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Mini Review

Removal of Pharmaceutical and Personal Care Products PPCPs from Wastewater

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Abstract

Water pollution gained worldwide attention due to the severity of the concern where many places of the world are going through the drought and groundwater pollution. Pharmaceuticals and personal care products (PPCPs). PPCPs are the unadorned and noxious pollutants, although water purification processes by various techniques as bioremediation, phytoremediation, conventional wastewater treatment etc. are taking place. For PPCPs, there are no specific method is discovered yet where convention treatment is found inappropriate for the same. This research will lead the PPCPs removal from the industrial wastewater, which comprises the photo catalysis as well as absorbent method. Photo catalysis, an emerging concept is trusted as effective treatment methods for the removal and determination of PPCPs from wastewater treatment because of the efficiency and feasibility. Furthermore, a detailed studyis required on blending other techniques with the photo catalysis like Advance Oxidation Process (AOP)and absorbent method. This research will focus on the thorough purification of PPCPs from wastewater through Photo-catalysis and Advance Oxidation Process (AOP) [1,2].

Keywords: Wastewater; PPCPs; Photo catalysis; Wastewater Treatment

Introduction

Water is the basic component that supports life on the earth and the precious natural resource. Water pollution is the key concern worldwide, which is to be a cure at every level. Industrial wastewater is treated at every possible way and it is utilized for the irrigation and aquaculture. India is holding the third position in terms of Pharmaceutical industries by volume. Which contribute a large variant of water pollutant in low concentration. Pharmaceutical and Personal care Products (PPCPs) are the emerging pollutants in wastewater, which is not efficient removed even after the conventional wastewater treatment. However, it may not cause any immediate effect to the life on the earth, but it may be big concern when it will be exposed a longer period [3-5]. The scientific and industrial communities are still a long way from the most effective, economic and applicable methods to reach these goals and overcome the current WWTP challenges. Although the challenges of the removal of PPCPs from wastewater treatment are significant, a number of these challenges are possibly temporary, including economic, technical and environmental hurdles. A serious collaboration between research, industrial and governmental sectors is essential to solving these challenges. There are some researches, which is taking place in various research centers worldwide [6].

Currently, in the available literature, most studies Advance Oxidation Processes are Fenton Oxidation process, Ozone Oxidation, H_2O_2 Oxidation, Electrochemical methods and Nonchemical methods as well as photochemical degradation using UV. It is found, there is a need to coupled advance oxidation processes. PPCPs can be removed efficiently by using Physical and biological agents combined. Therefore, the biological couplings with chemical techniques are not covered yet in the literature. It may produce the efficient removal of PPCPs from the wastewater [7].

Literature Review

L. T. Lemmuel et al. (2018) elaborated about the recent research on PPCPs removal. Study states that the advances in analytical chemistry instrumentation, low levels of PPCPs can now be detected by mass spectroscopy which may be coupled to either liquid or gas chromatography. Adsorption is the most popular physical method, which is often used for removal of trace organic pollutants in water and one of the main processes for

removing PPCPs in the environment. For biological approaches the use of microbes for degradation processes are the most important removal mechanism for organic pollutants in the environment, which has many advantages such as low cost and mild operational conditions. Microbes in either pure culture or mixed cultures can remove the pollutants by utilizing the essential elements or the carbon backbone of the PPCPs for their metabolic functions and in most cases the microbial consortia cooperate together in the removal of the pollutants. Some of the well-known advanced oxidation (AO) methods are ozonation, UV oxidation processes, conventional Fenton oxidation and Fenton-like systems, photocatalysis, ultrasonication (US) and electrochemical methods, while rapidly evolving advanced oxidation technologies include ionizing radiation, microwaves, pulsed plasma and the use of ferrate reagent. Current technologies for AOPs can be employed either alone or in combination with other physico-chemical or biological processes for actual wastewater treatment [8].

J. E.Anekwe et al. (2017) explained that PPCPs are a group of emerging contaminants with physicochemical characteristics that distinguish them from other contaminants (e.g. persistent organic pollutants). Pharmaceuticals are structurally designed to maximize their biological activity at low concentrations and developed to produce a prolonged action. These properties highlight the risks associated with the inadvertent presence of PPCPs in the environment. S. Honglan et al (2012) concluded in his study that emerging contaminant compounds occur in trace concentrations in waters, their adverse effects to aquatic organisms, animals, and humans cannot be underestimated due to their continuous release into the water systems. The assessment and removal of emerging contaminants and their transformation products in natural and drinking waters are challenging tasks because of the complexity of contaminants in water samples. However, tremendous progress has been made on assessment of many emerging contaminants due to the great efforts and times committed by many scientists working in different research fields. The effectiveness of the treatment depends not only on the properties of the technique, but also on various environmental conditions and variables used for the processes, e.g. in physical removal process, it depends on pH, ionic strength, temperature, existence of competing organic or inorganic compounds in solution, initial adsorb ate and adsorbent concentration, contact time and speed of rotation, particle size of adsorbent, etc [9].

S. Esplugas et al. (2007) studied and stated AOPs (Advanced oxidation processes) such as UV/H2O2 or UV/O3 processes should be considered for their effective removal. Advanced oxidation processes (AOPs) constitute a promising technology for the treatment of wastewaters containing pharmaceuticals and personal care products (PPCPs) and especially endocrine disrupting chemicals (EDCs). Data concerning the degradation of PPCPs and EDCs by means of AOPs. Ozonation is the oxidation process most studied, gives the best expectative because feasible techniques need to be in place to remove them or at least reduced them below the regulated levels. Identification of the contaminants PPCPs can be done with the help of HPLC, GC-MS and LC-MS etc. whereas the removal of PPCPs can be experiment by using various absorbents and Photo-catalytic agents (Figure 1) [10].

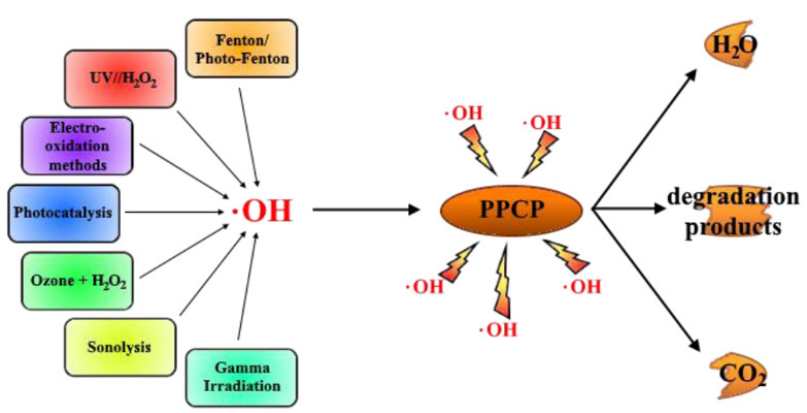

Figure 1: General mechanism of PPCP degradation using advanced oxidation processes.

Conclusion

Analytical and environmental application Such as removal of PPCPs, reduction of a waterborne pathogen or antibacterial tests as well as physicochemical analysis of industrial wastewater quality, it helps to achieve the sustainable development goals for e.g. clean water and sanitation. More attention and efforts should be given to these topics to be developed and know all details concerning the toxicity of PPCPs and how can be removed from our environment.

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