NEWSLETTER

Development of Monitoring and Removal Strategies of Emerging Micropollutants in wastewaters

December ‘22

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

中华人民共和国科学技术部
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CONFERENCES

"Versatile synthesis of graphene materials for the removal of copper ions from aqueous solutions"

D. Trikkaliotis, D.. Lambropoulou, A. Mitropoulos, G. Z. Kyzas

9th IUPAC International Conference on Green Chemistry

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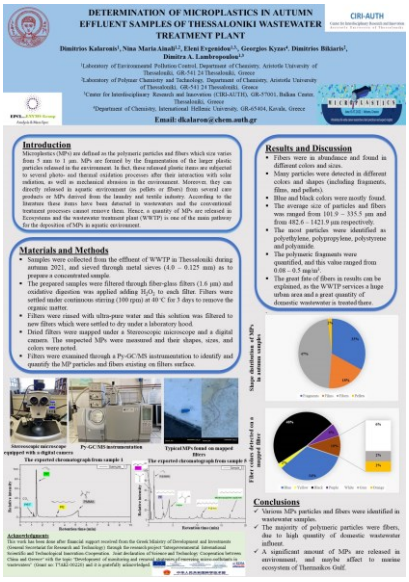
Early Career Microplastics Workshop: Best practices and expert insights, National and Kapodistrian University, June 2022, Athens, Greece


DETERMINATION OF MICROPLASTICS IN AUTUMN EFFLUENT SAMPLES OF THESSALONIKI WASTEWATER TREATMENT PLANT

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Introduction

Materials and Methods

Results and Discussion

Conclusions

Acknowledgements

WORKSHOPS

"Determination of microplastics in effluent autumn samples of Thessaloniki's wastewater treatment plant"

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Low-cost agricultural wastes (orange peels) for the synthesis and characterization of activated carbon biosorbents in the removal of pharmaceuticals in multi-component mixtures from aqueous matrices

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ABSTRACT

In recent years, bio-based carbons derived from environmentally friendly biomass materials have received considerable attention because of their abundance, easy processability, tunable surface properties and relatively low cost. Herein, a simple, less hazardous and low-cost method for the synthesis of ultrahigh surface area activated carbon material was proposed using orange peels as a carbon source. Within this context, three different biosorbents were synthesized: activated carbon samples derived from orange peels after activation with (i) phosphoric acid by pyrolysis at 450 °C (ORPs-H_3PO_4(450)) and (ii) at 650 °C (ORPs-H_3PO_4(650)), as well as (iii) after activation with potassium hydroxide at 450 °C (ORPs-KOH (450)). Characterisation and morphology of all materials has been conducted using various characterization techniques as FTIR, BET and SEM. The adsorption capacity was evaluated in a multi-component fashion for a mixture of five NSAIDs, namely diclofenac (DCF), ibuprofen (IBF), ketoprofen (KPF), salicylic acid (SAL) and paracetamol (PAR). The evaluation of the adsorption was achieved by investigating several variables like the effect of the solution's pH, of contact time (kinetic modelling) and of the initial pharmaceuticals' concentration. Acidic pH (pH ~ 2) appeared to be the optimal pH value while the pseudo-second order kinetic model and the Langmuir model demonstrate better fitting to the adsorption kinetics and isotherms respectively. Increase of temperature from 25 to 35 °C appears to have a positive effect on the adsorption capacity and the negative values of $\Delta G°$ indicated that all target pharmaceuticals were adsorbed spontaneously to the synthesized biosorbents. Aqueous eluents with different pH values were used to accomplish desorption while pH = 6 appears to the optimum pH value for the desorption of the target pollutants.

1. Introduction

Over the last few decades, the identification of pharmaceutical compounds in aquatic systems has posed a great environmental issue since their continuous discharge into water and wastewater systems contributes to an increased threat on human health and aquatic life [1,2]. Pharmaceuticals can be characterized as major and rapidly growing category of organic pollutants notable by their constant and excessive usage with special emphasis on their pseudo-persistent nature [3,4]. In comparison with some other organic contaminants, they persist in the environment for a long period of time, where they can be accumulated even in small concentrations (in the μg/L and ng/L concentration range). Their unrestrained discharge into environmental systems can have short or long-term harmful effects on human health [5]. This is a category of pollutants with high and continuous influx into the ecosystem whose impact on biota has not been sufficiently examined, especially when it comes to pharmaceutical cocktails, their degradation process and forming of transformation products [6]. Taking into account that their daily use is inevitable, but also that their used amounts all over the world are not fully controlled, these organic compounds can be considered a very alarming category of pollutants and as such very suitable for further research. Taking into

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PUBLICATIONS

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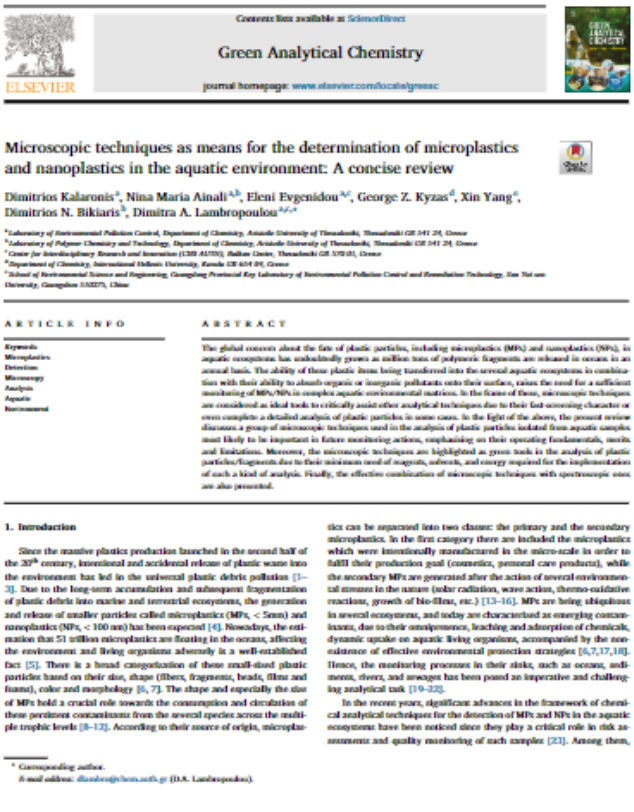
Green Analytical Chemistry



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Microscopic techniques as means for the determination of microplastics and nanoplastics in the aquatic environment: A concise review

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ABSTRACT

The global concern about the fate of plastic particles, including microplastics (MPs) and nanoplastics (NPs), in aquatic ecosystems has undoubtedly grown as million tons of polymeric fragments are released in oceans in an annual basis. The ability of these plastic items being transformed into the several aquatic ecosystems in combination with their ability to absorb organic or inorganic pollutants onto their surface, raises the need for a sufficient monitoring of MPs/NPs in complex aquatic environmental matrices. In the frame of these, microscopic techniques are considered as ideal tools to critically assist other analytical techniques due to their fast screening character or even complete a detailed analysis of plastic particles in some cases. In the light of the above, the present review discusses a group of microscopic techniques used in the analysis of plastic particles isolated from aquatic samples most likely to be important in future monitoring actions, emphasizing on their operating fundamentals, merits and limitations. Moreover, the microscopic techniques are highlighted as green tools in the analysis of plastic particles/fragments due to their minimum need of reagents, solvents, and energy required for the implementation of such a kind of analysis. Finally, the effective combination of microscopic techniques with spectroscopic ones are also presented.

1. Introduction

Since the massive plastics production launched in the second half of the 20th century, intentional and accidental release of plastic waste into the environment has led in the universal plastic debris pollution [1–3]. Due to the long-term accumulation and subsequent fragmentation of plastic debris into marine and terrestrial ecosystems, the generation and release of smaller particles called microplastics (MPs, < 5mm) and nanoplastics (NPs, < 100 nm) has been expected [4]. Nowadays, the estimation that 51 trillion microplastics are floating in the oceans, affecting the environment and living organisms adversely is a well-established fact [5]. There is a broad categorization of these small-sized plastic particles based on their size, shape (fibers, fragments, beads, films and foams), color and morphology [6, 7]. The shape and especially the size of MPs hold a crucial role towards the consumption and circulation of these pertinent contaminants from the several species across the multiple trophic levels [8–12]. According to their source of origin, microplastics can be separated into two classes: the primary and the secondary microplastics. In the first category there are included the microplastics which were intentionally manufactured in the micro-scale in order to fulfill their production goal (cosmetics, personal care products), while the secondary MPs are generated after the action of several environmental stressors in the nature (solar radiation, wave action, thermo-oxidative reactions, growth of bio-films, etc.) [13–16]. MPs are being ubiquitous in several ecosystems, and today are characterized as emerging contaminants, due to their omnipresence, leaching and adsorption of chemicals, dynamic uptake on aquatic living organisms, accompanied by the non-existence of effective environmental protection strategies [6,7,17,18]. Hence, the monitoring processes in their sinks, such as oceans, sediments, rivers, and seawater has been posed an imperative and challenging analytical task [19–22].

In the recent years, significant advances in the framework of chemical analytical techniques for the detection of MPs and NPs in the aquatic ecosystems have been noticed since they play a critical role in risk assessment and quality monitoring of such samples [23]. Among them,

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