


NORLEX SYSTEMS

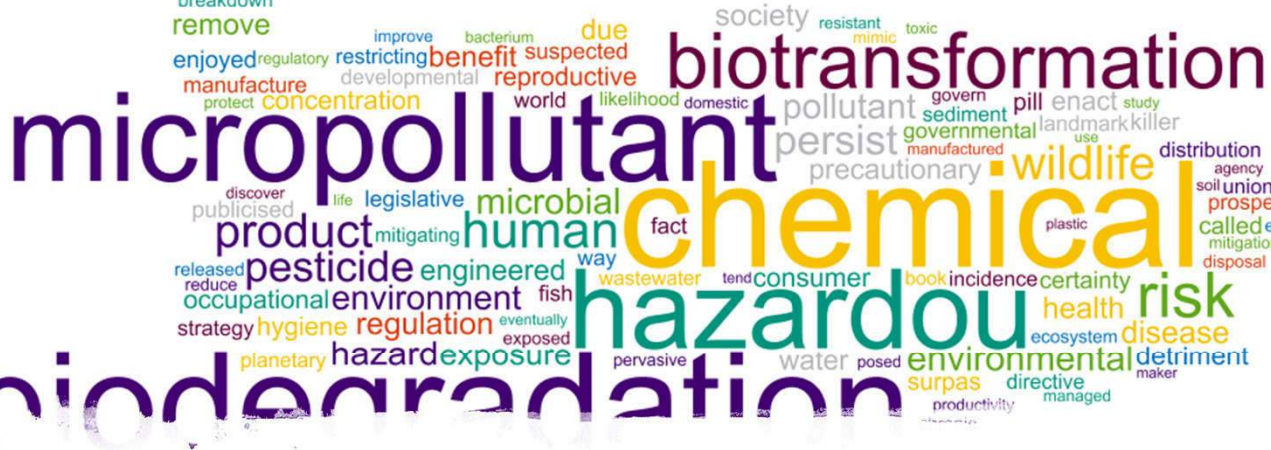


MICRO POLLUTANTS

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25.09.2018

1



MICRO POLLUTANTS

There are currently 100 000 commercially registered compounds in Europe and residue from the majority of these will eventually end up in the water cycle.

MICRO POLLUTANTS

- Very small particles or molecules of polluting material that are non-biodegradable and therefore end up in our water cycle
- Increased focus on micro pollutants due to increasing environmental footprint of human behavior
- Examples include heavy metals, micro plastic, medicine remains, carcinogenic substances, multiresistant bacteria
- Norlex is devoted to reduction of micro pollutants in the environment

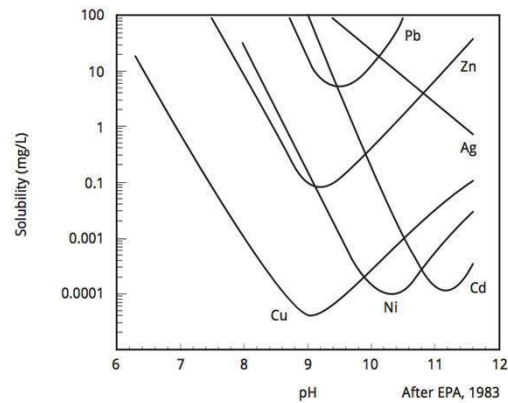


HEAVY METALS

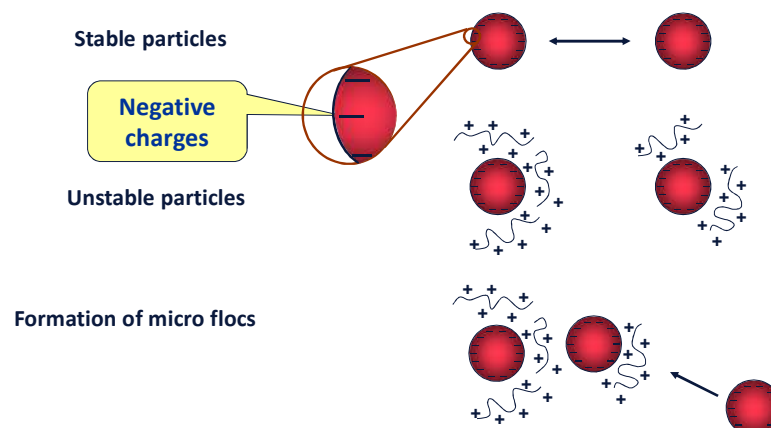
- Too much of anything is not good
- All transition metals are highly toxic to life at low levels, but at the same time some, such as manganese, iron, cobalt, nickel, copper, zinc and molybdenum, are essential micronutrients needed for the human body to function properly
- Heavy metals exists in a soluble and insoluble form
- Accumulate in the body

HOW TO REMOVE HEAVY METALS?

- Change pH to make sure the target metals are on insoluble form
- Add coagulant to bind the created particles together
- Get pH back to neutral.
- Add polymer, flocculate
- Remove floc of precipitated metals (plural: sludge) from water
- Discharge water and dewater sludge



Coagulation

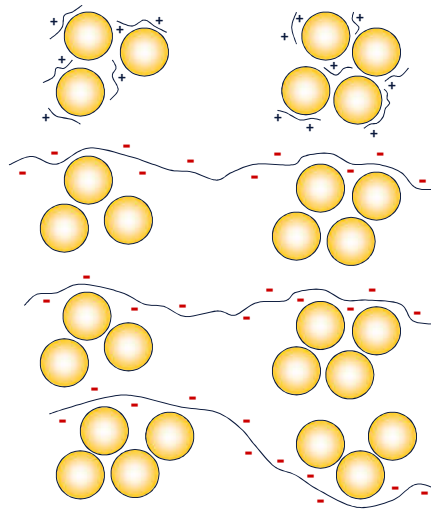


Flocculation

Unstable particles

« Bridging » by Polymers

Floc formation

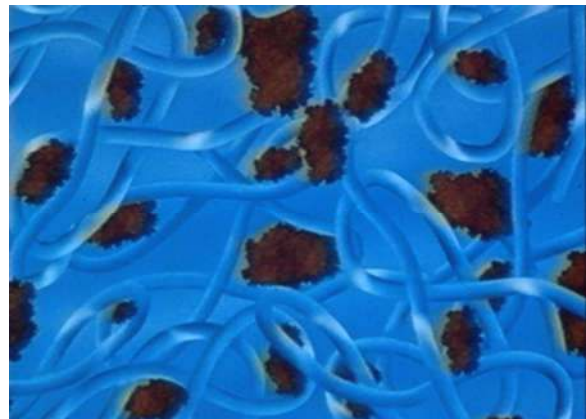
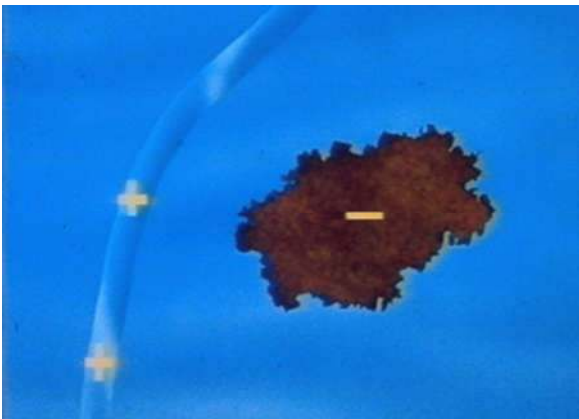


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7

Floc formation



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8

Norlex Integrated Systems

- Norlex suggests heavy metal removals using integrated systems combining:
- Belt filters with integrated chemical treatment (Physico-chemical)
- Dewatering equipment – Centrifuge, Filter Press, Screw Press
- Examples include heavy metal reduction in laundry wastewater and treatment of water in biofueled power plants



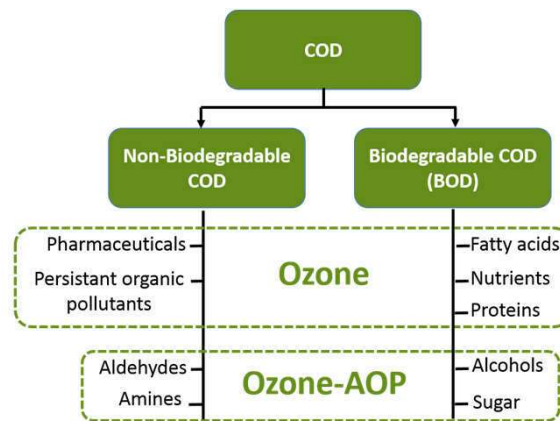
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ORGANIC MICRO POLLUTANTS

- Examples include: phenols, PAH, medicine, other toxic organic compounds
- To remove abovementioned compounds, a powerful oxidation is needed
- Oxidation of a compound means that aggressive oxygen cuts the molecules into pieces, eventually ending up with CO₂ and H₂O

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Oxidation vs. Advanced Oxidation (AOP)

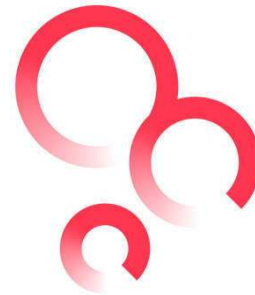
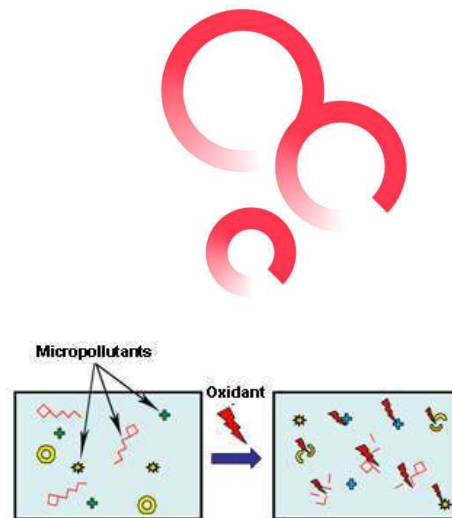


AOP

- **WIKI: Advanced oxidation processes** (abbreviation: **AOPs**), in a broad sense, 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($\cdot\text{OH}$)
- **IntenseOx**: AOP with a twist; focus is on injection, application and monitoring

IntenseOX

- IntenseOx is Norlex' technology for oxidation of wastewater. It incorporates oxidative gas, addition of oxidation boosters and state-of-the-art mixing.
- As the IntenseOx technology can be used on a wide spectrum of applications, the following is chosen as main focus:
 - Removal of organic micropollutants from wastewater and sludge; e.g. phenols, PAH, formaldehyde
 - Treatment of hospital wastewater



Bubbles

- MNB, micro-nano-bubbles are ideal for gas-liquid mass transfer
- Prolongs the effect of e.g. ozone in the water
- On-edge science – Norlex has developed a tool which accurately predicts gas transfer rates as a function of bubble size



Phenol removal

- Phenols are used in a wide range of industrial applications
- Phenol are highly toxic and carcinogenic
- Regulations are tightening for amount allowed to discharge
- Norlex Systems experience:
 - IntenseOx systems installed at large manufacturer – in combination with oil and heavy metals removal

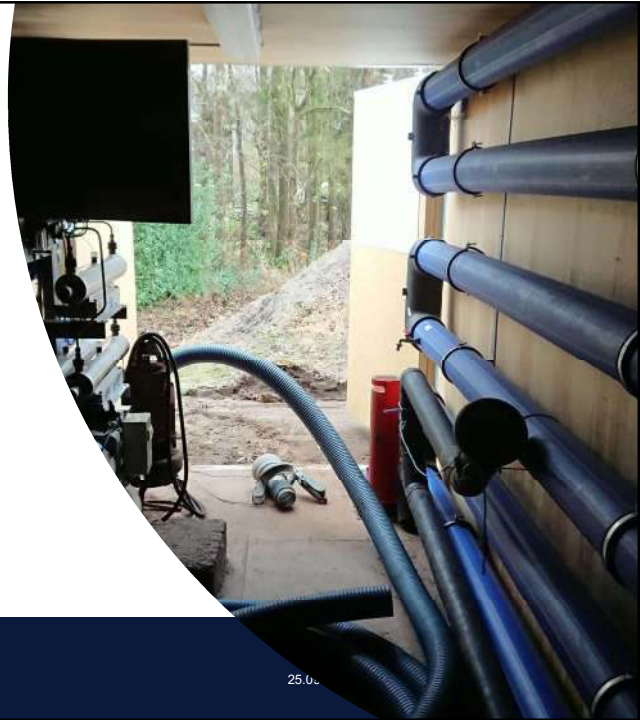


PAH removal

- PAH is a term for more than 100 aromatic hydrocarbons. Some are highly toxic and carcinogenic
- Ongoing tests for PAH reduction in sludge from municipal WWTP
- IntenseOx is expected to be able to reduce PAH in primary sludge from treatment plants by 95%
- Norlex Systems is working on response units, to be able to remove excess amounts of PAH in sludge

Hospital wastewater

- Disinfection of wastewater to remove multiresistant bacteria
- IntenseOx can target specifically bacteria, not the organic matter otherwise present in the water
- Medicine remains will be greatly reduced
- State-of-the-art monitoring system is developed to ensure correct dosing



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NORLEX GROUP

- Founded in 1982
 - Organic growth
 - Acquisitions
- NORLEX CHEMICALS
 - All chemical business is consolidated in this business unit
- NORLEX SYSTEMS
 - System integrator, New proprietary technologies
- NORDISK ALUMINATE
 - Production of functional aluminates and CMA

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18