14th International Conference on Sustainable Development, 09-10 September 2026, Rome, Italy
https://ecsdev.org

Influence of aging process on adsorption properties of microplastics

Laura Węgrzyn[1], Dominika Uchmanowicz[1], Justyna Pyssa[1], Katarzyna Styszko[1]
[1]AGH University of Krakow
frydel@agh.edu.pl

INTRODUCTION

Micropollutants are a group of contaminants of particular concern due to their persistent presence in the environment [1] and negative impact on organisms and the environment. In addition to pharmaceuticals and endocrine compounds, micropollutants also include microplastics (MPs) [2]. MPs are characterized by large specific surface areas, which may allow them to be effective adsorbents of pollutants [3]. The aging process can increase the specific surface area, and consequently, the adsorption potential of microplastics [4].

RESULTS

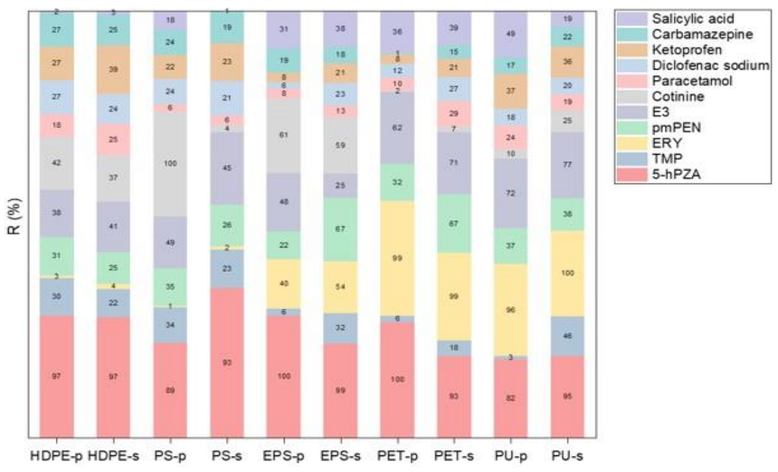

Figure 1. The removal efficiencies (R%) for pharmaceuticals, estriol and cotinine.

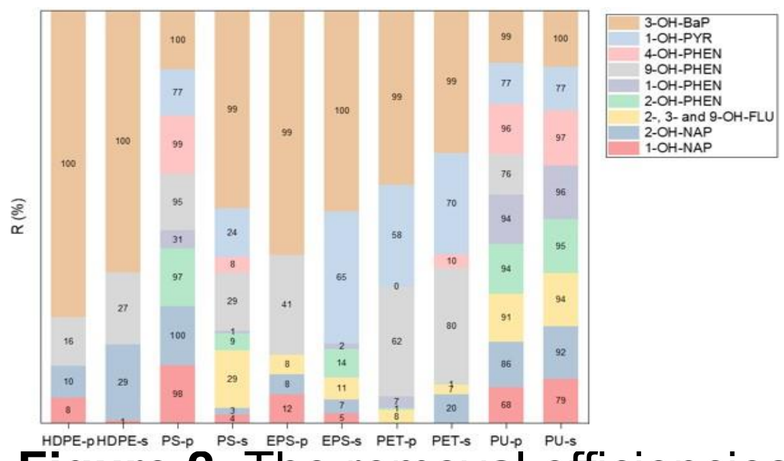

Figure 2. The removal efficiencies (R%) for hydroxyl derivatives of PAHs.

*primary plastics (-p) and accelerated samples (-s)

ABSTRACT: Monitoring the presence of microplastics and micropollutants is essential due to their negative impact on health and life. The aim of this study was to investigate the adsorption of selected micropollutants on microplastics before and after the aging proces, which involved exposure to hydrogen peroxide and UV radiation. Obtained microplastics were then used as adsorbents. The removal efficiencies was calculated for adsorption equilibrium, which was reached at 24 hours of contact time.Concentrations before and after adsorption were determined using LC-MS/MS. Polyurethane (PU) and expanded polystyrene (EPS) demonstrated the best adsorption properties for the tested adsorbates.

Key words
Microplastics, adsorption, LC-MS/MS, micropollutants

DISCUSSION

Due to their widespread occurrence in aquatic environments, MPs may significantly influence the environmental fate and transport of micropolluatnts. Those results demonstrate that MPs can effectively adsorb various micropollutants, although the extent of sorption strongly depends on both polymer type and physicochemical properties of the compounds.

CONCLUSIONS

1. PU and EPS showed the highest sorption capacities for several compounds.
2. The highest adsorption values were observed for COT on EPS-p (129.35 μg g^{-1}), 5-hPZA (up to 43.65 μg g^{-1} on EPS-p) and ERY (up to 36.47 μg g^{-1} on PU-s), 2-OH-NAP and 4-OH-PHEN on PU-p and PU-p, with q_e values exceeding 50 μg g^{-1}, indicating strong affinity of these compounds toward heterogeneous polymer surfaces.
3. The results confirm that MPs can act as effective sorbents and potential carriers of micropollutants.

REFERENCES

1. J. Rogowska, M. Cieszynska-Semenowicz, W. Ratajczyk, L. Wolska, Micropollutants in Treated Wastewater, *Ambio*, 49 (2020), 487-503.
2. A. Khan, Z. Jia, Recent insights into uptake, toxicity, and molecular targets of microplastics and nanoplastics relevant to human health impacts, *iScience*, 26 (2023), 106061.
3. F. Wang, M. Zhang, W. Sha, Y. Wang, H. Hao, Y. Dou, Y. Li, Sorption Behavior and Mechanisms of Organic Contaminants to Nano and Microplastics, *Molecules*, 25 (2020), 1827.
4. H. Luo, C. Tu, D. He, A. Zhang, J. Sun, J. Li, J. Xu, X. Pan, Interactions between microplastics and contaminants: A review focusing on the effect of aging process, *Science of the Total Environment*, 899 (2023), 165615.

ACKNOWLEDGMENTS

Research supported by AGH UST within the framework of the “Excellence Initiative - Research University”.