

SOLAROX-3C

What is Solar Disinfection?

Watch Water® has created a proprietary innovation **solar engine** for molecular chemistry. In the water treatment industry, product discovery never stops. Rather than relying on off-the-shelf treatment, **Watch Water®** constantly seek for new treatment that could make for better results. **Watch-TiO₂** is used in various applications for its **PHOTOCATALYTIC** properties shown in the figure. In these applications, **Watch TiO₂** in the presence of light catalyzes the degradation or other reaction of undesired chemicals or microorganisms. **Watch TiO₂** is currently used as a photocatalyst.

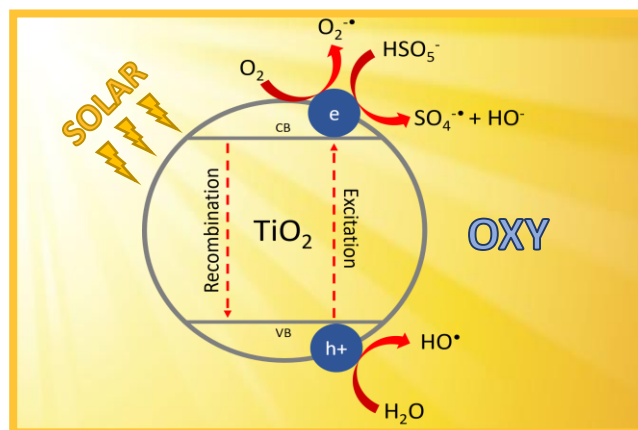
Titansorb	Adsorber for Heavy Metals	Granules
CarbonBlock-TS	Removal of organics and inorganics. Self-regenerable.	Block
SuperOxy	Regeneration of Activated Carbon	Powder

Now large-scale production and use of **Watch - TiO₂** in **SOLAROX-3C** with multiple products to clean **water pollution** from A to Z using **solar energy**.

WATER POLLUTION?

- Water Pollution:** is in our River's, Reservoirs, Lakes, and Seas are drowning in Chemicals, Plastic Waste, Pharmaceuticals, Sewage, and other pollutants.
- Water Pollution:** occurs when harmful substances – often chemicals and microorganism contaminate a stream, river, lake, ocean, aquifer, or another body of water, degrading water quality, air quality and contribute its toxic to humans or the environment.
- Water Pollution:** According to the most recent surveys on water quality from the **U.S. Environment Protection Agency**, nearly 75% of our rivers, lakes, streams and more than half of our surface water is polluted and unfit for swimming, fishing, and drinking.

TiO₂ A UNIQUE KIND OF WATER TREATMENT



Nutrient pollution, which includes nitrates and phosphates is the leading type of contamination in these freshwater sources. Whole plants and animals need these nutrients to grow, they have become a **major pollutant** due to farm waste and fertilizer runoff. Municipal and industrial waste discharge contributes to their fair share of toxins as well.

- Water Pollution:** This is mostly caused by sewage and industrial wastewater. Used water is wastewater it comes from our sinks, showers, and toilets (think sewage) and from commercial, industrial and **agriculture activities** (think metals, solvents, and toxic sludge) The term also includes **stormwater-runoff**, which occurs when rainfall carries road salt, rubber, oil, grease chemicals, and debris from impermeable surfaces into our waterways.
- Water Pollution:** More than 90% of the world's wastewater flows back into the environment without being treated or **reused**. Using **SOLAROX-3C** by wastewater treatment facilities. Billion's of gallon's of wastewater can be treated easily. This low-cost Solar technology can reduce the amount of pollutant's such as Hydrogen Sulfide, Methane, Carbon dioxide, Pathogens, Arsenic, Lead, Phosphorus and Nitrates in sewage, **SOLAROX-3C** adsorbs heavy metals and toxic chemicals.



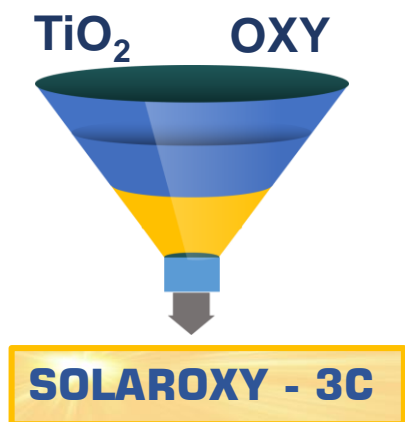
WHAT ARE THE EFFECTS OF WATER POLLUTION ?

OIL POLLUTION

Consumers account for the vast majority of oil pollution in our sea's, including oil and gasoline that drips from million of cars and trucks every day. Moreover, nearly half of the 2 million tons of oil that makes its way into marine environments each year comes not only from tanker spills but also from land-based sources such as factories, farms, and cities. At sea, tankers spills account for about 10 percent of the oil in water around the world, while regular operations of the shipping industry – through both legal and illegal discharges contribute about one third.

All mentioned water pollutions contain complex molecules that are bio-refractory in nature. Therefore, they inhibit biological water and wastewater treatment processes and cannot be completely degraded by any of the conventional biological processes. Thus, we introduced this novel method for remediation of water and wastewater.

Catalyst and Oxidation



The **Oxydes-P** is a strong oxidant with high oxidation potential of $E^\circ = 3.7 \text{ V}$ and upon activation with solar energy and catalyst TiO_2 it starts to produce strong free sulfate radicals (SO_4^\cdot), which are even stronger oxidants ($E^\circ = 4.2 \text{ V}$). Therefore, **SOLAROXY-3C** is capable to degrade almost all pollutants, even those with high toxicity and persistence. This can be applied to not only in wastewater but also in polluted Streams, Rivers, Lakes, Surface and Groundwater.

Physical and Chemical Properties of SOLAROXY-3C

Physical Name	SOLAROXY
Physical Form	Crystalline (Triclinic)
Melting Point	Decomposes at 10°C
Boiling Point	Not applicable
Formula	UV/ TiO_2 / OXYDES-P
Molecular Weight (g/mol)	270.3
Crystal density at 20°C (g/cc)	2.48
Colour	White
Odor	None
Loose bulk density (g/cc)	1.40
Solubility g/100g of H_2O_2 at 25°C in water	6

Due to **SOLAROXY-3C** unique properties it can be used for polluted soil, water and wastewater remediation or in other environmental applications. **SOLAROXY-3C** is the best available technology to oxidize non-filterable contaminants in Aquatic farms, Swimming pools and other recreational water. **SOLAROXY-3C** is in the area of **(VAOP's)** Very Advanced Oxidation Process. AOP's are applied as a pre-treatment or for complete mineralization at degradation of complex pollutants. **SOLAROXY-3C** can be defined as a process that involves the generation of both hydroxyl radicals as well as sulfate radicals as a strongest oxidant to degrade compounds that cannot be oxidized by conventional oxidants, like ineffective Aeration, Ozone, UV and Chlorine.



SOLAROXY-3C AND MICROPOLLUTANT REMOVAL

UV - Oxidation

UV-Oxidation treatment is getting bigger and brighter for over last 100 years – but – their electrical bill has also increased and going higher and higher. Solar treatment requires no power and is energy saving alternative. Only **Solar** treatment is **Green Treatment** for water and Waste Water. Watch-Water is introducing **SOLAROXY-3C** that emit ultraviolet (UV) light which could improve treatment processes for removing micropollutants in water and wastewater, including harmful pesticides and organic matter.



If the time comes when **UV-Oxidation** needs to be rolled out on a much larger scale across the Water supply network, the potential limitations to the process as it stands will become clear ; not affordable in electricity bill. The UV lamps required are expensive to purchase at the outset and expensive to run at scale. UV lamps also do not burn out as normal bulbs do. They "**SOLARIZE**" which means their intensity can be reduced by up to 60% through just one year of continuous use. This is even shorten significantly if the lamp is turned on and off frequently, meaning their effectiveness and feasibility is reduced. UV lamps also contain mercury and they often break. This lead to risk of Mercury release in water and wastewater. Also their disposal must be properly managed.

UV LAMPS ARE NOT A GREEN SOLUTION

SOLAROXY-3C in water treatment processes is a real Innovation. Watch Water **VAOP** involves the combination of **SOLAR** – **TiO₂** – **H₂O₂**. This oxidation process is very attractive for water treatment since crystalline **Watch TiO₂** can be easily separated at the end of the process and reused, which makes the treatment effective and absolute-chemical free.

Watch Water is focusing on implementing this (**VAOP**) at large scale. By Adsorbing Light, **Watch TiO₂** excites an electron and the excited electron is transferred to a single oxygen atom through simple oxidation state change. The transfer of an electron in turn changes back surrounding **TiO₂** structures. The crystal form of **Watch TiO₂** has a decisive effect on its catalytic performance.

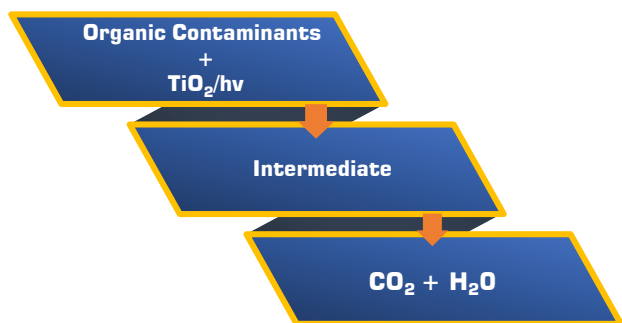
Oxidative – Reductive Reactions of SOLAR + WATCH TiO₂ + OXY

Step	Process
1	Photoexcitation $\text{TiO}_2 + h\nu$
2	Charge-carrier trapping of e^-
3	Charge- carrier trapping of h^+
4	Electron – hole recombination
5	Photoexcited e^- scavenging
6	Oxidation of hydroxyls
7	Photodegrading by OH^\bullet
8	Photodegradation by SO_4^\bullet
9	Direct Photoholes
10	Protonation of Super Oxides $\text{O}_2^\bullet + \text{OH}^\bullet \rightarrow \text{HOO}^\bullet$
11	CO- Scavenging of e^- $\text{HOO}^\bullet + e^- \rightarrow \text{HO}_2^-$
12	Formation of H_2O_2 $\text{HOO}^\bullet + \text{H}^+ \rightarrow \text{H}_2\text{O}_2$

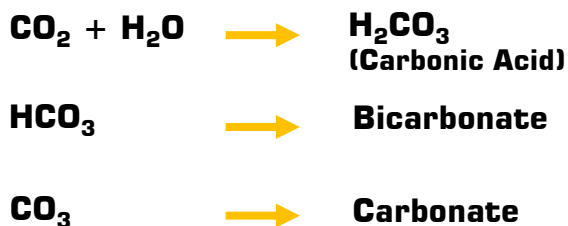


SOLAR OXY-3C AND MICROPOLLUTANT REMOVAL

An important precursor to these set of reactions is the absolute necessity of molecules, without which, hydroxyl radicals could not be created. The formation of not only hydroxyl radicals and sulfate radicals but also the superoxide anions ($O_2^{\cdot-}$) which contributes to the formation of Hydrogen Peroxide. The combination of these three very strong oxidants generates (VAOP's) and series of mineralization reaction's geared toward the destruction of all organic contaminants.



And in the absence of this CO_2 in Water there will be no Carbonate Chemistry. Alkalinity found in natured waters mostly derives from ...



Alkalinity is a measurement of the capability for water to accept protons (H^+ -ions), without a measurable change in pH level. This is the parameter of Drinking water which works to retain the pH level in the range of **6.5 to 9.5** pH units. In human health criteria table, **Alkalinity** is simply listed as a **Non-Priority-Pollutant** (NP) and no recommended value is given. Alkalinity is most often expressed as $CaCO_3$, same as Water Hardness.

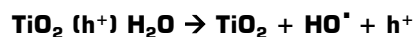
**“No disease Including cancer,
Can exist in an Alkaline environment”**

**1931 (Dr. Otto Warburg)
Nobel prize for cancer discovery**



Solar-TiO₂ + Solar-oxy

Titanium dioxide became a photocatalysis when **Watch Water** started manufacturing crystalline **TiO₂**. Watch Water discovered the photochemical reaction of **Watch TiO₂**, exhibited when combined with the power of **Oxydes-P** and **solar light**. This resulting reaction was the splitting of water molecule to generate a Hydroxyl radical

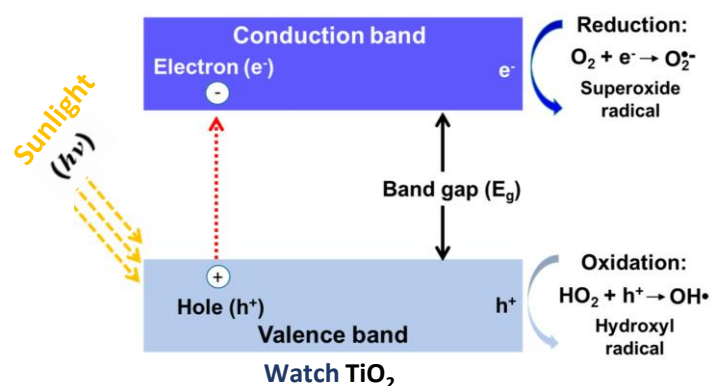


The photocatalytic properties of watch **TiO₂** combined with Oxydes-P can degrade 99% of all water pollutants when treated with sunlight and **SOLAR OXY-3C**.

This piqued the interest to introduce it to the entire world to clean and disinfect contaminated Air-Soil-Water using the free solar energy of the sun. **Oxidative and Reductive** reactions from unique-**Watch TiO₂** are due to its crystalline characteristic of processing a sole electron in its outer orbital. The reaction process begins when **sunlight** energy photoexcites that lone electron, which creates an empty outer valence band.

SOLAR-TiO₂ + SOLAR-OXY

PROCESS OF PHOTOCATALYTIC Watch TiO₂



The organic compounds are mineralized to carbon dioxide and water by given enough irradiation time. A basic visual representation of the **Photocatalytic** mechanism can be seen in the figure above which demonstrates the process that occurs when light energy irradiates **Watch TiO₂** crystalline particles. The illumination ejects electrons from **Valence** band resulting in a positively charged area with "HOLES" (h⁺).

These holes primarily react with **water molecules** to generate hydroxyl radicals, thus creating the dominant destructive component of the photocatalytic process. The free electrons e⁻ jump to the **conduction** band where they can react with oxygen molecules in the water to generate **Superoxide** radical anions.

USING SOLAROX-3C

The generation of mixed radicals OH[•] as well as SR (Sulfate radicals) in the photocatalytic process of **SOLAROX-3C** makes it possible to decompose any organic as inorganic compounds. These contaminants can be removed without adding any other **floculants** or oxidants like Chlorine, Ozone, UV, Hydrogen peroxide and etc. **SOLAROX-3C** can even be used to treat Landfill leachate. **30 to 40** grams of dosage is optimal to remove 100% of **COD & BOD** including the Colour removal.

SOLAROX-3C can be used to treat highly concentrated effluent with a **continuously** stirred batch reactor. To accelerate the Hydroxyl and Sulfate radicals production, Oxydes-P can be added with **SOLAROX-3C**.

The **SOLAROX-3C** outperform the slow and all conventional technologies by removing nearly all contaminants from the water and wastewater within 30 minutes.

SOLAROX-3C is the best available (**VAOP**) to mineralize all toxins produced by cyanobacteria using falling or spraying doser over the Lakes, Streams, Rivers, Sewage, Wastewater system, clarifiers, Landfill- leachate. **Ammonia** in all water's can be reduced to 100%. Only **SOLAROX-3C** can degrade Ammonia from wastewaters. The **SOLAROX-3C** process can be used to provide the energy necessary for the conversion of **Ammonia** to hydrogen and nitrogen gases.



The above equation shows that 2 moles of **Ammonia** can be converted to 3 moles of **Hydrogen** gas and 1 mole of **Nitrogen** gas. Formation of H₂ from photocatalytic destruction of NH₃ photocatalytic degradation on Ammonia in **Manure** can be removed up to 100% is possible. **SOLAROX-3C** can remove odor from all human and animal manure. Watch TiO₂ Photocatalytic Oxidation or **SOLAROX-3C** can be used to Deactivate pathogen indicators such as Escherichia coli (E. coli). Using 1 g/L **SOLAROX-3C** will inactivate E.coli completely in just 10 minutes. Inactivate E.coli to levels below detectable limits.

SUMMARY

The use of **SOLAROX-3C** can be employed for the removal of Organics, Nitrogen based contaminants, Antibiotics, Pharmaceuticals, microplastics, Odor and even Pathogens. Removal of COD and BOD is the best job for **SOLAROX-3C**. Regarding removal of heavy metals and metallic oxyanions **SOLAROX-3C** photocatalysis is the Best Available Technology (BAT). Watch TiO₂ is a Crystalline Metal Oxide with a high sorption capacity. It can adsorb heavy metals like **Lead, Chromium, Arsenic, Copper, Selenium, Uranium**.

Detailed description can be found in our

TITANSORB-P BROCHURE

OXY TREATMENT

FILTRATION

ADSORPTION

FILTERS OR B

INSTANT PRODUCTS



APPLICATIONS OF SOLAROXY-3C

POLLUTANT'S TO REMOVE

Wide range of applications

- ✓ Drinking Water
- ✓ Ground Water
- ✓ Surface Water
- ✓ Grey Water
- ✓ Effluent Water
- ✓ Sewage Water
- ✓ Rainwater Drains
- ✓ Ponds
- ✓ Lakes
- ✓ Rivers
- ✓ Aquatic Ponds
- ✓ Swimming Pools
- ✓ Municipal Sludge
- ✓ Landfill Leachate
- ✓ Blackwater
- ✓ Infected Surfaces
- ✓ Cooling Water
- ✓ Algae Growth inhibitor
- ✓ Usage of **SOLAROXY-3C** as – Algaecide, - fungicide



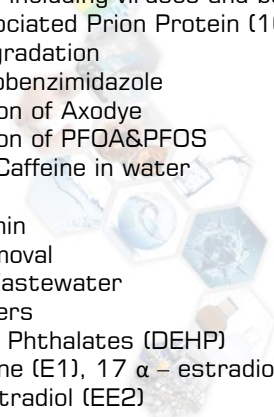
In Disinfection

- ✓ Sterilizing of Surfaces
- ✓ Disinfectant for all surfaces
- ✓ Disinfection of Ion exchange Resins
- ✓ Disinfection of Membranes
- ✓ Disinfection of Activated Carbons
- ✓ Strong Disinfection for treatment of water systems

In Wastewater

- ✓ Simulated Wastewater
- ✓ Lagoon Wastewater
- ✓ Municipal Wastewater
- ✓ Industrial Wastewater
- ✓ Pharmaceutical Wastewater
- ✓ Hospital Wastewater
- ✓ Commercial Wastewater
- ✓ Oil & Petrochemical Wastewater
- ✓ Food & beverage wastewater
- ✓ Paper mill Wastewater
- ✓ Industrial Wastewater Sludge
- ✓ Municipal Wastewater sludge

- Ammonium Ion's
- Creatinine
- Chlorinated Creatine
- Arginine
- Escherichia Coll (E.coli) 99.99%
- Enterococcus faecium
- Urea & Uric acid
- Amino acids
- Micropollutants
- Phenol, 2, 4 – dichlorophenol
- Atrazine
- Naphthalene
- Microcystin – LR
- Dyes including congo red
- Volatile Organic Compounds(VOC's)
- Endocrine disruptors
- Pharmaceuticals and their Metabolites
- Cyanotoxins
- Per-fluorinated Compounds
- Lindane (Chlorinated pesticide)
- Carbamazepine
- Bisphenol (BPA)
- Porcine Circovirus
- Chloramphenicol Antibiotic
- ALL Organic Pollutants (100%)
- Hormones
- Herbicides incl. tembotrione
- N,N Diethyl – P-Phenylenediamine (DPD)
- Ethylenediamine tetraacetic acid EDTA
- Microorganisms including viruses and bacteria
- Diseases – Associated Prion Protein (100 %)
- Methyl Blue Degradation
- 2-phenyl-5-Sulfobenzimidazole
- Rapid degradation of Axodye
- Rapid degradation of PFOA&PFOS
- Degradation of Caffeine in water
- All anionic dyes
- Oxidation of Lignin
- 100% Algae removal
- Nitrobenzene Wastewater
- "Penta" congeners
- Di (2-ethylhexyl) Phthalates (DEHP)
- Steroids: Estrone (E1), 17 α – estradiol (E2), 17 β – ethinylestradiol (EE2)





OXY TREATMENT

FILTRATION
ADSORPTION
FILTERS ORB
INSTANT PRODUCTS



POLLUTANT'S TO REMOVE

Medicines and Pharmaceuticals

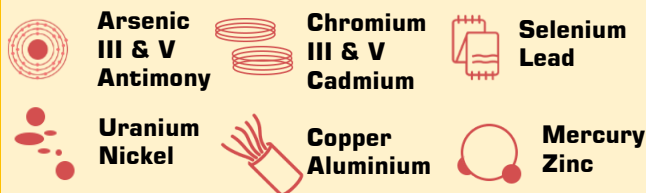
- Diclofenac
- Ibuprofen
- Atorvastatin
- Para and ortho hydro atorvastatin
- Propranolol
- Erythromycin
- Norerythromycin
- Azithromycin
- Clarithromycin
- Ciprofloxacin
- Metformin
- Ranitidine
- Carbamazepine
- 10.11 – epoxy carbamazepine
- Sertraline
- Novsetraline
- Fluoxetine
- Tamoxifen
- Trixylenyl phosphate
- 1,2,3 benzotriazole
- Tolytrazole
- 4,5 benzotriazole

Watch Water Combines Adsorption and Oxidation for the effective removal of Organic & Inorganic within a single product. During the process, no energy is needed.

SOME OF SOLAROXY-3C MAIN BENEFITS

- No Toxic by products or sludge produced
- No Operational costs related to energy used
- Chemically and environmentally sound
- Safe to use and a simple dosing system

METALS & HEAVY METALS



SOLAROXY-3C Super Advanced Oxidation

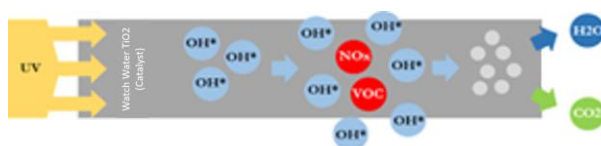
A novel oxidation material has been developed by **Watch Water® Germany**, which uses a catalyst for the degradation of environmentally harmful pollutants, which are released at a rate of 9600000 billion tonnes a year into the world water. A novel non-hazardous photocatalytic material effectively removes **chemicals, plastic waste, pharmaceuticals, antibiotics, fertilizers, sewage water, agricultural runoff of nitrates and phosphates including TOC, and heavy metals. SOLAROXY-3C** can adsorb 100% of the dye and enhancing the rate of dye breakdown rapidly using **(VISIBLE LIGHT)** from the sun.

By mixing crystalline Titanium dioxide (**Watch TiO₂**) and **Oxydes-P** (Oxidant) the mixture provides a huge surface area for organics and inorganics capture. The **SOLAROXY-3C** in the water or wastewater proceeds to adsorb **heavy metals** and break down organics into small and harmless molecules using the energy provided by sunlight, in a process known as

"PHOTOCATALYTIC DEGRADATION"

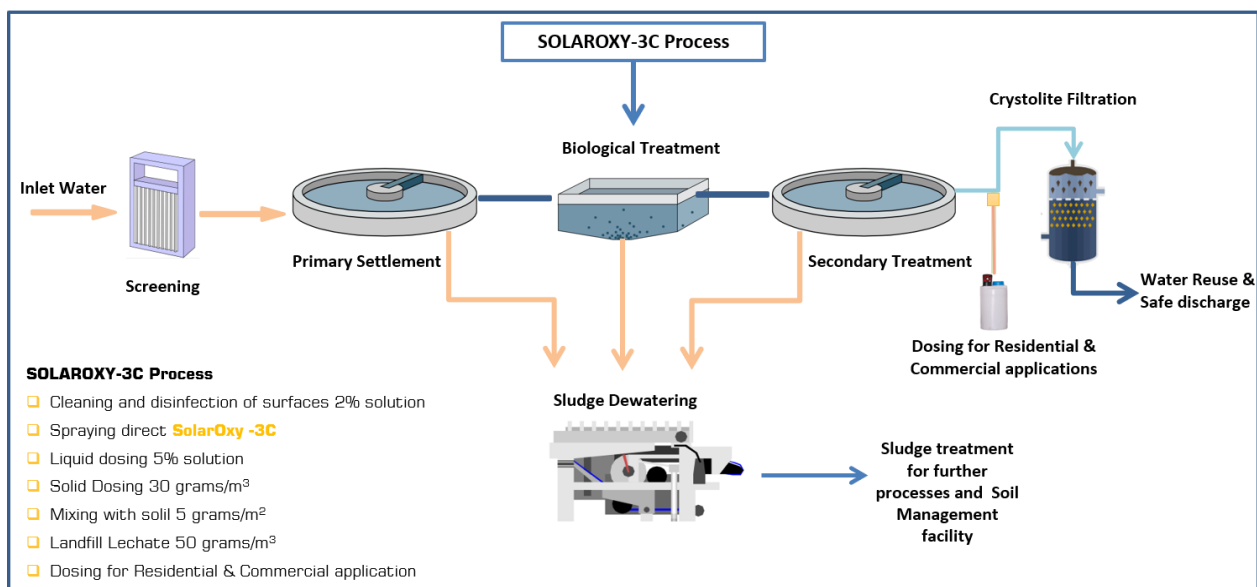
Having removed the harmful organics, the catalyst may simply be filtered from the clean water by **CRYSTOLITE** filtration media.

Both of the materials used in the **SOLAROXY-3C** have been manufactured by **Watch Water® Mannheim. Titansorb-P** is considered as one of the most promising materials for a range of Photocatalytic application's, owing to its high electrical conductivity, chemical stability, and surface activity, in addition to its strong light absorbance. As a low band-gap-semiconductor, **Watch TiO₂** is white in colour due to its ability to **adsorb** almost the entire spectrum of **VISIBLE-LIGHT** and therefore extracts a high amount of energy from sunlight to generate **Hydroxyl radicals** and **sulphate radicals** to power the degradation processes.



SOLAROXY-3C PROCESS

Schematic of the Watchwater SOLAROXY-3C process



However, the true potential of the **Watch TiO₂** and **Oxydes-P** was only realized, once they were combined into a single **SOLAROXY-3C**. Due to the exchange of electrons between the two materials, the organic and inorganic's were broken down by the **SOLAROXY-3C** at around double the rate achieved by **Oxydes-P** on its own, while **Oxydes-P** alone is incapable to degrade heavy metals. In contrast to all other leading catalytic materials, many of which are toxic to both humans and aquatic life, both our **Watch Water®** products are classified as **Non-Hazardous-Materials**.

The **Watch Water® GmbH**, believes that their **SOLAROXY-3C** has a huge potential. As we introduced and we know the Capabilities of our **SOLAROXY-3C**.

Our aim is not only to market the product but we're also exploring its viability in other areas, such as the photocatalyzed adsorption of CO₂ to generate Carbonates.

Watch Water® is a team of highly experienced specialists in Water Treatment Sector and provide new superior technologies compare to old conventional technologies and products. Our experience and very successful products are unmatched in the industry and we have been recognized as an innovative industry leader. **Watch Water®** takes full responsibility in all water treatment problems, with its innovative concepts and pragmatic solutions, geared towards bio-friendly water treatment chemicals and systems.

Disclaimer: The information and recommendation in this publication are true and based on data we believe to be reliable. They are offered in good faith but do not imply any warranty, liability or performance guarantee. Specifications are subject to change without notice. Watch Water® will not be liable under any circumstance for consequential or incidental damages, including but not limited to, lost profits resulting from the use of our products.