Peschl Ultraviolet
advanced uv-products

APPLICATION INFORMATION

Advanced Oxidation Processes (AOP)
Excellence in UV assisted water treatment

The correct UV reactor for each AOP process

Actual situation

It is a fact that during the last century a decay on quality and amount of drinking water resources has occured. It is also remarkable all the efforts focused to cope with the growing pollution of the hydrosphere.

Technologies involved in pollutant removal are adopted in goverment legislation: flocculation, coagulation, filtration, biological reactors, and many more. Used waters of normal anthropogenic origin can be efficiently treated using biological treatment stations but chemical treatment may also be applied where the capacity of the bioprocess is not enough efficient.

Nowadays, there is a real interest in new water treatment systems that can reduce the use of energy or chemical consumption. The UV assisted AOP process might be a solution for many effluents, but unfortunately there is a lack of knowledge in the industry and most of UV-AOP reactors offered are modifications of disinfection reactors coupled to a stirred contact reservoire. This inadequate design result in unoptimized installations with higher energy and chemical cost than required.

Technological Approach

Peschl Ultraviolet provide required ready to use products as well as engineering and consultancy services in the design and implementation of UV assisted AOP for organic carbon decomposition (TOC) in water, as well as tuned UV equipment for a successful project development

The AOP processes of Peschl Ultraviolet are mainly based on the generation and subsequent reaction of the hydroxyl radicals with the organic pollutants.

The hydroxyl radicals usually proceed from the photolysis of precursors such as O_3, H_2O_2 , ... That is the reason for the existence of different treatment methods.

Different technology approaches

Photo Fenton treatments

It is a complex photcatalytic reaction based on the cation Fe^{+2} catalytic capacity to split water peroxide and its regeneration thanks to the ultraviolet. A simplified reaction path is exposed in next reaction:

$Fe^{+2}_{Aq} + H_2O_2 \longrightarrow Fe^{+3}_{Aq} + \cdot OH + OH^-$

$Fe^{+3}_{Aq} + H_2O + h\nu \longrightarrow Fe^{+2}_{Aq} + \cdot OH + H^+$

UV/H_2O_2

These process implies the direct generation of Hydroxyl radicals from the photolysis of hydrogen peroxide, and the subsequent generation of 2 hydroxyl radicals as exposed in next reaction: $H_2O_2 + h\nu \longrightarrow 2\ HO\cdot$

UV/O_3

Water ozonation is a well known and implanted process. That is the main reason to use this process that can be easily retrofitted into existing ozonization installations. It is an easy way to enhance and optimize the ozonolysis of contaminants in water. Main reactions in this process are:

$O_3 + h\nu \longrightarrow O_2 + O(^1D)$

$O(^1D) + H_2O \longrightarrow 2\ HO\cdot$

$O_3 + H_2O + h\nu \longrightarrow \ldots \longrightarrow H_2O_2 + O_2$

$H_2O_2 + h\nu \longrightarrow 2\ HO\cdot$

UV/VUV photolysis

New lamp generations and special reactor design enables us to use the direct water photolysis by photons below 190 nm as a hydroxyl radical source:

$H_2O + h\nu \longrightarrow \cdot OH + 1/2\ H_2$

Evenmore the degradation of contaminats can be also initiated by its molecular phololysis within the VUV region:

$R\text{-}X + h\nu \longrightarrow R\cdot + \cdot X$

UV photocatalysis

TiO2 is able to promote the generation of hydroxyl radicals and direct degradation of absorved organic molecules:

$TiO_2 + h\nu \longrightarrow TiO_2\ (e^- + h^+)$

$TiO_2\ (h^+) + RX\ (ad) \longrightarrow TiO_2 + RX(ad)^{\cdot +}$

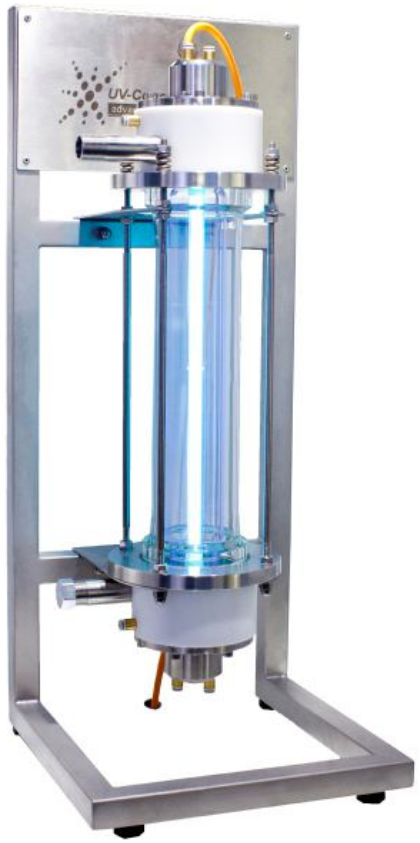
$TiO_2\ (h^+) + H_2O\ (ad) \longrightarrow TiO_2 + HO\cdot + H^+$

$TiO_2\ (h^+) + O_2\ (ad) \longrightarrow TiO_2 + O_2^{\cdot -}$

Different applications for AOPs

Typical Applications of AOPs

- Treatment of residual Active Pharmaceutical Ingredients (APIs) in water
- Elimination of drugs and pesticides in water
- Reduction of TOC in leaches coming from industrial or municipal waste dump
- Pre-treatment of no biodegradable TOC before the treatment in bioreactors
- Ultrapure water preparation
- Oxidation of solvents in water
- Degradation of organohalogenated chemicals
- Elimination of cyanide in the surface finishing industry
- Dyes degradations in water



Laboratory Reactor System **AOP**80

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Technology expertise

Improvement of the precipitation on disolved metals, chelates degration experience demonstrated that selection of one of the above listed technologies or a combination of various photochemical processes depends on many parameters and should be judged independently for each and every project. Peschl Ultraviolet offer its expertise and consultancy in cooperation with Prof. Dr. Andr M. Braun, Quantapplic.

Your partner in each project phase

Working more than 30 years on photochemical processes has been materialized in an innovative reactor design that can be used for all the UV assisted AOP with only slight modifications. We can also collaborate on the laboratory trial phase for selecting the process way as well as in a first advising meeting in order to elucidate the posibilities that UV technology offers.

Light Sources

As already exposed, one highlighted aspect of this reactor design is the versatility, offering a wide range of light sources and irradiancies. Among the UV light sources that are offered with the reactor are:

- Medium pressure mercury lamps with different doping
- Low pressure VUV mercury lamps up to 600 W
- Xe2-Excimer lamps for VUV irradiations (upon request)

The selection of the light source and reactor characteristics will depend on the chosen treatment and the effluent. In case you need assistance for the selection of the AOP process, reactor or UV light source, please do not hesitate to contact us and our application engineer will guide you to find the best solution for your task.

MTQ10-AOP Tauchlampensystem mit Glasreaktor

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