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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 oxide [8], 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 production [13]. 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 (•OH) under conditions of ambient pressure and temperature conditions [1, 14]. After radical fluorine, which is the strongest oxidant agent, Radical hydroxyl (•OH) is ranked second. •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]. UV/H_2O_2 [17], O_3 [18], UV/O_3 [19], Fenton [20], Electro Fenton [21], 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 EP_s to the environment.

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