Austin Journal of Environmental Toxicology

Open Access

Austin Publishing Group

Editorial

# Removal of Toxic and Carcinogenic Pollutants by Aops

**Aref Shokri***
Department of Young Researchers and Elite Club, Arak Branch, Islamic Azad University, Arak, Iran

***Corresponding author:** Aref Shokri, Department of Young Researchers and Elite Club, Arak Branch, Islamic Azad University, Arak, Iran

**Received:** June 13, 2017; **Accepted:** October 12, 2017; **Published:** October 19, 2017

## Introduction

Cancer is the main leading cause of death in the world. One of the main causes of cancer is chemical agents, such as chemical pollutants like benzene derivatives, ortho toluidine, aniline and so on. These compounds can originate Methomoglobina. It occurs when Red Blood Cells (RBCs) contain Methemoglobin at levels higher than 1%. The Methemoglobin (MetHb) outcomes from the presence of iron in the Ferric form as an alternative of the usual Ferrous form [1]. This results in a reduced availability of oxygen to the tissues. Signs are proportional to the Methemoglobin level and include skin and blood color changes at levels up to 15%. As levels rise above 15%, neurologic and cardiac symptoms arise as a consequence of hypoxia. Levels higher than 70% are usually mortal.

Hemoglobin (Hb) is one of the most significant hem proteins contained in red blood cells in mammals. Also, its important function as an oxygen transporter in the blood, it is able to catalyze the oxidation of a large number of compounds since in its encountered state (MetHb, Hb-FeIII) and in the presence of hydrogen peroxide, it shows peroxidase-like and catalase-like activities [2,3].Various toxic pollutants treatment processes have been tried using physical, chemical, and biological methods. Some of these methods have disadvantages, and cannot be applied for large scale treatment. For example, one weakness of precipitation methods is sludge creation. Chemical coagulation and flocculation use a large amount of chemicals and the produced sludge may contain toxic materials, so sludge removal remains a problem. Adsorption techniques have been used broadly for the removal of different wastewater pollutants. Their disadvantage is that the pollutants may only transfer to the adsorbent, extract from one phase to another, resulting in additional costs and treatments [4]. Membrane technologies have been employed for the full scale treatment and reuse of water and chemicals. However, these methods have several operational difficulties in addition to high capital costs. As a result, physical methods may not be appropriate for the full removal of pollutants from the environment. In the same way, two different basic biological remediation methods have been used: aerobic and anaerobic treatments. These methods also do not absolutely remove the high concentration of pollutants. Other biological methods are not economic and have operational difficulties, making biological means inappropriate.

Even though oxidation processes, including hydroxyl radicals have been in use since the late 19th century, the utilization of such oxidative species in water treatment did not receive adequate attention until Glaze et al., suggested the possible generation of hydroxyl radicals and defined the term "Advanced Oxidation Processes" for the first time in 1987 [5]. The Advanced Oxidation Processes (AOPs) are based on the in-situ creation of highly reactive hydroxyl radicals. These reactive species are the strongest oxidants that can be used to oxidize any compound present in the water matrix, often at a diffusion controlled reaction speed. Thus, hydroxyl radical reacts unselectively once formed and contaminants will be quickly and efficiently degraded and converted into small inorganic species. Hydroxyl radicals are produced with the help of one or more primary oxidants (ozone, hydrogen peroxide, oxygen) and/or energy sources (ultraviolet light) or catalysts (titanium and zinc dioxide). Advanced oxidation generally uses strong oxidizing agents like Hydrogen peroxide ($H_2O_2$) or Ozone ($O_3$), catalysts (iron ions, electrodes, metal oxides) and irradiation (UV light, solar light, ultrasounds) separately or in combination at mild conditions (low temperature and pressure) [6,7]. Among different available AOPs, those driven by light seem to be the most popular technologies for wastewater treatment as shown by the large amount of data available in the literature. Solar AOPs are particularly attractive due to the abundance of solar light in regions where water scarcity is high and due to their relatively low costs and high efficiencies. The exact, estimated dosages, orders and blends of these reagents are employed to get a maximum efficiency. Generally, when applied in optimized conditions, AOPs can reduce the concentration of contaminants and therefore considerably bring Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC) down, which earned it the credit of water treatment processes of the 21$^{st}$ century.

The AOP procedure is mostly useful for cleaning biologically toxic or non-degradable materials such as aromatics, pesticides, petroleum constituents, and volatile organic compounds in wastewater. Moreover, AOPs can be used to treat effluent of secondary treated wastewater which is then called tertiary treatment. The contaminant compounds are converted into stable inorganic compounds such as water, carbon dioxide and salts. The purpose of the wastewater remediation by means of AOP procedures is the lessening toxicity and chemical pollutants to such an extent that the cleaned wastewater may be recycled into receiving streams or, at least, into a conventional sewage treatment [8].

AOPs still have not been put into commercial use on a large scale (especially in developing countries) even up to today mostly because of the relatively high costs. However, its high oxidative capability and efficiency make AOPs to be an accepted method at tertiary treatment in which the most recalcitrant organic and inorganic contaminants are removed. The rising interest in water reuse and more stringent regulations regarding water pollution are currently accelerating the performance of AOPs at full-scale. There are approximately 500 commercialized AOPs installations in the world at present, mostly in Europe and the United States. Other countries like China are showing growing interests in AOPs.


**ISSN: 2472-372X** | www.austinpublishinggroup.com


**Citation:** Shokri A. Removal of Toxic and Carcinogenic Pollutants by Aops. Austin J Environ Toxicol. 2017; 3(1): 1019.

AOPs have a wide range of applications such as air purification, soil remediation and water decontamination. In water, these processes have the ability to destroy organic pollutants, but they can also be adapted to the removal of inorganic metals. Moreover, AOPs are successful to inactivate bacteria, viruses etc. Various kinds of water are therefore suitable for an AOP treatment: for example industrial waste water comprising toxic compounds can be treated by solar photo-Fenton; surface or ground water can be disinfected by means of improved solar water disinfection by adding $H_2O_2$; both bacteria in drinking water plants or micro-pollutants in sewage system can be degraded using ozonation [9]. Dissolved arsenic can be removed from water by co-precipitation by means of simple methods in presence of iron.

The Advantages of AOPs are Destroys toxic organic compounds without pollution transfer to another phase, Very efficient to treat almost all organic pollutants and remove some toxic metals, Works also for water disinfection, Cheap to install, and being Flexible to small scales in developing countries.

The Weaknesses of AOPs are comparatively high operational costs due to chemicals or energy input, Creation of oxidation intermediates potentially toxic, and Engineers are required for the design and operation.

AOPs can degrade toxic and aromatic carcinogenic pollutants by the absorbing a hydrogen atom from structure or an electron from the ring to destroy the aromatisity and stability of the compound. The intermediate elements can be destroyed by hydroxyl radicals again and finally the mineralization of pollutants and production of carbon dioxide and water had happened [10].

## Conclusion

Therefore, the classic methods are a separation method, transfer the pollutants from one phase to another, but the AOPs can degrade the pollutants basically. The AOPs can combine with classical methods to save capital and energy in large scale.

## References


1. Ferlay J, Parkin DM, Steliarova-Foucher E. Estimatesof cancer incidence and mortality in Europe in 2008. Eur J Cancer. 2010; 46: 765-781.
2. Danford N, The genetic toxicology of ortho-toluidine. Mutat Res. 1991; 258: 207-236.
3. Gaber K, Harréus UA, Matthias C, Kleinsasser NH, Richter E. Hemoglobin adducts of the human bladder carcinogen o-toluidine after treatment with the local anesthetic prilocaine. Toxicology. 2007; 229: 157-64.
4. Shokri A, Mahanpoor K & Soodbar D. Degradation of Ortho-Toluidine in petrochemical wastewater by ozonation, UV/$O_3$, $O_3$/H2$O_2$ and UV/$O_3$/$H_2O_2$ processes. Desal. Water Treat. 2016; 57: 16473-16482.
5. Glaze WH, Kang J, Chapin H. The Chemistry of Water Treatment Processes Involving Ozone, Hydrogen Peroxide and Ultraviolet Radiation. Ozone Science Eng. 1987; 9: 335-352.
6. Shokri A. Degradation of 2-Nitrophenol from Petrochemical Wastewater by Ozone. Russ. J Appl Chem., 2015; 88: 2038-2043.
7. Shokri A. Investigation of UV/$H_2O_2$ process for removal of Ortho-toluidine from industrial wastewater by response surface methodology based on the central composite design. Des.Wat.Treat. 2017; 58: 258-266.
8. Shokri A, Mahanpoor K, Soodbar D. Evaluation of a modified TiO2 (GO-B-TiO2) photo catalyst for degradation of 4-nitrophenol in petrochemical wastewater by response surface methodology based on the central composite design. J Environ Chem Eng. 2016; 4: 585-598.
9. Lucas MS, Peres JA, Puma GL. Treatment of winery wastewater by ozone-based advanced oxidation processes ($O_3$, $O_3$/UV and O3/UV/$H_2O_2$) in a pilot-scale bubble column reactor and process economics. Sep. Purif. Technol. 2010; 72: 235-241.
10. Gharbani P, Mehrizad A. Heterogeneous catalytic ozonation process for removal of 4-chloro-2-nitrophenol from aqueous solutions, J. Saudi Chem. Soc. 2014; 18: 60-605.


Austin J Environ Toxicol - Volume 3 Issue 1 - 2017
ISSN: 2472-372X | www.austinpublishinggroup.com


Citation: Shokri A. Removal of Toxic and Carcinogenic Pollutants by Aops. Austin J Environ Toxicol. 2017; 3(1): 1019.