proven to adsorb microplastics, removing oil from water when they are put together with microplastics is a strenuous procedure. Hence, when oil is mixed with Iron Oxide, that mixture can be removed using a magnet. Here Iron Oxide is used the surface area to catalyse adsorption. The Oil-Iron Oxide mixture thus can capture the microplastics and this mixture can be removed using magnets.

Design and Modelling

Fig.3 depicts the process of filtering process sewage waster before leaving for the ocean. On a grand scale, this operation can be easily incorporated in Sewage Disposal Plants. Rather than disposing of the sewage water directly, it can be treated using the above methods. This helps in reducing the count of Microplastics in the ocean.



ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Sp.Iss 7 , 2022**

Fig.3 Process Flow of Sewage water discharging into the Ocean

Sewage Treatment Plants are recommended to add this new design to their already existing procedures, by setting up a separate stage for Iron Oxide Filtration.

Prototypes can be made using regular mesh filters and procedures like Chlorination can be proceeded in regular manner, While for Oil Spill and Iron Oxide Filtration, a big tank of Sewage water, which is half treated can be treated with the Oil and Iron Oxide.

3. Results & Discussions

The soaringnecessity for plastic products has led to tremendous rise in plastic debris in different environmental matrices, thereby resulting in plastic pollution. This affects plants, animals, and even humans, as microplastics can enter the food chain and cause several health implications. Microplastics are largely debated nowadays owing to their environmental risk assessment. Their potential to interact with other toxic contaminants, their tendency to be ingested or taken up by living organisms and their longevity is a serious threat to our environment.

Nonetheless there are no studies on the removal of MPs using M−CNTs as adsorbents. As such, this study aims tosynthesize an efficient and recyclable M−CNTs for MPs removal; optimize operational conditions for the recycle and reuse of M−CNTs; investigate the mechanism of the M−CNTs based MPs removal process.

The technology makes it possible to separate plastics based on a purer chemical composition than is possible today, and this opens for completely new opportunities to recycle plastics.The wastes are not usually separated at house, factory, or industry level. This waste when dumped in large grounds is mixed with all kinds of waste which makes it difficult for separation. But using this Ferrous powder Separation Technique AKA MPlastAd Technique, as we have named it, makes it easier for plastic segregation. Plastic particles with a diameter of more than 200 μm were targeted for separation, and various conditions for separation were investigated by simulation. In terms ofthe outcome, it was shown that a high level of separation efficiency was achieved under the following conditions: flow velocity of 0.2 m/s, electrode size of 150 mm, current density of 0.93 A/cm^2 , and applied magnetic field of 3T.

4. Conclusion

The technology makes it possible to separate plastics based on a purer chemical composition than is possible today, and this opens for completely new opportunities to recycle plastics. In most cases, waste is not typically separated at the household, factory, or industrial level. When these wastes are dumped in large landfills, they become intermingled with various types of waste, rendering separation a challenging task. However, the utilization of the Ferrous Powder Separation Technique, which we have named the 'MPlastAd Technique,' simplifies the operation of segregating plastics.

Acknowledgements

We'd also like to express our profound gratitude to our faculty members and all my team for their efforts and collaboration in doing this project work.We also sincerely thank Dr. VL Mangesh Sir for guiding us in the proper way when we have proposed the idea for this work. Finally, we express our heartiest gratitude to the lecturers of my department for their counsel and instruction in completing the project successfully.

6. References

1. Gao, S., Zhao, M., Chen, Y., Yu, M., & Ruan, W. (2015). Tolerance response to in situ ammonia stress in a pilot-scale anaerobic digestion reactor for alleviating ammonia inhibition. Bioresource Technology, 198, 372-379.
2. Henriques, I. D., & Love, N. G. (2007). The role of extracellular polymeric substances in the toxicity response of activated sludge bacteria to chemical toxins. Water Research, 41(18), 4177-4185.
3. Kim, W., Shin, S. G., Han, G., Cho, K., & Hwang, S. (2015). Structures of microbial communities found in anaerobic batch runs that produce methane from propionic acid—Seeded from full-scale anaerobic digesters above a certain threshold. Journal of biotechnology, 214, 192-198.
4. Mu, H., Chen, Y., & Xiao, N. (2011). Effects of metal oxide nanoparticles (TiO2, Al2O3, SiO2 and ZnO) on waste activated sludge anaerobic digestion. Bioresource technology, 102(22), 10305-10311.
5. Nava, V., & Leoni, B. (2021). Comparison of different procedures for separating microplastics from sediments. Water, 13(20), 2854.
6. Tang, Y., Zhang, S., Su, Y., Wu, D., Zhao, Y., & Xie, B. (2021). Removal of microplastics from aqueous solutions by magnetic carbon nanotubes. Chemical Engineering Journal, 406, 126804.
7. Thompson, R. C., Olsen, Y., Mitchell, R. P., Davis, A., Rowland, S. J., John, A. W., ... & Russell, A. E. (2004). Lost at sea: where is all the plastic?. Science, 304(5672), 838-838.
8. McCracken J, Rauzan B, Kjellman J, Kandel M, Liu Y, Badea A (2018) 3D-printed hydrogel composites for predictive temporal (4D) cellular organizations and patterned biogenic mineralization. Adv Healthc Mater 8(1):1800788
9. Tao J, Zhang J, Du T, Xu X, Deng X, Chen S (2019) Rapid 3D printing of functional nanoparticle-enhanced conduits for effective nerve repair. Acta Biomater 90:49–59
10. Celikkin N, Mastrogiacomo S, Walboomers X, Swieszkowski W (2019) Enhancing X-ray attenuation of 3D printed gelatin methacrylate (GelMA) hydrogels utilizing gold nanoparticles for bone tissue engineering applications. Polymers 11(2):367
11. Löwa N, Fabert J, Gutkelch D, Paysen H, Kosch O, Wiekhorst F (2019) 3D-printing of novel magnetic composites based on magnetic nanoparticles and photopolymers. J MagnMagn Mater 469:456–460