Water & Ice process solution

Introduction:

Advanced oxidation processes (AOPs) are a set of chemical treatment procedures designed to remove organic and sometimes inorganic materials from water and wastewater by oxidation through reactions with hydroxyl radicals (·OH) or sulphate radicals ($SO4^{\cdot-}$)[12]. These reactive species are the strongest oxidants that can be applied in water and can oxidize virtually any compound present in the water matrix, often at a diffusion-controlled reaction speed[1].

AOPs rely on the in-situ production of highly reactive hydroxyl radicals (·OH) or sulphate radicals ($SO4^{\cdot-}$). These radicals are produced with the help of one or more primary oxidants (e.g. ozone, hydrogen peroxide, oxygen) and/or energy sources (e.g. ultraviolet light) or catalysts (e.g. titanium dioxide). Precise, pre-programmed dosages, sequences, and combinations of these reagents are applied in order to obtain a maximum •OH or $SO4^{\cdot-}$ yield[1].

The AOP procedure is particularly useful for cleaning biologically toxic or non-degradable materials such as aromatics, pesticides, petroleum constituents, and volatile organic compounds in wastewater. Additionally, AOPs can be used to treat effluent of secondary treated wastewater which is then called tertiary treatment. The contaminant materials are largely converted into stable inorganic compounds such as water, carbon dioxide, and salts, i.e., they undergo mineralization[1].

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Advantages:

Advanced oxidation processes (AOPs) are a set of chemical treatment procedures designed to remove organic and sometimes inorganic materials in water and wastewater by oxidation through reactions with hydroxyl radicals (·OH)

AOPs have several advantages, including:

1. **Rapid reaction rates**: Hydroxyl radicals have some of the fastest reaction rates of all the oxidants used to treat water, Aquaculture and wastewater due to their high oxidation potentials and nonselective nature[2].
2. **Small footprint**: Advanced oxidation process units do not require much land area to process the needed flow rate for the system[2].
3. **Potential to reduce toxicity of organic compounds**: AOPs can reduce the toxicity of organic compounds by converting them into salt and CO2[2].
4. **Mineralization of organics**: AOPs can mineralize organic compounds, meaning they can convert them into stable compounds[2].
5. **Low sludge production**: AOPs do not concentrate waste for further treatment, such as membranes, or produce “spent carbon” such as activated carbon absorption[2].
6. **Easily automated and controlled**: AOPs can be easily automated and controlled, reducing labor input[2].
7. **Minimal environmental impact**: Theoretically, AOPs do not introduce new hazardous substances into water[3].

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Challenges:

Advanced Oxidation Processes (AOPs) are a set of chemical treatment procedures designed to remove organic and inorganic materials in wastewater. While AOPs have been shown to be effective in treating a wide range of contaminants, there are several challenges associated with their use.
One of the main challenges of AOPs is their **high cost**. This is due to the use of energy through radiation devices during photo-oxidative degradation operations, which can be expensive[1].
Another challenge is the **energy consumption** associated with AOPs. The use of energy-intensive processes such as UV radiation and ozonation can result in high energy costs, which can make AOPs less attractive from an economic standpoint[1].

The formation of **byproducts** is another challenge associated with AOPs. The use of chemical oxidants such as ozone and hydrogen peroxide can result in the formation of harmful byproducts, which can pose a risk to human health and the environment.
Finally, **process optimization** is a challenge for AOPs. The effectiveness of AOPs can vary depending on factors such as the type and concentration of contaminants, the pH and temperature of the Aquaculture, wastewater, and the type and dosage of oxidants used. As a result, it can be difficult to optimize the process to achieve maximum treatment efficiency[1].

Overall, while AOPs have shown promise in treating a wide range of contaminants, there are several challenges that must be addressed in order to make them more widely adopted. These challenges include high cost, energy consumption, byproduct formation, and process optimization. [15]

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Applications:

Advanced Oxidation Processes (AOPs) are a set of chemical treatment procedures designed to remove organic and sometimes inorganic materials in water, Aquaculture and wastewater by oxidation through reactions with hydroxyl radicals (·OH)[1]. AOPs were first proposed in the 1980s for drinking water treatment and later were widely studied for treatment of different wastewaters[2]. During the AOP treatment of wastewater, hydroxyl radicals (OH·) or sulphate radicals (SO4 ·−) are generated in sufficient quantity to remove refractory organic matters, traceable organic contaminants, or certain inorganic pollutants, or to increase wastewater biodegradability as a pre-treatment prior to an ensuing biological treatment[2].

AOPs are applied for different types of water, Aquaculture and wastewater treatment, such as landfill leachate[2], biologically treated municipal wastewater[2], drinking water[4], and industrial effluents[5].

For example:

- Landfill leachate: AOPs are an efficient and powerful treatment for landfill leachate. AOPs are classified into different types, including photocatalytic oxidation, Fenton or Fenton-like processes, electrochemical oxidation, and persulfate-based AOPs[3].
- Biologically treated municipal wastewater: During the AOP treatment of biologically treated municipal wastewater, hydroxyl radicals (OH·) or sulphate radicals (SO4 ·−) are generated in sufficient quantity to remove refractory organic matters, traceable organic contaminants, or certain inorganic pollutants[4].
- Drinking water: Advanced oxidation processes (AOPs) were first proposed for potable water treatment in the 1980s [5], which are defined as the oxidation processes involving the generation of hydroxyl radicals (OH·) in sufficient quantity to effect water purification[6].
- Industrial effluents: Fenton and ozone-based advanced oxidation processes (AOPs) are widely applied in Aquaculture industrial effluent treatment. In this process, reactive species, mainly ·OH, and other mechanisms are formed in situ [7]

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Conclusion:

Advanced oxidation processes (AOPs) are a set of chemical treatment procedures designed to remove organic and sometimes inorganic materials in water and wastewater by *oxidation through reactions with hydroxyl radicals* (·OH). *AOPs are particularly useful for cleaning biologically toxic or non-degradable materials such as aromatics, pesticides, petroleum constituents, and volatile organic compounds in wastewater*[1].

In recent years, AOPs have received a great deal of attention for their capability, adaptability, and efficiency in the degradation of organic wastewater contaminants with little or no leaching potential[2]. Carbonaceous materials have attracted increasing attention in AOPs due to their capability, adaptability, and efficiency in the degradation of organic wastewater contaminants with little or no leaching potential[2].

Future perspectives for AOPs in water and wastewater treatment include improving the design and properties of carbonaceous catalysts[2]. Additionally, recent advances have highlighted other advanced treatment processes (ATPs) as possible alternatives, such as advanced reduction processes (ARPs) and advanced oxidation-reduction processes (AORPs)[3]. These ATPs may remove contaminants that are not readily treatable by AOPs or offer better performance than the former[3].

In summary, AOPs are an important development for wastewater purification systems that are capable of degrading the complete organic compounds present in wastewater. Future research directions include improving the design and properties of carbonaceous catalysts and exploring other advanced treatment processes as possible alternatives.

Our company's New product

Advance Oxidation process(AOP)

Recirculating Aquaculture system

for ***fish farming*** and ***shrimp farming***

- ✓ No construction,
- ✓ Minimum electrical consumption,
- ✓ Minimum labour,
- ✓ Minimum space require
- ✓ Remove colour & order from water
- ✓ Zero foot print in water,
- ✓ Directly reduce Ammonia,
- ✓ Ammonia no covert in No2 no3,
- ✓ No3 complete remove from water,
- ✓ Chemical free,
- ✓ Complete Automatic operation

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