

Phthalates as Emerging Pollutants in Water Environment: Control & Treatment Strategies

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Emerging pollutants (EPs) refer compounds that have not previously have been detected in water or sewage or their concentrations aren't detectable. Nonetheless, today they are detected in water and sewage. The EPs include pharmaceuticals compounds such as antibiotics and hormone, plasticizers such as phthalates, surfactants, some herbicides, and flame retardants worldwide ^{1, 2}. Developing in industry, agriculture, and medicine, as well as increasing human needs for survival, has increased production and consumption of these materials. The excessive use of these compounds has led to the release of these pollutants into the drinking water and aquatic ecosystems ³.

An important class of emerging pollutants is phthalates. Phthalates are extensively used in plastic industries in order to increase the flexibility and quality of products. They are also used in cosmetics products, shampoo, soap, toys, and etc. Approximately 60 types of phthalates

are produced in the universe. Phthalate diethylhexyl (PDE), phthalate dibutyl (PDB), and phthalate dimethyl (PDM) are the most important compounds that are used in industries. ^{4, 5}. Since most phthalate compounds have hydrophobic interaction, low solubility properties, and also chemical reactions phthalate are very weak with other components, therefore they are easily released into the aqueous environment. Phthalates have been detected in the air, soil, surface water, and groundwater. It was reported the maximum amount of Phthalates are in the range of ng to µg per liter, and ng.g⁻¹ in the water, and sediments, respectively ^{6, 7}.

Although phthalates have the low range of concentrations in the environment, they have hazardous effects on animal and human health. Furthermore, some phthalate compounds can cause adverse effects in particular on the gastrointestinal tract, circulation system, respiratory system, genital system, kidney and

urinary tract. Therefore, great attempts have been made lately for phthalates efficient removal from the wastewater before discharging them within the environment. So far, low comprehensive studies have been conducted for determination and removal of phthalates from the aqueous environment, including adsorption by graphene oxide⁸, Activated sludge use extended aeration^{9, 10}, chlorination^{11,12} have been used to removal of phthalates.

Each of the water treatment processes has a number of disadvantages, including operating and maintenance cost, inefficiency, long reaction time, sludge production, and the need to manage sludge production¹³. The most important problem with the above processes is to transfer pollutants from one phase to another phase without degradation or decomposition of contaminants. Today, advanced oxidation processes (AOPs) have received considerable attention to decompose toxic and non-degradable pollutants which can produce radical hydroxyl ($\cdot\text{OH}$) under conditions of ambient pressure and temperature conditions^{1, 14}. After radical fluorine, which is the strongest oxidant agent, Radical hydroxyl ($\cdot\text{OH}$) is ranked second. $\cdot\text{OH}$ attacked the organic compounds in the liquid phase and degraded it and finally converted organic compounds into mineralization, decomposition, degradation and harmless forms such as CO_2 and H_2O . Some of the processes that produce hydroxyl radicals including catalysts^{15, 16}, $\text{UV}/\text{H}_2\text{O}_2$ ¹⁷, O_3 ¹⁸, UV/O_3 ¹⁹, Fenton²⁰, Electro Fenton²¹, ultrasonic waves^{21, 22}, and combination oxidation process are the most common class of AOPs. Advanced oxidation processes can be used as an effective technique to remove phthalates and other EPs. In addition to a treatment process that reduces and eliminate pollutants, appropriate use of products and replacing these materials with those that are environmentally friendly can be an approach to prevent the release of these EPs to the environment.

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References

1. Ahmadzadeh S, Dolatabadi M. Removal of acetaminophen from hospital wastewater using electro-Fenton process. *Environ Earth Sci*. 2018; 77(2): 53-64.
2. Deblonde T, Cossu-Leguille C, Hartemann P. Emerging pollutants in wastewater: a review of the literature. *Int J Hyg Environ Health*. 2011; 214(6): 442-8.
3. Gavrilescu M, Demnerová K, Aamand J, et al. Emerging pollutants in the environment: present and future challenges in biomonitoring, ecological risks and bioremediation. *New Biotechnology*. 2015; 32(1): 147-56.
4. Bodzek M, Dudziak M, Luks-Betlej K. Application of membrane techniques to water purification. Removal of phthalates. *Desalination*. 2004; 162(1): 121-8.
5. Tamamushi K, Wilson DJ. Removal of refractory organics by aeration. VI. Solvent sublation of alkyl phthalates. *Sep Purif Technol*. 1984; 19(14): 1013-23.
6. Dargnat C, Teil M-J, Chevreuil M, Blanchard M. Phthalate removal throughout wastewater treatment plant: case study of Marne Aval station (France). *Sci Total Environ*. 2009; 407(4): 1235-44.
7. Mohan SV, Shailaja S, Krishna MR, et al. Adsorptive removal of phthalate ester (Di-ethyl phthalate) from aqueous phase by activated carbon: A kinetic study. *J Hazard Mater*. 2007; 146(1-2): 278-82.
8. Adhoum N, Monser L. Removal of phthalate on modified activated carbon: application to the treatment of industrial wastewater. *Sep Purif Technol*. 2004; 38(3): 233-9.
9. Chen CY, Wu PS, Chung YC. Coupled biological and photo-Fenton pretreatment system for the removal of di-(2-ethylhexyl) phthalate (DEHP) from water. *Bioresour Bioprocess*. 2009; 100(19): 4531-4.
10. Roslev P, Vorkamp K, Aarup J, et al. Degradation of phthalate esters in an activated

- sludge wastewater treatment plant. *Water Res.* 2007; 41(5): 969-76.
11. Chen G, Hu H, Wu T, et al. Rapid and sensitive determination of plasticizer diethylhexyl phthalate in drink by diffuse reflectance UV spectroscopy coupled with membrane filtration. *Food Control.* 2014; 35(1): 218-22.
 12. Zhang W, Xu Z, Pan B, et al. Assessment on the removal of dimethyl phthalate from aqueous phase using a hydrophilic hyper-cross-linked polymer resin NDA-702. *J Colloid Interface Sci.* 2007; 311(2): 382-90.
 13. Ahmadzadeh S, Dolatabadi M. In situ generation of hydroxyl radical for efficient degradation of 2, 4-dichlorophenol from aqueous solutions. *Environmental monitoring and assessment.* 2018; 190(6): 340.
 14. Ahmadzadeh S, Dolatabadi M. Modeling and kinetics study of electrochemical peroxidation process for mineralization of bisphenol A; a new paradigm for groundwater treatment. *J Mol Liq.* 2018; 254: 76-82.
 15. Vogna D, Marotta R, Napolitano A, et al. Advanced oxidation of the pharmaceutical drug diclofenac with UV/H₂O₂ and ozone. *Water Res.* 2004; 38(2): 414-22.
 16. Muruganandham M, Swaminathan M. Photochemical oxidation of reactive azo dye with UV-H₂O₂ process. *Dyes Pigm.* 2004; 62(3): 269-75.
 17. Liu Yx, Zhang J. Photochemical oxidation removal of NO and SO₂ from simulated flue gas of coal-fired power plants by wet scrubbing using UV/H₂O₂ advanced oxidation process. *Ind Eng Chem Res.* 2011;50(7):3836-41.
 18. Calvert JG, Lindberg SE. Mechanisms of mercury removal by O₃ and OH in the atmosphere. *Atmos Environ.* 2005;39(18):3355-67.
 19. Shu HY, Chang MC. Decolorization effects of six azo dyes by O₃, UV/O₃ and UV/H₂O₂ processes. *Dyes Pigm.* 2005; 65(1): 25-31.
 20. Wang CT, Hu JL, Chou WL, et al. Removal of color from real dyeing wastewater by Electro-Fenton technology using a three-dimensional graphite cathode. *J Hazard Mater.* 2008; 152(2): 601-6.
 21. Wang CT, Chou WL, Chung MH, et al. COD removal from real dyeing wastewater by electro-Fenton technology using an activated carbon fiber cathode. *Desalination.* 2010; 253(2): 129-34.
 22. Lin SH, Chang CC. Treatment of landfill leachate by combined electro-Fenton oxidation and sequencing batch reactor method. *Water Res.* 2000; 34(17): 4243-9.