

Importance of Monitor and Control on New-Emerging Pollutants in Conventional Wastewater Treatment Plants

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Abstract

The wide occurrence of new-emerging pollutants and their potential environmental and ecological risks have recently caused great public concerns. The paper firstly put forward the severe problem. Then the possible main reasons were analyzed which might attribute to both the inefficient removal of wastewater treatment plants with conventional technology and ignorance of the monitor and control of new-emerging pollutants in the effluents. Also, the complexity and extreme high costs may also make the organizations sidestep the problem. Finally, possible strategies to deal with the problems were proposed. The upgrade of wastewater treatment plants was important and urgent.

Keywords

New-Emerging Pollutants, Environmental and Ecological Risks, Inefficient Removal, Wastewater Treatment Plants, Upgrade

1. Introduction

As the social and industrial development, more and more new-emerging organic pollutants (NEOPs), such as the pharmaceuticals and personal care products (PPCPs), were detected in natural environments [1], and have been enormously documented to be devastating to ecological biodiversity and public health [2] [3] [4] [5]. But the intentions and measures taken to deal with the environmental health problem are weak. For example, in 2014, World Health Organization firstly reported the causal relationships between antibiotics and severe diseases in humans and warned the public as a world crisis [6]. However, high concen-

trations of antibiotics were still extensively detected in aquatic environment, even in drinking water in China in 2016 [7]. The newly found antidepressants in Great Lakes and psychoactive pharmaceuticals in Czech Republic with evident toxicity to aquatic organisms are also typical examples of such events [5] [8]. The constantly reported environmental risks caused by NEOPs lead to public panic and drive us to keep close eyes on their environmental behaviors and explore effective approaches to handle the problems.

2. Possible Reasons for the Wide Occurrence of NEOPs

Wastewater treatment plants (WWTPs) are commonly regarded as the most important barrier to prevent the entry of pollutants into environments but they failed to play the roles in new-emerging micro-pollutants removal. Numerous studies have demonstrated that the discharge from WWTPs is one of the largest sources for new-emerging organic pollutants to natural environment [1] [3] [9] [10]. Many NEOPs are derived from the public's daily life, such as the highlighted PPCPs, then discharged and entered into the WWTPs directly [8]. Unfortunately, the current municipal wastewater treatment systems are not specifically designed to remove these pollutants and thus the inefficient removal (most of them are below 50%) results in the release and occurrence of organic contaminants residues in different environments such as surface water, soil, sediments and even drinking water [2] [3] [5].

The deep-rooted reason for the problem is that the importance on the NEOPs removal in WWTPs is far below recognized, especially in developing countries. The "modern" WWTPs still follow the traditional standards and focus on the efficient removal of typical COD, total nitrogen, phosphate and *et al.*, which is obviously outdated. The lack of discharge standards for NEOPs usually results in the invalid supervision. Under the "illusion" of low COD in effluents, the concentrations as well as the ecological impacts of NEOPs are involuntarily ignored. However, the loads of such pollutants that entry into natural environments via WWTPs discharge and the subsequent impacts are both enormous considering the huge amounts of effluents (*i.e.* In 2016, the treated wastewater is up to 170 million m³/d with the pollutants concentration varying from ng/L to µg/L currently in China) [9] [11], and the persistent and bio-accumulative properties of pollutants. Therefore, one of the potential approaches to effectively relieve the side impacts of NEOPs is to further make the most of WWTPs.

It is undeniable that the difficulty and complexity of monitoring all the possible NEOPs in effluents and the correspondingly extreme high costs may also make the organizations sidestep the problem.

3. Potential Approaches to Control the NEOPs

In order to efficiently control the source of NEOPs in natural environment, the upgrade of WWTPs was quite necessary and urgent. In future, it should no longer merely focus on the optimization of processes for deep removal of nitro-

gen and phosphate and energy sustainability for economic benefits (e.g. Chinese government is currently sparing no efforts in WWTPs upgrade, but it still focus on further control of nitrogen and phosphate) [12]. The ideal operation of WWTPs must try to consider every aspect, especially those closely correlating environmental and ecologic safety. Undoubtedly, the enhancement of NEOPs degradation should be also prioritized. From this perspective, the ultra-deep treatments that specially target at micro-pollutants, such as the effective and rapid advanced oxidation and reverse osmosis, are necessarily and mandatorily adopted in large application in future WWTPs [9]. Simultaneously, the establishments of discharging standards for NEOPs in effluents and strict executions and supervision by governments are extremely urgent and important for efficient control as well. But the rapid and accurate monitoring approaches in determining the possible NEOPs in wastewater should firstly be conducted and formed.

Besides, part of the reasons for the wide occurrence of NEOPs in natural environments in developing countries could be attributed to the ubiquitous use of combined collection systems which brought great amounts of micro-pollutants from industrial wastewater into WWTPs that are beyond the treatment capacity [13]. Thus, the continued construction of separate drainage systems is necessary and important from the perspective of controlling NEOPs. However, the corresponding problems are the increase of operational costs and the difficulty in management which make it hard to completely implement in short time. However, a comprehensive environmental-ecological benefit should be considered which would inevitably entail the economic input.

4. Conclusion

The monitor and control of NEOPs are quite necessary and urgent. Though there are still some technical problems and economic issues to overcome which make it a long way to go, it is quite worthwhile for the sustainable ecosystems and welfare of humans when considering the potential catastrophic consequence of NEOPs.

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Notes

The authors declare no competing financial interest.

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