Manufactured in Germany

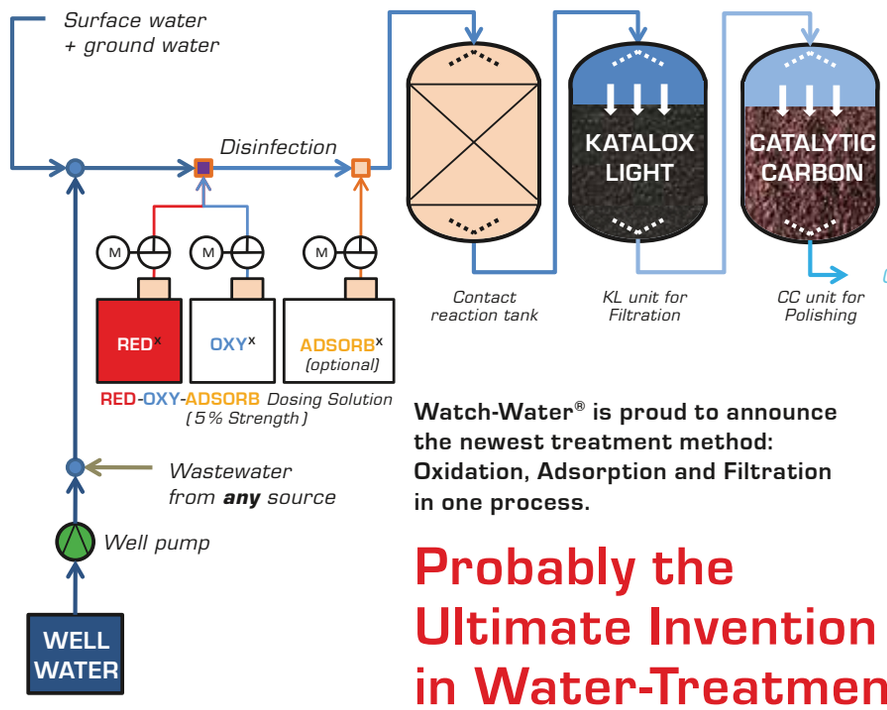
WATCHER®
WATCH WATER
a Water Company

RED-OXY TREATMENT
FILTRATION
ADSORPTION
FILTERSORB
INSTANT PRODUCTS

RED-OXY® TREATMENT

OXIDATION – ADSORPTION – FILTRATION

ALL CONDITIONS ⇨ ONE SOLUTION



Watch-Water® is proud to announce the newest treatment method: Oxidation, Adsorption and Filtration in one process.

Probably the Ultimate Invention in Water-Treatment!

Advantages

- No Chlorine
- No Flocculent/alum
- No Acids
- No DBPs
- No Ozone

Applications

- Drinking water
- Process water Re-use
- Irrigation
- Mining
- Wastewater treatment
- Oil & Gas industries
- Fracking
- Soil Treatment
- Paper and pulp industries

Green CHEMISTRY
Non Toxic

RED-OXY TREATMENT

INTRODUCTION TO RED-OXY®

Introduction

Revolution in all waters including waste water treatment by **RED-OXY®**. Treatment of any kind of water with **RED-OXY®** has showed the best results for the removal of turbidity, color, odor, BOD, COD and inactivation if bacteria. In all waters **RED-OXY®** produced high quality of final water, predominantly due to its simultaneously action as an adsorbent, oxidant and disinfectant. Working as an adsorbent, **RED-OXY®** produces **BEST QUALITY WATER** of final water compared to all the adsorbent based on Iron or Aluminum. The advantage of using **RED-OXY®** is never to change adsorbent thus producing minimum waste and this makes **RED-OXY®** a very promising adsorbent in all waters including wastewater.

Goal

Watch-Water®'s goal and interest to develop new technologies for the filtration, adsorption and disinfection including the removal of organic materials from potable water supplies and also removal of organics from aqueous process streams prior to recycle (water reuse) or discharge into deep wells or natural surface waters.

Most of the research in Watch-Water® is dedicated to discontinuing the use of

- Chlorine
- Chlorine Dioxide
- Ozone as all of them produce huge amount of disinfection by products.

RED-OXY® has shown great results as multi-functional water and waste water treatment product for

- Adsorption
- Oxidation
- Disinfection

RED-OXY® has proved to remove toxic organic molecules such as nitrosamine, organic sulfur compounds including sulfates and phenol, as well as inorganic ions such as arsenic, copper, chromium, cadmium, cyanides, fluorides including destroying all viruses and bacteria.

RED-OXY® holds its greatest reward for residential, commercial, industrial, municipal including fracking applications. Nothing is better than **RED-OXY®**, the only source for **ULTIMATE WATER SOLUTION**.

The fastest, safest and cheapest solution

High speed bullet train **RED**^{x} + **OXY**^{x} and **KATALOX-LIGHT®** both with Formula FeO_4^{-2} + MnO_4^{-2} – are considered to have the same formula named tetrahedral structured **ions**. Tetrahedral FeO_4^{-2} produced with the system **RED**^{x} having the highest **Oxi**dation and **Red**uction potential in acidic solution. **RED-OXY®** with its ferrate ions is the strongest oxidant and is capable of removing inorganic and organic impurities just in few seconds of reaction. The ferrate will generate iron ions and oxygen molecules. The oxidation-reduction reaction is the strongest reaction with a particular significance in the entire water treatment industry because of no by-products. After the oxidation of all organics including inorganics, the final left over is the ferric ion. Now to take the maximum efficiency of the valuable ferric iron the solution of **ADSORB**^{x} is dosed to create the floc and catch the inorganic precipitates of cations and adsorb anions and all suspended particles including colloids.

There is no other method to reach the solution point with safety, convenient, versatility with lots of cost saving using any other train. In this respect **RED**^{x}, **OXY**^{x} and **ADSORB**^{x} are an environmentally friendly bullet train.

WHAT IS RED-OXY®?

Description

RED-OXY® generated **Ferrate** with Watch-Water® process s the most stable form of **Ferrate** (VI) because it is generated with Ferric Hexahydrate granules. The oxidant used in this process is a strong acid halogen which generates high voltage of oxidant without any DBPs. REDOX potential of the oxidant is as high as Hydroxyl Radicals. Watch-Water® has no doubt that its proprietary process will be commercialize world-wide with its own branches or through very close partners.

Watch-Water® understands chemistry. Generated Ferrate with its proprietary process of **ONLY TWO COMPONENTS** uses

HEXAHYDRATE GRANULES ⟷ RED^x
+
ACIDIC HALOGEN OXIDANT ⟷ OXY^x

RED-OXY® spontaneously decomposes in the presence of all contaminants listed on page 8, in any kind of water into strong oxygen and the most powerful Adsorbent based on ferric hydroxide with the surface area of 3500 m^2/gram.

The chemical formation reaction is

$$Fe(OH)_3 + \tfrac{3}{4} O_2 + 2OH^-$$

This reaction is the strongest for the Oxidation-Adsorption of metals, non-metals and or organic contaminants in water and wastewater treatment. These include ammonia, cyanide, thiocyanate and very high concentration of hydrogen sulfide. All other contaminants are listed on page 8. As many of the reactions are pH based reaction it can be controlled in the process with **OXY^x** (the most powerful oxidant and disinfectant against viruses and Coli-form Bacteria). Inactivation of viruses and all kind of bacteria occur faster as the pH drops, a phenomenon that has been attributed to mono-protonated form of $HFeO_4^-$

RED-OXY® treatment can be done without investing on the equipments as in most of the systems worldwide the dosing equipment can be used from existing feed pumps which will bring substantial improvements in finished water quality, especially as regards to trace organic contaminants and DBPs. Most water treatment systems, regardless of their size, use a coagulant which in future is **RED^x** and a chemical disinfectant which in future is **OXY^x** and the sand filter in future are **KATALOX-LIGHT®** systems. However only adding **I-SOFT** Corrosion Control chemicals may be necessary if after treatment corrosion-control is needed. Watch-Water® has developed this technology in INSTANT form of **RED^x** and **OXY^x** to save transportation cost of chemicals.

Solutions for all contaminants problem just got much easier. How to approach some thousands of communities, municipalities to use this innovative treatment: **RED-OXY®** – Oxidation and Adsorption represents an improved Multiple Applications.

ALL CONDITIONS ⟹ ONE SOLUTION

Green CHEMISTRY
Non Toxic

RED-OXY TREATMENT

THE RED^{x} ADVANTAGES

Watch-Water® Germany has designed the **RED**^{x} system to generate ferrate on very reasonable costs, in addition to low costs, the **RED**^{x} is the only system for treating drinking water, agricultural irrigation, industrial applications, municipal water treatment including disinfection and filtration in one process easier and less expensive that no other technology can provide in the existing water treatment company.

RED-OXY® mobile labs by Watch-Water® are provided to test any water on the spot which is absolutely identical to **RED**^{x} systems. To order **RED-OXY® LAB** please provide us your company details.

Watch-Water® Germany is the only innovator to introduce the first On-Site **RED**^{x} generator and the **S**trongest **O**xidant **S**olution [**SOS**] generator for disinfection and adsorption of almost every contaminants in water. **RED**^{x} technology combines salt of **RED**^{x}, **OXY**^{x} and **ADSORB**^{x} to generate the most cost effective high capacity Oxidant, Disinfectant and Adsorbent with Real Chemistry on site. Our **Xtremely** intelligent and expertly designed **RED**^{x} generators give all our customers the freedom to produce oxidants, disinfectants and adsorbents in the amount they need and when they need it.

RED^{x} will serve any kind of water in any kind of industries. **RED**^{x} generators are available in different sizes to fit every applications and to produce much superior results compared to any other oxidants and disinfectants including adsorbents, available all over the water treatment market. **RED**^{x} chemistries will clean over 7000 billion gallons of water everyday. Safer, economical and absolutely more effective **RED**^{x} is just a new revolution in the process of making water neat, clean and safe and without any hazardous byproducts.

VERY IMPORTANT

Watch-Water® herewith guarantee that there are no toxic products involved in **RED-OXY®** Treatment. All compounds are "environment friendly". All other **Oxidants like Chlorine or Ozone** are hazardous to workers, since they are highly toxic, no such compounds are used in **RED-OXY®** Treatment.

RED^{x} in the process is reduced to Fe (III) with adsorb FeOOH water leaving the **KATALOX-LIGHT®** and **CATALYTIC CARBON®** free of iron and zero non-toxic by-products, including any organisms such as cells, bacteria, viruses. In this reaction all organics are oxidized to biological inactivation product.

Water at outlet of **KATALOX-LIGHT®** has the highest cleaning effect of any sewage to remove coli form bacteria, ammonia and nitrogen. For further cleaning effect use of **CATALYTIC CARBON®** as the polishing filter is best recommended.

We know the water and we can re-use any water.

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Non Toxic

RED-OXY TREATMENT

RED-OXY® CHEMISTRY

What is RED^X ?

The element of **RED**^{x} is iron which is one of the metals in periodic table that is named as "**Transition Metal**". This is the secret of **RED**^{x} that it exhibit multiple oxidation states. In fact, theoretically the valence up to +8 can be generated. But the most stable valence is +6 which is called Ferrate (FeO_4^{2-}).

Ferrate is a very powerful oxidizing compound that can be utilized in many applications. Ferrate has Oxidation Potential of 2.2 Volts under acidic conditions. As one of the most practical and powerful transition metal Ferrate [**Fe(VI)**] can be utilized to create **Fenton's Reaction** (activation of H_2O_2 with **RED**^{x}) with its modification to **Hydroxyl Radicals (HRs)** with an extra oxidation potential of 1.8 – 2.7 Volts (depends on the pH and dosing of **OXY**^{x} values).

Since **RED**^{x} has now been changed to a catalyst all sulfates in composition of **OXY**^{x} generates **Sulfate Radicals (SRs)** with a redox potential of 2.5 – 3.1 Volts. Heterogeneous generation of Sulfate Radicals has now changed dissolved **RED**^{x} ions into the solid phase. Metallic hydroxide (FeOOH) particles (as adsorbent) can be easily removed by **KATALOX-LIGHT® Filtration.**

Explanation I

RED is to reduce
Extremely Toxic organics and
Disinfection of water
with
Oxidation potential of over 8.5 V
Xtremely high sulfate and hydroxyl radicals
Yielding breakthrough in chemistry and process

Explanation II

$$RED_1 + OXY_1 \longrightarrow OXY_2 + RED_2$$

RED_1 and RED_2 are both Reducers
OXY_1 and OXY_2 are both Oxidizers

Each pairs $\boxed{\begin{matrix} RED_1 / OXY_2 \\ OXY_1 / RED_2 \end{matrix}}$ **are corresponding pairs.**

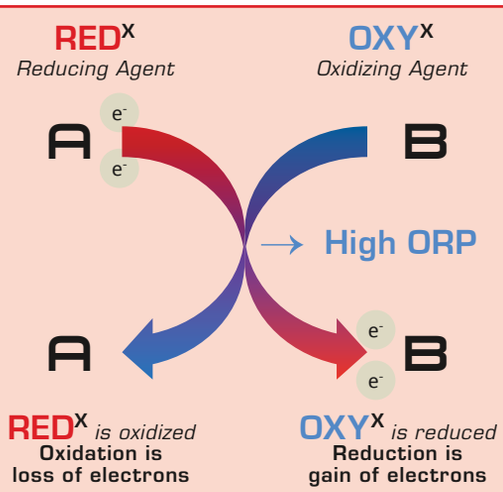
Oxidizers give electron (-) and Reduce
Reducers takes electron (+) and Oxidize
This process is called REDOXY Reaction

Oxidation and Reduction

The reaction mechanisms of **RED**^{x} + **OXY**^{x} + **ADSORB**^{x} *which makes REDOXY based Advanced Oxidation Technology unique.*

The highest oxidation reduction potential (ORP)
2.2 (Ferrate) + 2.7 (HRs) + 3.1 (SRs) = 8.0
for the followings,

- *Removal of Toxic Cations*
- *Removal of Toxic Anions*
- *Oxidation of inorganic*
- *Oxidation of Organic Contaminants*
- *Destroy Pharmaceuticals and Personal Care products*
- *Destroys endocrine disrupting chemicals*
- *Removal of pesticides fungicides and herbicides*
- *Destroys all bacterial and viruses*
- *Destroys Petroleum Hydrocarbons*



High purity ferrate

RED-OXY® process of mixing Hydrated ferric solution and strong **OXY**ˣ solution is the easiest method to produce pure Ferrate in the reaction tank. The purity of Ferrate is more than 99 % in the mixed form. The Ferrate reduced is an exclusive process of Watch-Water® Germany.

RED-OXY® is the safest oxidant, inexpensive and "**environmental friendly**", especially for potable water and waste water treatment applications. **RED-OXY®** is an ideal treatment for industrial and municipal effluent containing hazardous organic and inorganic compounds as listed on page no. 8. Using **RED-OXY®** there is no need to dose poisonous and corrosive fesses like chlorine, hypochlorite or ozone. These oxidants have deleterious side effects. Additionally, the handling of chlorine, hypochlorite, HOCl, chlorine dioxide or ozone are potential danger to workers due to their high toxicity. And a major disadvantage of chlorine and chlorine dioxide or any other chlorine-containing oxidant produce, **chloramines, chlorinated aromatics, chlorinated amines** or **hydrocarbons**. All of these oxidants are potential mutagens or **carcinogens** and are for sure more toxic than the parent contaminants.

RED-OXY® a new oxidant is designed to move away from chlorine, as well as ozone. Both of the compositions in red and oxy are oxidation products and 100 % biodegradable. The **ferrate** molecule precipitates out of solution as $Fe(OH)_3$ and now the adsorption process starts to collect cation as well as anions from the water. The iron containing sales can be easily filtered out by **KATALOX-LIGHT®** leaving iron-free water containing innocuous by-products.

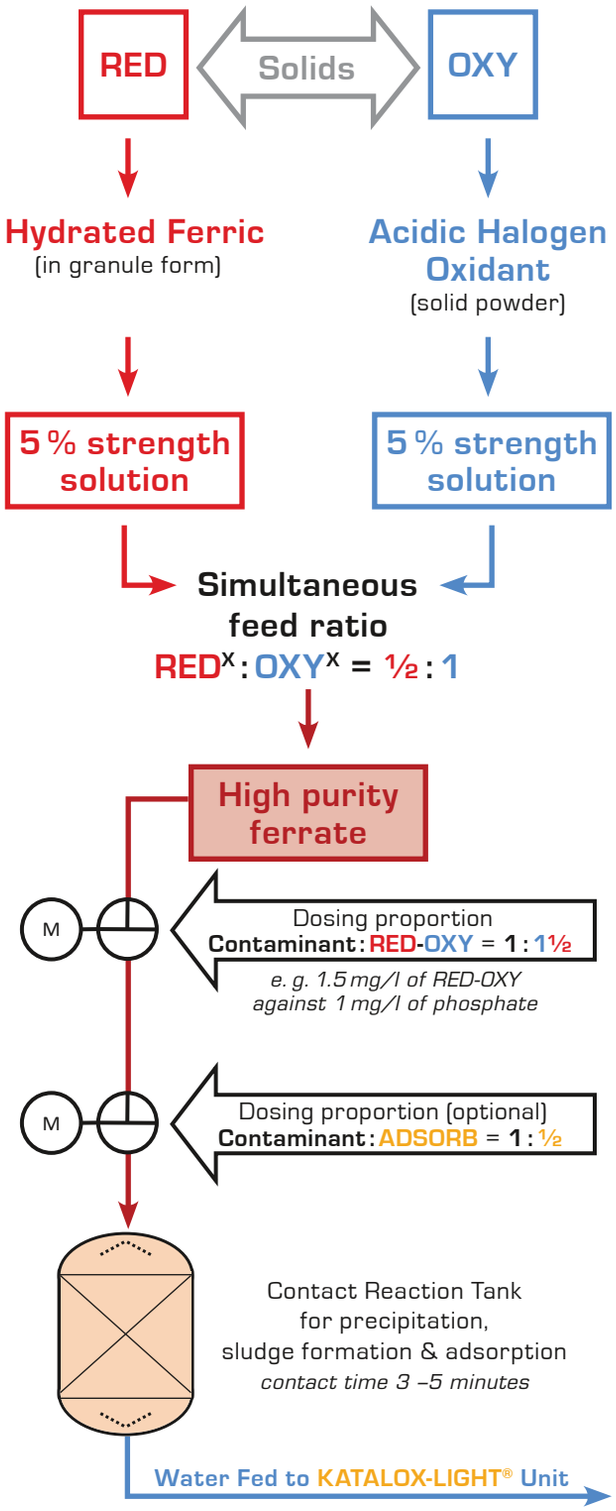


Fig. 2

Strong Oxidation Solution (SOS)

Strong Oxidation Solution (SOS) is the highest performing oxidant and disinfectant without producing any environmentally toxic byproducts. The revolution starts and its efficiency is derived from the second oxidant present in the **ADSORB**ˣ solution in the form of hydrogen peroxide which adjusts the COD and BOD to zero after dosing.

1. **RED**ˣ and **OXY**ˣ both food grade salts are injected into the pipe.
2. Strong reaction occurs inside the pipe producing Strong Oxidant Solution (SOS)
3. SOS is ready to use

RED-OXY TREATMENT

Strong Oxidation Solution (SOS)

It's safe with RED^x-OXY^x-ADSORB^x. Only KATALOX-LIGHT® for filtration and CATALYTIC CARBON® polishing for better taste and odor and to catch microorganisms to make the best water by Watch-Water®.

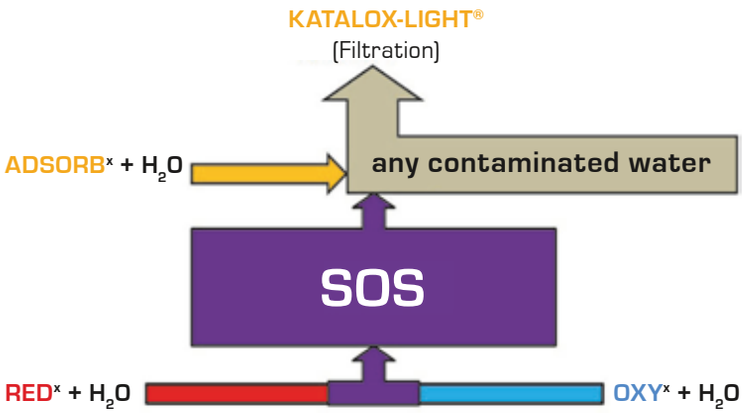


Fig. 3

Adsorption "A Trap"

RED^X particles made from ADSORB^x have a **hydrophobic** core and a **hydrophilic** shell. Then Watch-water came up with the idea to use these particles to remove toxic chemicals and pollutants including hormones from water and soil using UV light. Due to molecular scale forces, in a solution **hydrophobic** pollutant molecules are attracted more towards the hydrophobic **RED^x particles** and ADSORB^x on to their surface, where they effectively become "trapped". Without using ADSORB^x these would remain dissolved and dispersed evenly in water. But when come in contact with ADSORB^x which stabilizes the outer shell of the particles as a shed - and now "enriched" by pollutants – they form larger aggregate that can be removed through KATALOX-LIGHT® filtration.

This unique invention of Watch-Water® can be used to extract

- Phthalates
- Hormone-Disrupting chemicals used for softening plastics
- **BPA** – another endocrine disrupting synthetic compound widely used in plastics and plastic bottles and hundreds of different consumer goods from thermal printing paper samples
- Polycyclic hydrocarbons
- Carcinogenic compounds formed from incomplete combustion of fuels

... from contaminated soil.

Advantages of ADSORB^X

The adsorption of Toxic or dissolved metals takes place within 3 to 6 minutes. This unique adsorbent has very high surface of Iron Oxy hydroxide. The best breakthrough for adsorption process will be achieved at inlet of the column at pH 6.5. The higher outlet pH's of sampling as compared with initial pH coincide with an extensive accumulation of iron hydroxides role of adsorption / co-precipitation process.

Even more exciting!

The oxidation, Disinfection, Adsorption and Filtration, this whole process is irreversible and the backwash waste is biodegradable – minimizing the risks of toxic secondary products to persist in – say "**A Body of Soil**".

Once they switch to this Macro-situation where there are big clumps "Nobody can bring them back".

For the pilot applications where you do not need an expensive system, just use **RED-OXY Mobile Lab** to purify water, wastewater or concentrate. It is a cheap testing kit which every water treatment company can afford.

Green CHEMISTRY
Non Toxic

RED-OXY TREATMENT

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RED-OXY TREATMENT
FILTRATION
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CONTAMINANT LIST

(Subjected for update according to new data-collection)

Metal Cations Removed

Aluminum	Al (III)
Arsenic	As (III)
Barium	Ba (II)
Cadmium	Cd (II), Cd (III)
Calcium	Ca (II)
Cerium	Ce (III)
Cobalt	Co (II)
Copper	Cu (II)
Lead	Pb (II)
Magnesium	Mg (II)
Manganese	Mn (II)
Mercury	Hg (II)
Potassium	K (I)
Silver	Ag (I), Ag (II)
Thalium	Tl (III)
Tin	Sn (II)

Anions Removed

Arsenate	As (III)
Arsenite	As (V)
Ammonia	NH_3
Chromate	CrO_4^{2-}
Fluoride	F^-
Molybdate	MoO_4^{2-}
Phosphate	PO_4^{3-}
Selenite	SeO_3^{2-}
Silicate	SiO_2^{2-}
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

Oxidation

(inorganic & organic Contaminants)

1-Diaminopropane
1,2-Ethanediol
1,2-Propanediol
1,2,4-Butanetriol
1,3-Propanediol
2-Mercaptobenzoic acid
2-Mercaptoethanesulfonic acid
3-Amino-1-propanol
3-Mercaptopropionic acid
Acetaldehyde
Acetone
Alpha-Hydroxy-toluene
Ammonia
Aniline
Benzenesulfinate
Chloral
Cyanide
Cysteine
Cysine
Diethylamine
Diethylsulfide
Dimethylamine
Dimethylglycine
Dimethylsulfoxide
Ethyl alcohol
Ethyl ether
Ethylene glycol
Ferrocyanide
Fonnic acid
Formaldehyde
Glycerol
Glycine
Glycoaldehyde
Glycolic acid
Glyoxal
Glyoxylic acid
Hydrazine
Hydrogen sulfide
Iminodiacetic acid
Isopropyl alcohol
Methionine
Methyl alcohol
Methylamine
Methylhydrazine
Neopentyl alcohol
Nitriloacetic acid
Nitrite
Nitrosamines
Methanol
N-methyliminodiacetic acid
Oxylic acid
Phenol
p-Aminobenzoic acid
P-Hydroqiunone
p-Nitroaniline
p-Toluidine
Sarcosine
Thioacetamide
Thiodiethanol
Thiosulfate
Thiourea
Thioxane
Trimethylaldehyde

Disinfectant and Oxidants

Aerobic spore-bearers
B. Cereus
Bryopsis sp.
Caulerpa taxifolia
Dasya baillouviana
Enteromorpha intestinalis
Eschericha coli (E. Coli)
F-specific RNA-coliphage QB
f2 Coliphage
S. aureus
S. bovis
S. globigii
S. facalis
S. fiexneri
Sphaerotilus
S. Typhumurium
Styela plicata
Sulfite-reducing clostiridia
Thermotolerant coliforms
Total coliform

1,1,2,2-tetrachloroethane
1,1,2-trichloroethane
1,1-dichloroethane
1,2-dichlorobenzene
1,2-dichloroethylene
1,2,3-trichlorobenzene
2-Chlorophenol
2-Nitrophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
Acenaphene
Anthracene
Bromodichloromethane
COD
Chlorobenzene
Dichloromethane
Diethylphthalate
Dimethylphthalate
Ethylbenzene
Hexachlorobenzene
Nitrobenzene
Napthalene
Pentachlorophenol
Phenanthrene
Toluene
Trichloroethylene

Endocrine Disrupting Chemicals (EDCs)

Bisphenol A
Estrone (E1)
17 b-Estradiol (E2)
17 a-Ethynylestradiol (EE2)
16 a-Hydroxyestrone
4-Nonylphenol
4-tert-Octyphenol

Pharmaceuticals

Sulfamethoxazole
Ibuprofen

Pesticides

2,4-Dichlorophenoxyacetic acid
2,4,5-Trichlorophenoxyacetic acid
Dursban
EDB (Ethylene di-bromide)

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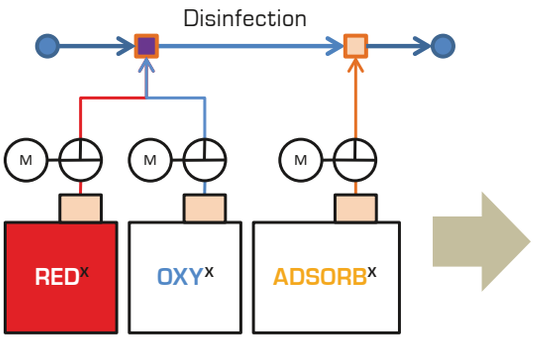
RED-OXY TREATMENT

RED-OXY SYSTEM

Oxidant and Adsorption Equipments



RED-OXY-ADSORB Dosing Solution
(5 % Strength)

Fig. 4

A real prototype of RED-OXY® Dosing system (made by Watch-Water® Germany)

Dosing Equipment for RED^x-OXY^x The dosing tank with mixer and the dosing pump should make the solution for one week. The flow control equipment to dose should be proportional. Watch-Water® recommends the use of water-meters with contact cables.

WARNING: Do not add salt (NaCl) in the OXY^x tank.

Dosing Amount

The chemical requirement could be approximated according to the half-reaction requirement basis. Here are two examples:

Example 1:
To neutralize 80 mg/l of phosphate dose 80 mg/l of OXY^x and 40 mg/l of RED^x dosing prepared solution. This would treat 1250 m^3 of water with dosing solution prepared from 5 kg of OXY^x and 2.5 kg of RED^x .

Example 2:
Total B = Value 1 + Value 2. Select dosing 1 x B amount of the prepared 5 % OXY^x dosing solution with combination with 0.5 x B amount of the prepared 5 % RED^x dosing solution. If ADSORB^x is added it shall be also 0.5 x B amount of the prepared 5%.

Cations (mg/l)	Anions (mg/l)
Iron	As (III)
Lead	As (V)
Copper	Phosphate
	Silicate
Value 1	Value 2

The Dosing table* proportion according to the upper limit TDS is as below.

Parameters	Drinking water	Brackish water	Water/Sea water	Sewage/waste water
TDS limit	Up to 2000 mg / l	Up to 10 000 mg / l	Up to 40 000 mg / l	Over 50 000 mg / l
Dilution strenght	5 %	5 %	5 %	5 %
RED^x	50 ml/m^3	125 ml/m^3	200 ml/m^3	250 ml/m^3
OXY^x	100 ml/m^3	250 ml/m^3	400 ml/m^3	500 ml/m^3
ADSORB^x	50 ml/m^3	125 ml/m^3	200 ml/m^3	250 ml/m^3
Total Dosing	200 ml/m^3	500 ml/m^3	800 ml/m^3	1 000 ml/m^3

** Adjustment might be required to achieve the desired performance.*

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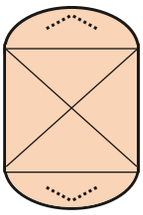
RED-OXY TREATMENT

In order to get the best results and to ensure the necessary Ferric Hxdroxide production, the operator should take into account the "Total Contaminants" to be removed. In order to achieve the best oxidation results to treat mixture of one or more impurities such as Biological impurities the same amount of oxidant to be used as in the process of Adsorbent production in the reaction tank. Biological impurities are those materials having biological origin. Thus any cells, bacteria, viruses, tissues or components thereof, whether from plants or animals can be considered to be biological impurities. This process will destroy sulfur-containing impurities and compounds containing sulfur atom including nitrogen-containing impurities, radioactive impurities etc.

There is virtually no limits of BOD or COD including TOC that RED-OXY® cannot handle.

Reaction Tank

Simple reaction tank should be chosen to provide a internal contact time of 3 to 5 minutes. The sludge and precipitation formed in the Reaction Tank must be removed before feeding the water to the Katalox-Light Filtration system.



KATALOX-LIGHT® for Filtration

Water is fed to the KATALOX-LIGHT® units for the filtration stage after contact reaction tank. For KATALOX-LIGHT® sizing please check KATALOX-LIGHT® technical datasheet.

All salts and impurities captured by adsorbent are easier to filter out with KATALOX-LIGHT® media, leaving iron free water containing none of the toxic byproducts. In addition the nature of KATALOX-LIGHT® can be utilized in urban or any industrial water treatment plants. Since the RED-OXY® technology is the highest effective and disinfectant technology, it is possible to replace every chlorinated drinking water equipment.

Therefore, any water, wastewater, irrigation water, surface water or ground water mixed with organic, inorganic or biological impurities in water can install RED-OXY® adsorption/disinfection equipment.

Note: If ferrate dosing is low the results may not satisfactory and on the other hand if ferrate yield is too high, the pressure drop in the KATALOX-LIGHT® unit will be high.

Reaction tank models	Flow rate	Inlet / Outlet	Contact time
10 x 54	0.5 – 1.0 m^3/h	¾ inch	3 to 5 minutes
13 x 54	1.0 – 2.0 m^3/h	1 inch	3 to 5 minutes
16 x 65	2.0 – 3.0 m^3/h	1 inch	3 to 5 minutes
18 x 65	3.0 – 5.0 m^3/h	1½ inches	3 to 5 minutes
24 x 69	5.0 – 8.5 m^3/h	2 inches	3 to 5 minutes
30 x 72	8.5 – 13.0 m^3/h	2 to 2½ inches	3 to 5 minutes
36 x 72	13.0 – 21.0 m^3/h	2 to 2½ inches	3 to 5 minutes
48 x 82	22.0 – 36.5 m^3/h	3 to 4 inches	3 to 5 minutes

Catalytic Carbon for Polishing

The waste water contaminants can include aluminium, chlorine, atrazine and all possible bio-accumulative organics and in the polishing process the presence of **arsenic, cyanide, chromium, pathogens** and **selenium**; as in the second process the activated carbon is the media with Metal Hydroxide coating and iron fillings. Presence of fluorides, lead and copper including phosphates and nitrates are also not a problem. All the waste waters can be discharged as to **legally allowed limits**. **CATALYTIC CARBON®** technology has solved the problem of trace toxic contaminants prior to discharge. **CATALYTIC CARBON®** shall be used as a polish filter in after the **KATALOX-LIGHT®** to remove any trace contaminants to provide the best quality re-usable water.

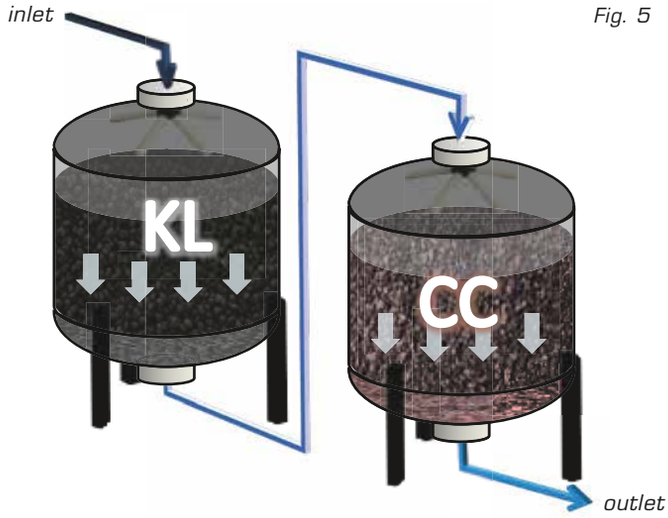


Fig. 5

APPLICATIONS

We bring you the possibilities!

Future of Water and Wastewater

Imagine wastewater so clean that you could bottle it. Imagine an oxidant so strong yet safe. Imagine a disinfectant so powerful but without any byproducts (DBPs). Imagine 1000 liters of **wastewater** with just few grams of solid waste. Imagine a water treatment facility so safe that you never have to worry about dangers associated with manufacturing Ozone gas or transporting, storing and using Acids and chlorates to produce chlorine gas. All technologies using salts and water and manufacturing HOCl are useless, just useless!

RED-OXY Mobile Lab has proved to water and wastewater companies around the world that **RED-OXY** on-site test offers significant advantages to prove that this is the only technology which proves its efficiency on site and no other technology can prove it.

Green CHEMISTRY
Non Toxic

RED-OXY TREATMENT

Oil-Field Industry

Watch Water®'s **RED-OXY®** process and system that can be used to treat any kind of water or waste water and remove **Hydrogen sulfide** in the produced water is the most advanced process in oilfield industry. Treatment of used oilfield water containing large amount of hydrogen sulfide is guaranteed using **RED-OXY®** process. After removing **Hydrogen sulfide** with **RED-OXY®** water can be reused because **it isn't toxic, corrosive or flammable**. Big advantage of using the **RED-OXY®** oxidation process is, absolute **GREEN CHEMICAL** oxidizer. **RED-OXY®** does not contain any chlorine, chlorine dioxide as the chlorine have a complex chemistry with H_2S. Example reaction between chlorine and Hydrogen sulfide include

$$H_2S + ClO_2 \longrightarrow HCl + H_2SO_4 + S^0$$

$$H_2S + ClO_2 + NaOH \longrightarrow H_2SO_4 + NaCl + HCl$$

$$H_2S + HClO_2 \longrightarrow H_2SO_4 + HCl + H_2O$$

Chlorine dioxide oxidize sulfide elemental sulfur that creates precipitation or bulk precipitation. If the water contains a precipitate, it can not be reused as it clog pipes, plug pore throats and damage equipments and formations.

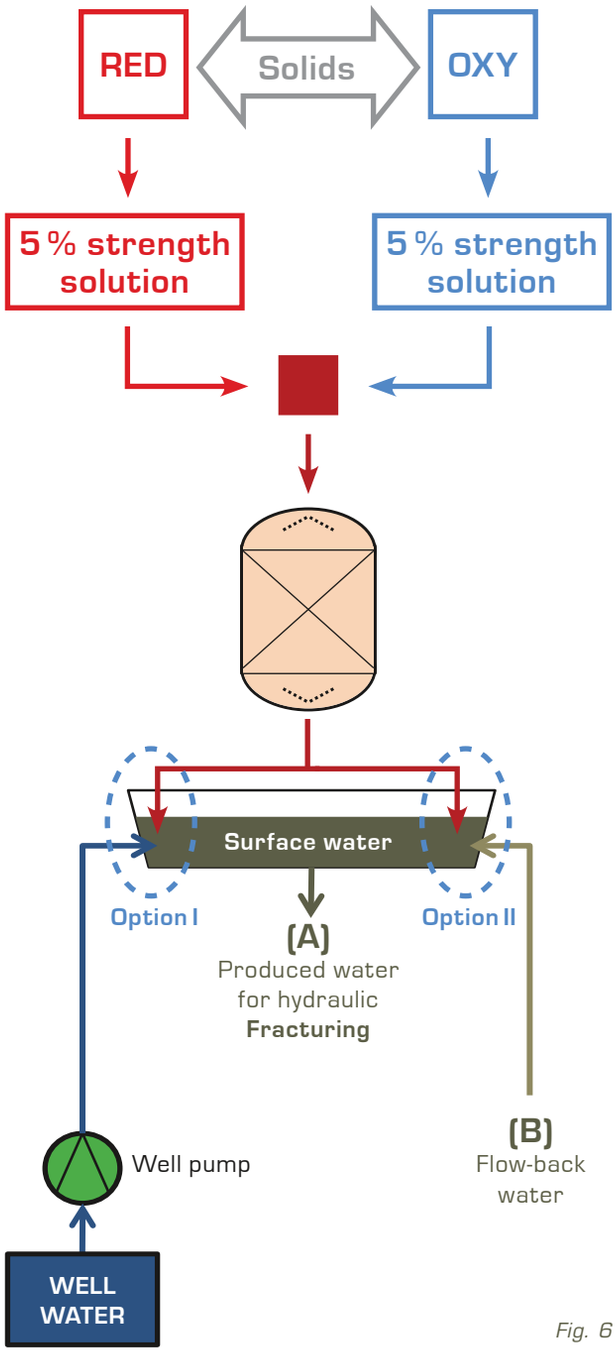


Fig. 6

TREATING HYDROGEN SULFIDE (H_2S) INCLUDING OILFIELD'S WATER

Hydrogen sulfide removal

Watch-Water® explains the process of fracturing and oilfields waste water. Waste water is a product of injecting water downhole or is formation water that flows from the formation to the **surface**.

As shown on the drawing on page 12 *(see Fig. 6)* oilfield waste water includes produced water, flowback water and the well water or a combination comprising at least one of the foregoing. Produced water typically is water that flows to the **surface** during production of oil and gas from a subterranean hydrocarbon source.

Flowback water on the other hand, generally is water that flows to the **surface** after performing a hydraulic fracturing job. The oilfield waste water **(A) Produced water** and **(B) Flowback water** *(see Fig. 6 on page 12)* contains a plurality of neutral and ionic species that include the elements which are causing heavy scale, corrosion and biofouling. Formulation of **RED**ˣ **Granules** contains the iron catalyst with unique combination of ingredients to clarify the oilfield waste water with a flocculent which has the highest capacity to adsorb heavy metals like

- Antimony
- Arsenic
- Copper
- Iron
- Lead
- Manganese
- Phosphorus
- Selenium
- Sulfur
- Uranium

The oilfield waste water also contain high amounts of polyvalent ions these are divalent alkaline earth metals such as Ca^{2+}, Mg^{2+}, Sr^{2+}, Ba^{2+} these cations present cause sulfate precipitation in an amount that depends on pH, that the sulfate solubility depends on the ph or the solubility product constant of the particular sulfate compound as $CaSO_4$, $MgSO_4$. Therefore to control sulfate produced by oxidation of sulfides the **OXY**ˣ contains sequesters in the formulation having advantages which avoids the precipitation of cations and form scale. To avoid any corrosion the **OXY**ˣ does not contain any oxidizers such as hydrogen peroxide, calcium peroxide or sodium hypochlorite's.

OXYˣ an exclusive formulation of Watch-Water® to treat waters with high content of sulfides (H_2S) with its very high oxidation power with **RED**ˣ changes sulfides to sulfates in forming a **Recycled water** that is useful as a hydraulic fracturing water or in enhanced oil production water. The formulation of **OXY**ˣ includes,

1. strong biocide
2. scale stabilizer
3. corrosion inhibitor
4. friction reducer
5. pH-adjusting agent
6. scale inhibitor and very important
7. a surfactant.

OXYˣ is the best formulation to kill bacteria and reduce the risk of any biofouling, stabilizing water hardness and provide the best corrosion prevention. **OXY**ˣ in combination of **RED**ˣ reduce all water and fluid tensions.

Arsenic removal

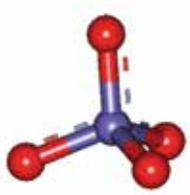
The ability of **RED**^{x} or the **RED**^{x}-**OXY**^{x}-combination provides the most efficient method for remediation of **arsenic** from any water under mildly acidic conditions. Both As (III) and As (V) forms of arsenic are amenable to treatment since **RED**^{x} rapidly oxidizes the former (+3) to +5 oxidation state. This is the only process which will decrease the amount of **all adsorbents** since **RED-OXY®** makes the fresh adsorbent because of using a soluble form of iron (**RED**^{x}) to treat all waters.

Most importantly, **RED-OXY®** method provides the most economic and inexpensive approach to meet every drinking water regulation where acceptable levels of arsenic may reach as low as 0.0 µg/l (Zero parts per billion). Another huge benefit of **RED-OXY®** treatment is that a reaction between arsenite and **RED-OXY®** is extremely rapid (within milliseconds) for all forms of arsenic.

Oxidation Kinetics

In order to provide our customers of how well **RED-OXY®** will work with "real life". To treat water with 50 ppb Arsenate at pH from 7 to 8 only 0.5 mg of **RED-OXY®** dosage is needed. As explained often, arsenic is usually present as As (V) in surface waters and as As (III) in most of ground-waters, which must be oxidized to the +5 state to ensure removal. Since **RED-OXY®** is the best oxidation method, the reaction kinetics between (AsO_3^{-3}) is shown as follows:

$$2FeO_4^{2-} + 3AsO_3^{-3} \longrightarrow 2Fe^{3+} + 3AsO_4^{3-}$$



RED-OXY® in small drinking water systems

Millions of small drinking water systems are equipped with Reverse Osmosis and the disadvantage of these systems, none of them is working, cannot be repaired because of limited financial and human resources, and some time due to their remote location. Watch-Water® has only one objective to install **RED-OXY®** systems to solve more than 90 % of water quality and treatment problems faced by small communities and villages.

RED-OXY® has proved to be more effective and less detrimental than any existing conventional

- Adsorbent media
- Chlorination
- Ozonation or
- Chlorine dioxide oxidation

These technologies are more costly, more hazardous or require specialized expertise to operate.

Watch-Water® will highlight the ways it can be used to improve water quality, lower cost and provide a more sustainable treatment alternative to any other existing technologies. Watch-Water® is already offering full-scale units for on-site production of the strongest adsorbent at cost of as low as 0.05 cents to treat one cubic meter (264.2 gallons) of water. **RED-OXY®** does not react with bromide like **ozone**; so the carcinogenic bromate is not produced in the treatment of bromide-containing water.

The dream of sustainable water re-use is now a reality!

The days of Ozone, Chlorine, Chlorine gas and Toxic Biocides are gone ...

... Thanks to RED-OXY®!

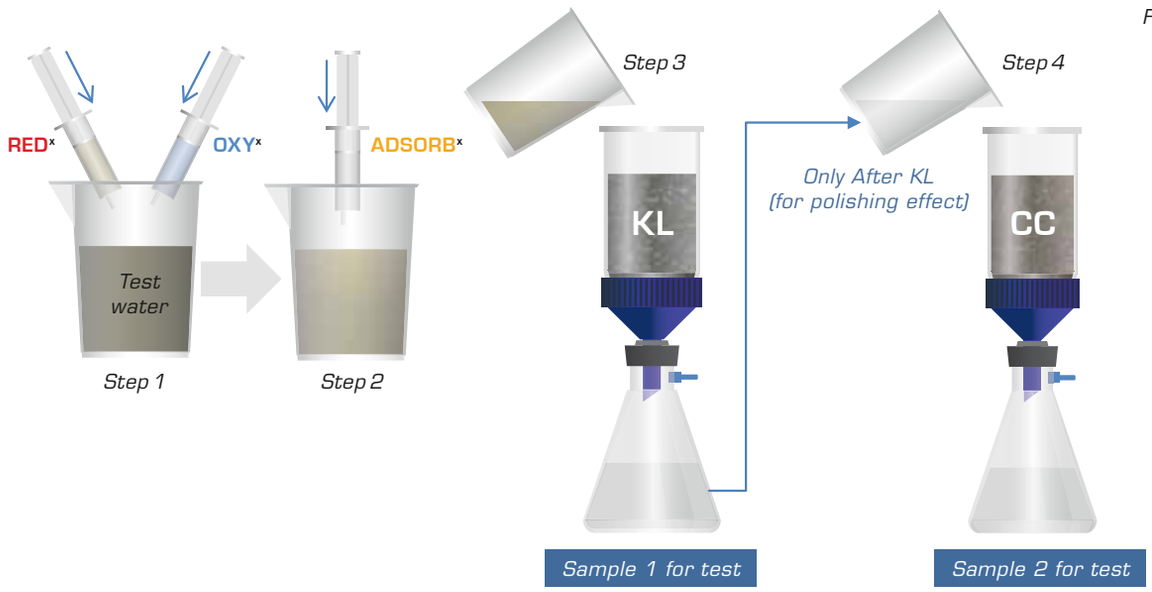
Breakthrough experiment

The **RED-OXY® LAB** breakthrough columns test can be conducted as a set of comparative tests, usually consisting of 2 to 4 columns in each run. But in the mobile Lab-Kit, a single column (95 mm diameter, 140 mm height) containing **KATALOX-LIGHT®** granules and a single column of the same size filled with **CATALYTIC CARBON®** is employed as a standard test on site. There are two sampling mugs to fill the columns on the inlet and collecting sampling at the outlets ends of the column. To begin a set of breakthrough results as to *(Fig. 7)*, a sample jar should be filled with the Contaminated Water. And now inject the prepared – **RED**^{x} and **OXY**^{x} into the sample *(Step 1)*. **ADSORB**^{X} shall be added to obtain the best results forming immediate sludge and precipitation *(Step 2)*.

The treated sample should be poured thorough **KATALOX-LIGHT®** *(Step 3)* and then collected and again poured through **CATALYTIC CARBON®** column for polishing effect *(Step 4)*.

To obtain results from the comparative columns both samples can be send to investigate water quality parameters.

Fig. 7



A Test Result with **RED-OXY® Lab** *showed the measured 95% reduction of very high concentration of sulfate.*

Water origin: wastewater from stone-wash facility in Germany

WATCH WATER
a Water Company

RED-OXY TREATMENT

FILTRATION
- KATALOX LIGHT
- CRYSTOLITE

ADSORPTION
- CATALYTIC CARBON
- TITANSORB
- FERROLOX

FILTERSORB
- FILTERSORB CT
- SORBEX
- FILTERSORB SP3
- SPECIAL FILTER

INSTANT PRODUCTS
- ISOFT CHEMICALS
- OXYDES
- OXYDES-P
- OXYSORB
- BIOXIDE
- SCALE-OVER
- GREEN-ACID

Message from the Leader board

Our partners will build

- Laboratory pilot Scale
- On-site Pilot Scale

We will be using any kind of water samples. This will allow us to prove the technology.

If you ask, is FeO_4^{2-} is the solution for

- Disinfection
- Oxidation and
- Adsorption followed by Katalox-Light® filtration

for water treatment in future?

The answer is YES!

RED-OXY® is the most powerful multi-purpose and environment friendly technology known in water-treatment.

RED-OXY® is available as INSTANT product (solid granule/powder form) that can be delivered worldwide without unnecessary water.

99 % purification/separation can be achieved using **RED-OXY®** (Ferrate Hexahydrate) Technology.

Packaging

4 x 5 kg bags of **RED**^{x} (Hydrated Iron in solid form) in a box

4 x 5 kg bags of **OXY**^{x} (oxidizer chemical in solid form) in a box

4 x 5 kg bags of **ADSORB**^{x} (adsorbent chemical in solid form) in a box

To know and learn more about this huge potential of **RED-OXY® TREATMENT** please contact us:

DISTRIBUIDOR AUTORIZADO

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