Biological Sludge Oxydation

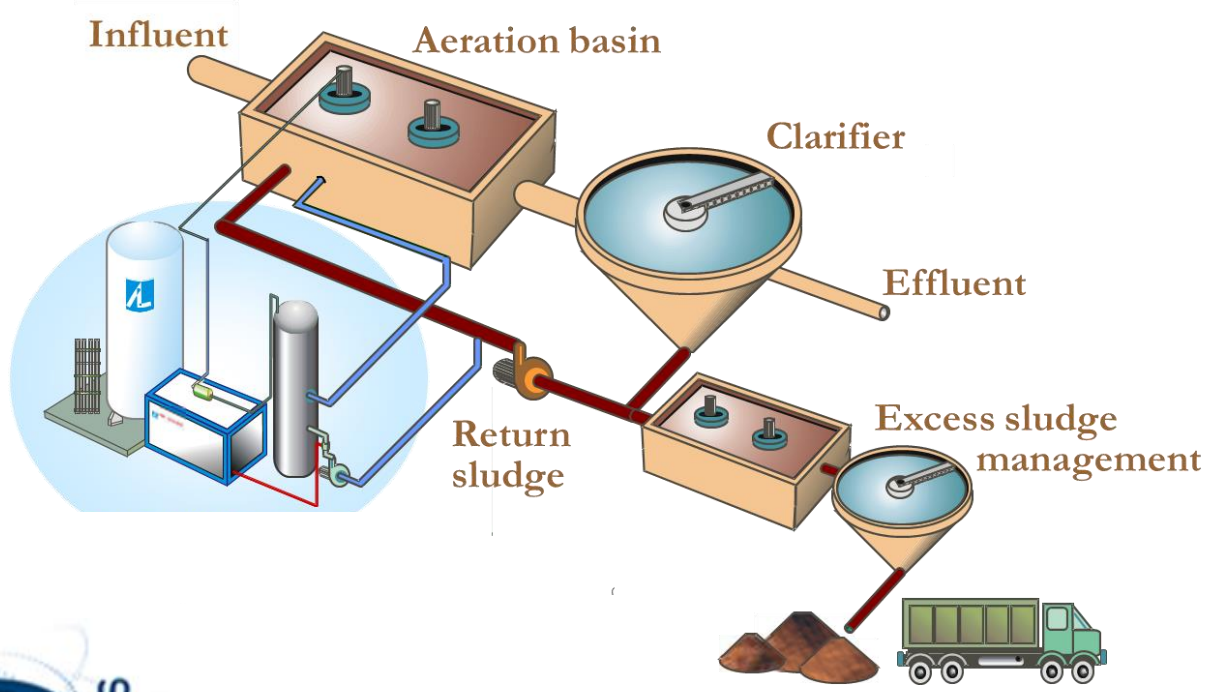
Ozonolysis of biological sludge: effective process to reduce excess sludge by partial Ozone injection.

40 YEARS
Ozone since 1970 with Passion

- Application
- Process
- Operational results and target
- Main installation and references
- Membrane Biological Reactor

Application

- Biological Sludge Oxydation treats a partial stream of the return sludge
- Desintegrated sludge will be metabolized back in the aeration basin



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Ozone since 1970 with Passion

Process

Use of a contained quantity of ozone allows:

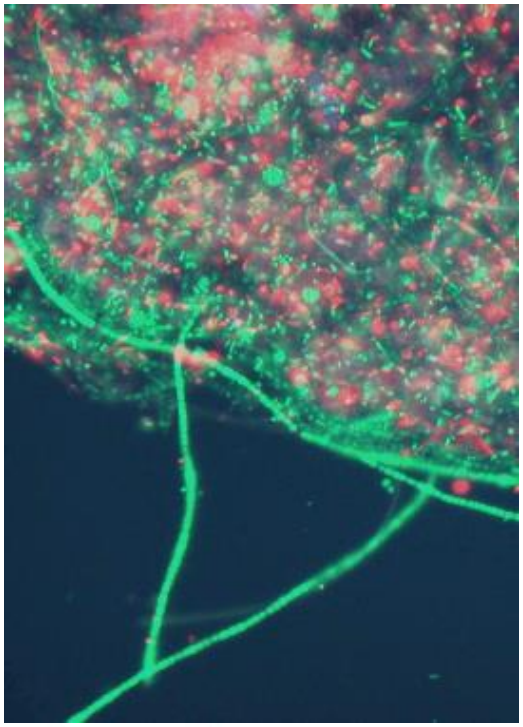
1. DAMAGE cellular structures of strongest organisms which use energy derived from the nutrients consumption for the restoration of the cell and not for reproduction.
2. LYSE weaker organisms
3. SELECT the "predators" (Protozoa) that metabolize lysed or damaged cells;
4. MAINTAIN the concentration of SST in the mud treaty.

Advantages:

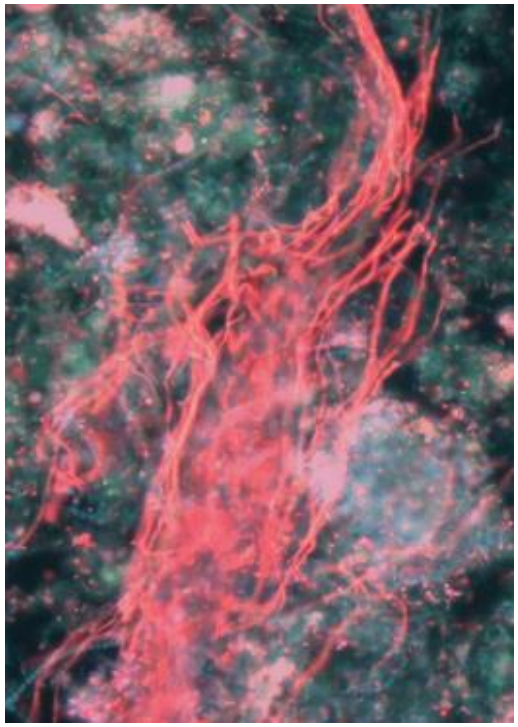
1. reduction in sludge disposal costs (less weight and better sedimentation);
2. reducing the cost of sludge treatment (less use of chemicals and equipment);
3. elimination of bulking.

Ozone effect on bacteria

Without ozone: ALIVE



With ozone: DEAD



40 YEARS
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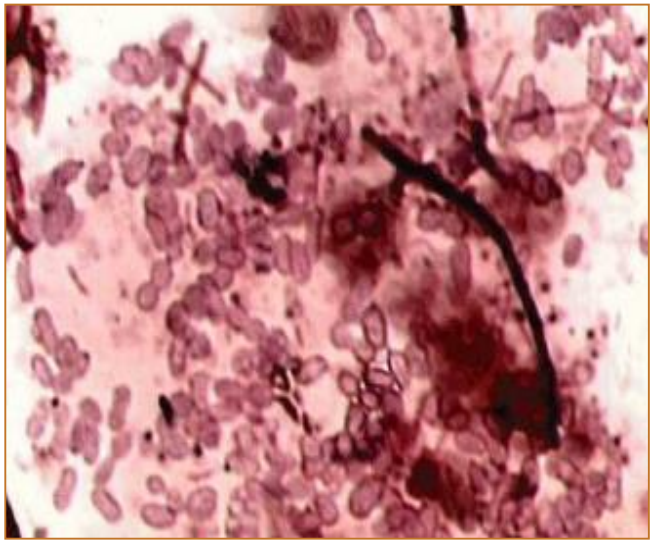
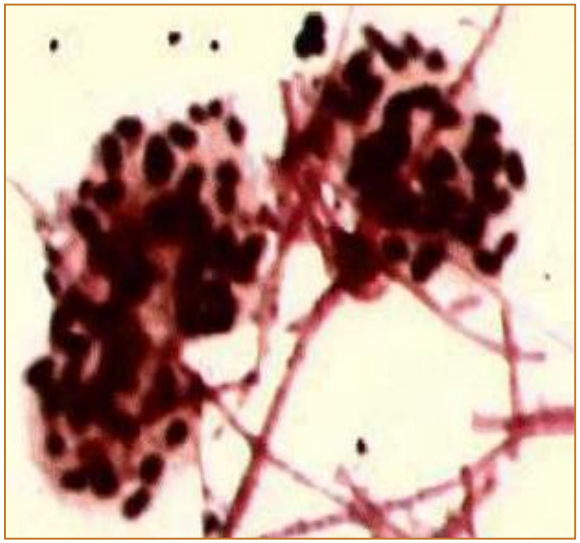
ECP reduction

Before ozonation



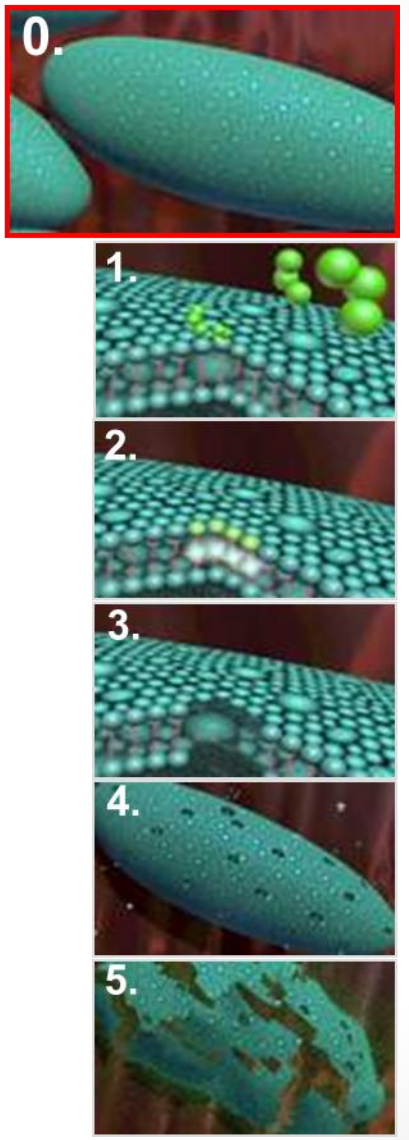
After ozonation



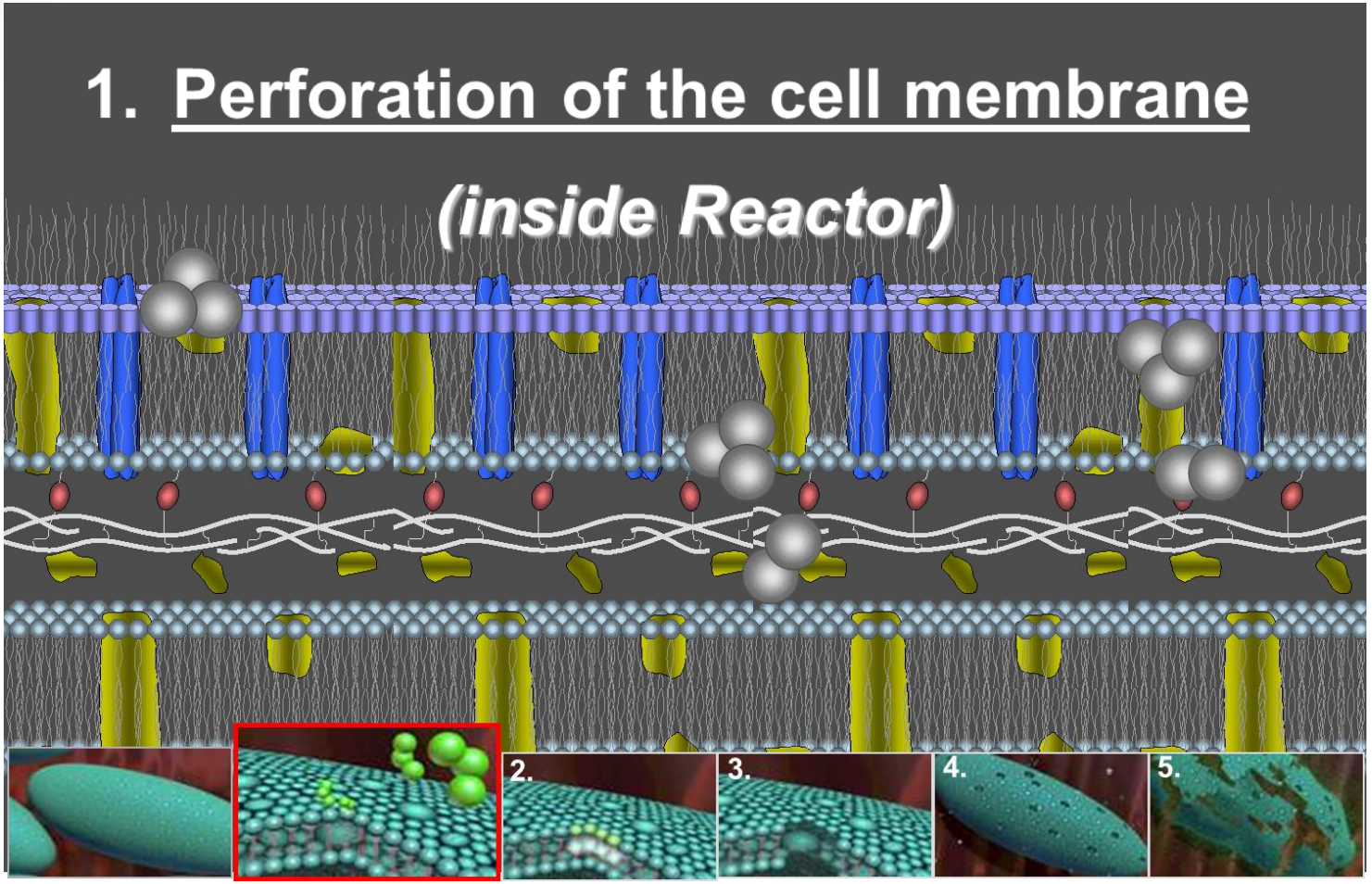
ECP are formed when bacteria are in a stressful situation, caused, for example, by lack of nutrients, predators, toxins, etc. ECP have a negative effect on dewatering, and are oxidized by ozone.

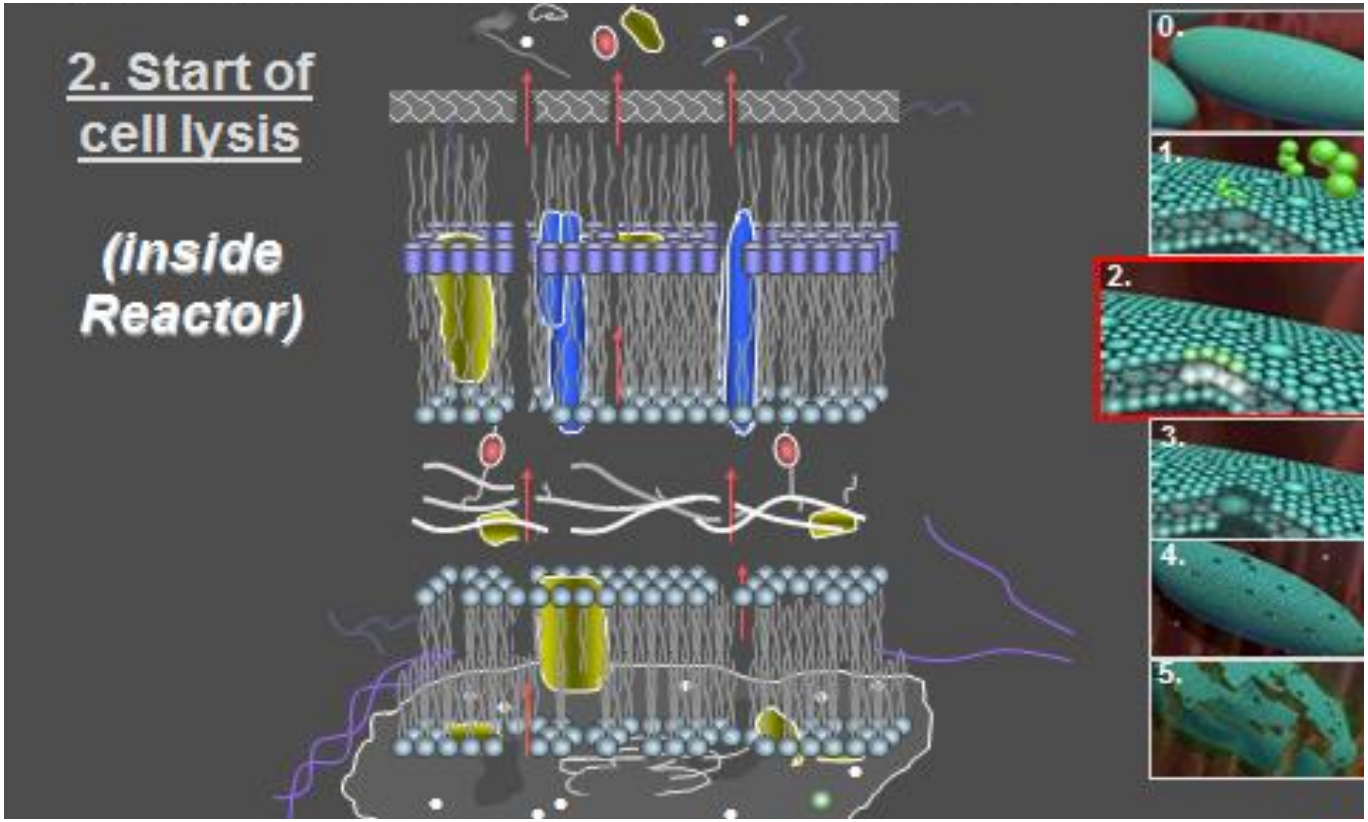
ECP reduction is about 30% after ozonation

Process



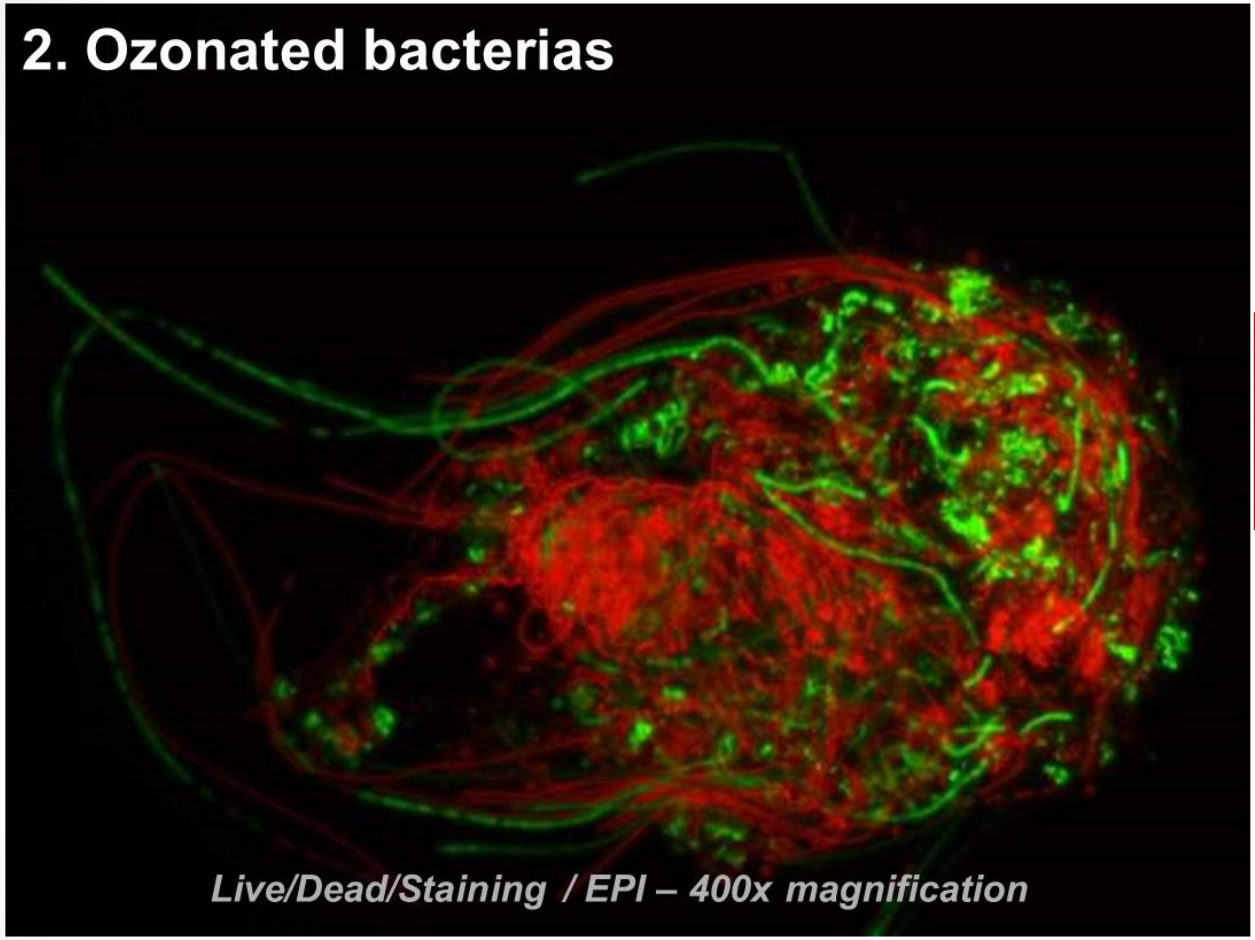
40 YEARS
Ozone since 1970 with Passion



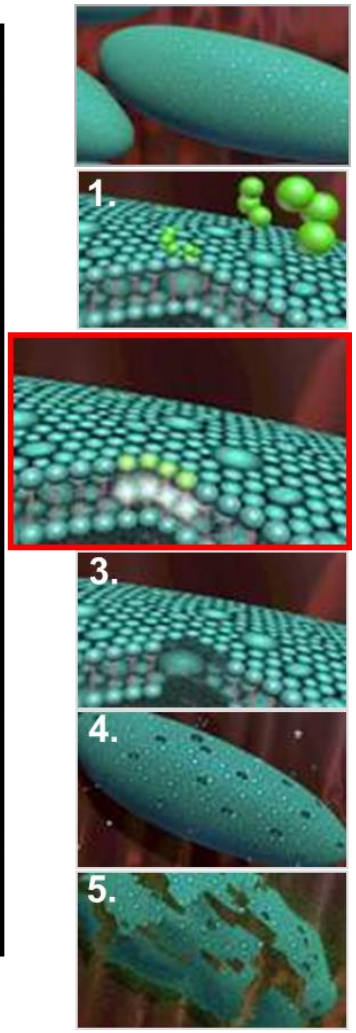


40 YEARS
Ozone since 1970 with Passion

2. Ozonated bacterias



Live/Dead/Staining / EPI – 400x magnification



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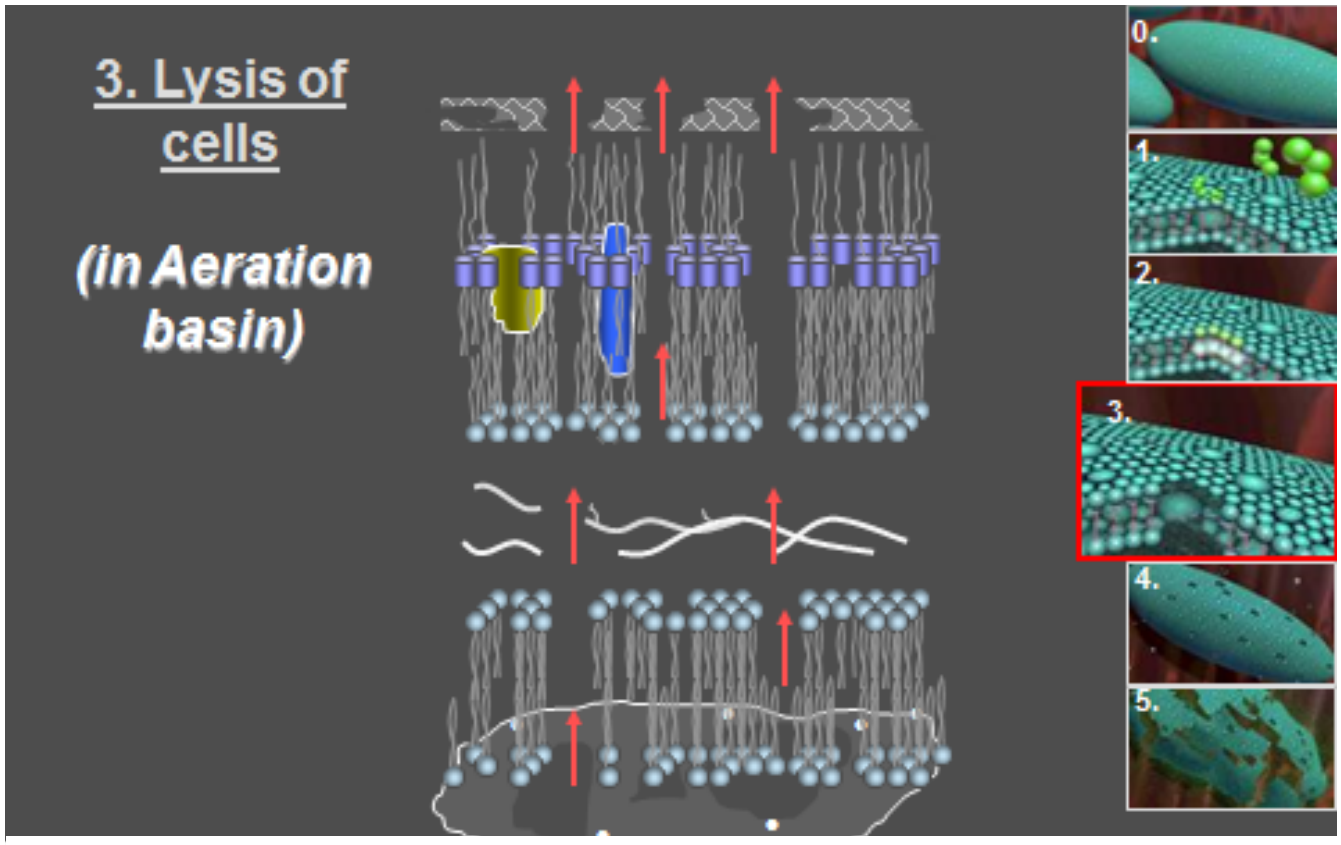

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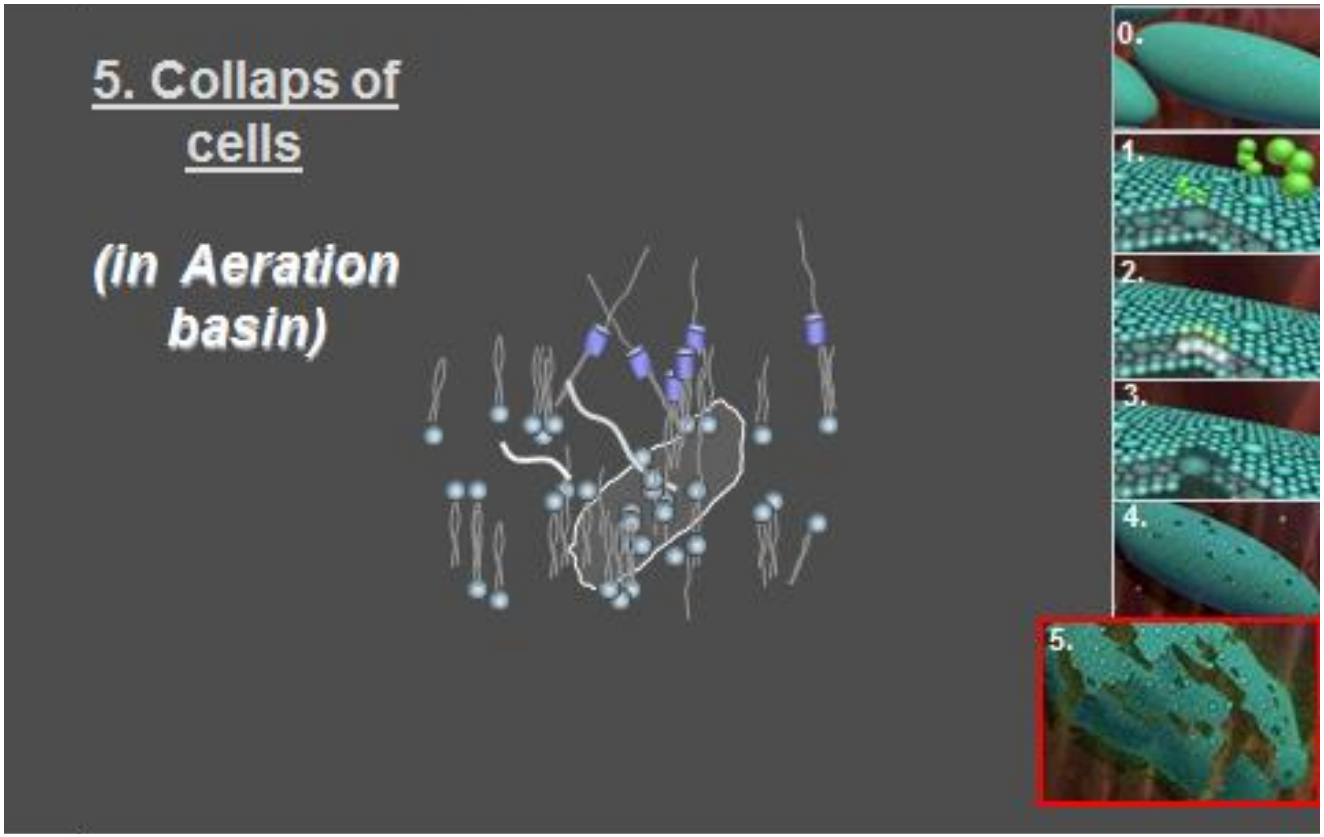
Ozone since 1970 with Passion



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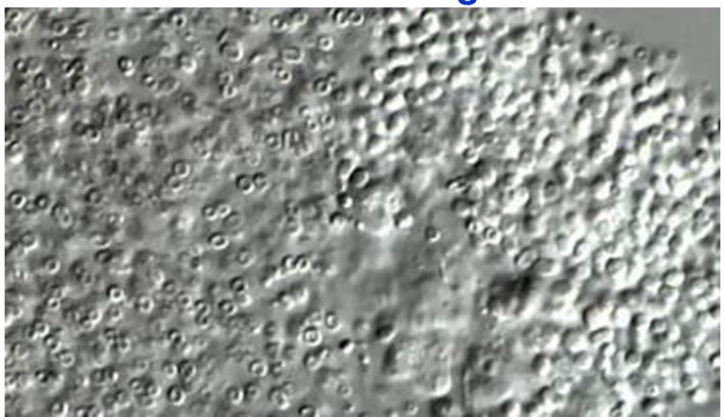
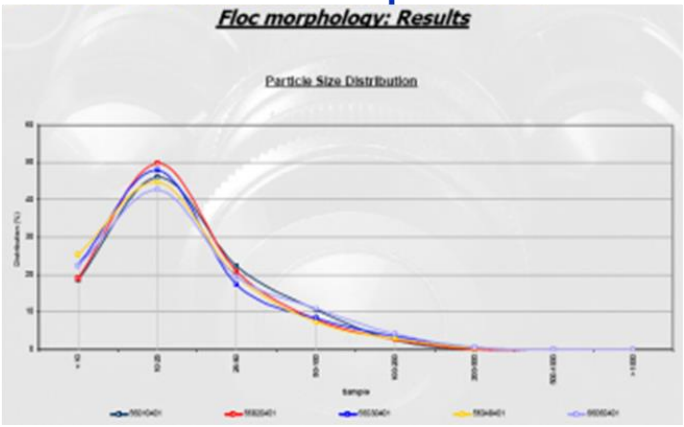
Effects

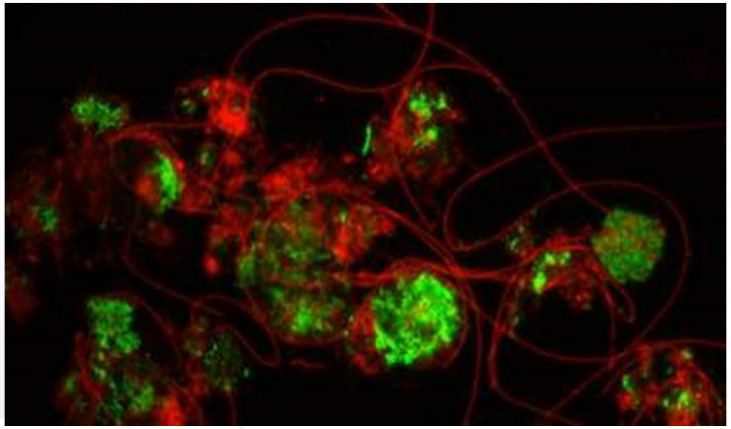
1. Reduce of excess sludge



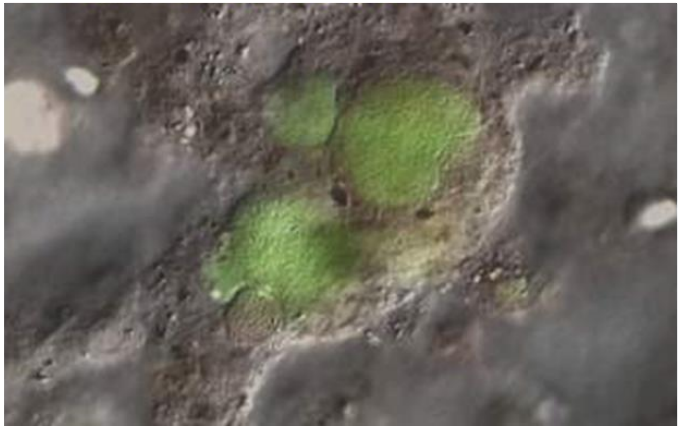
2. Floc structure keeps intakt



3. Oxidation of filamentuous bacterias



4. Nitrificants resists



Modell: Ozone-Effect on Biomass

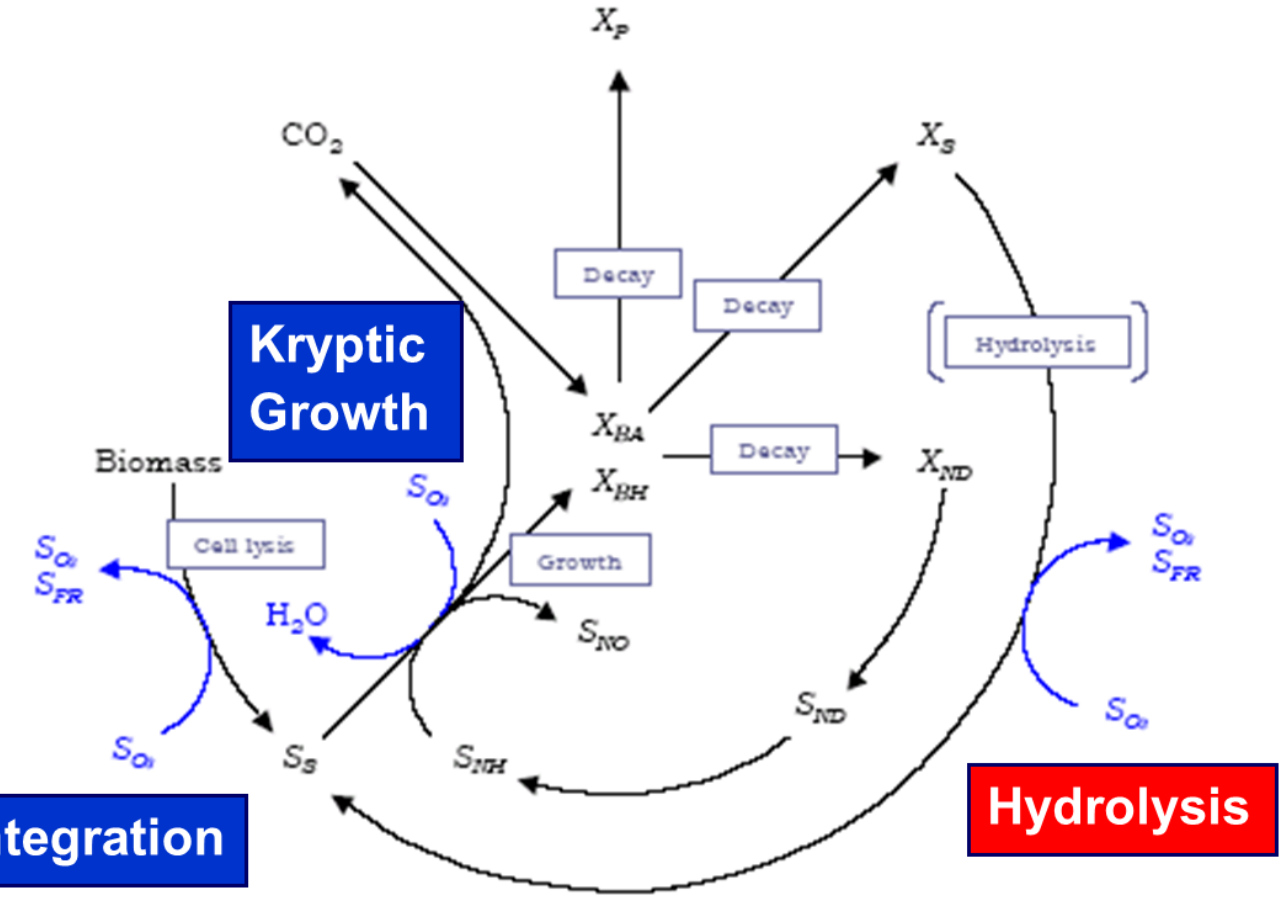
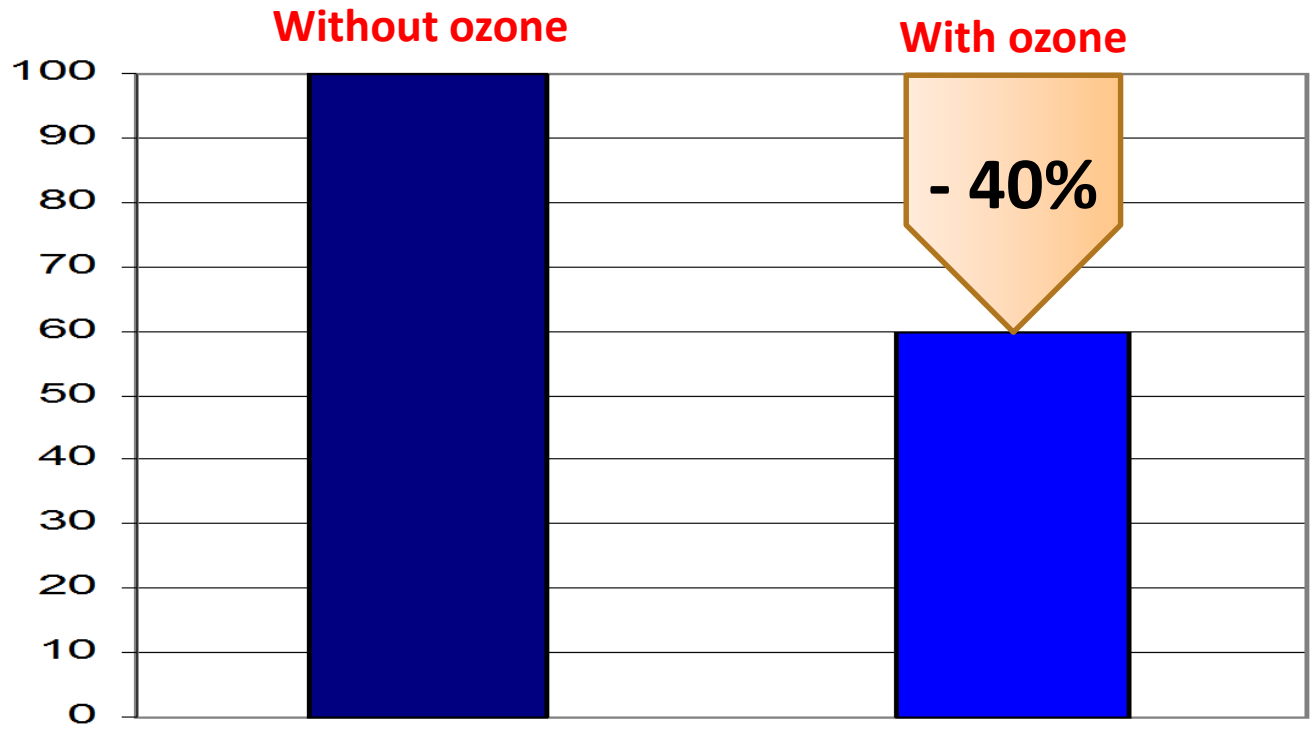


Figure 180. Biological pathways associated with ozonation

Operational Results and Target



40% reduction of produced sludge

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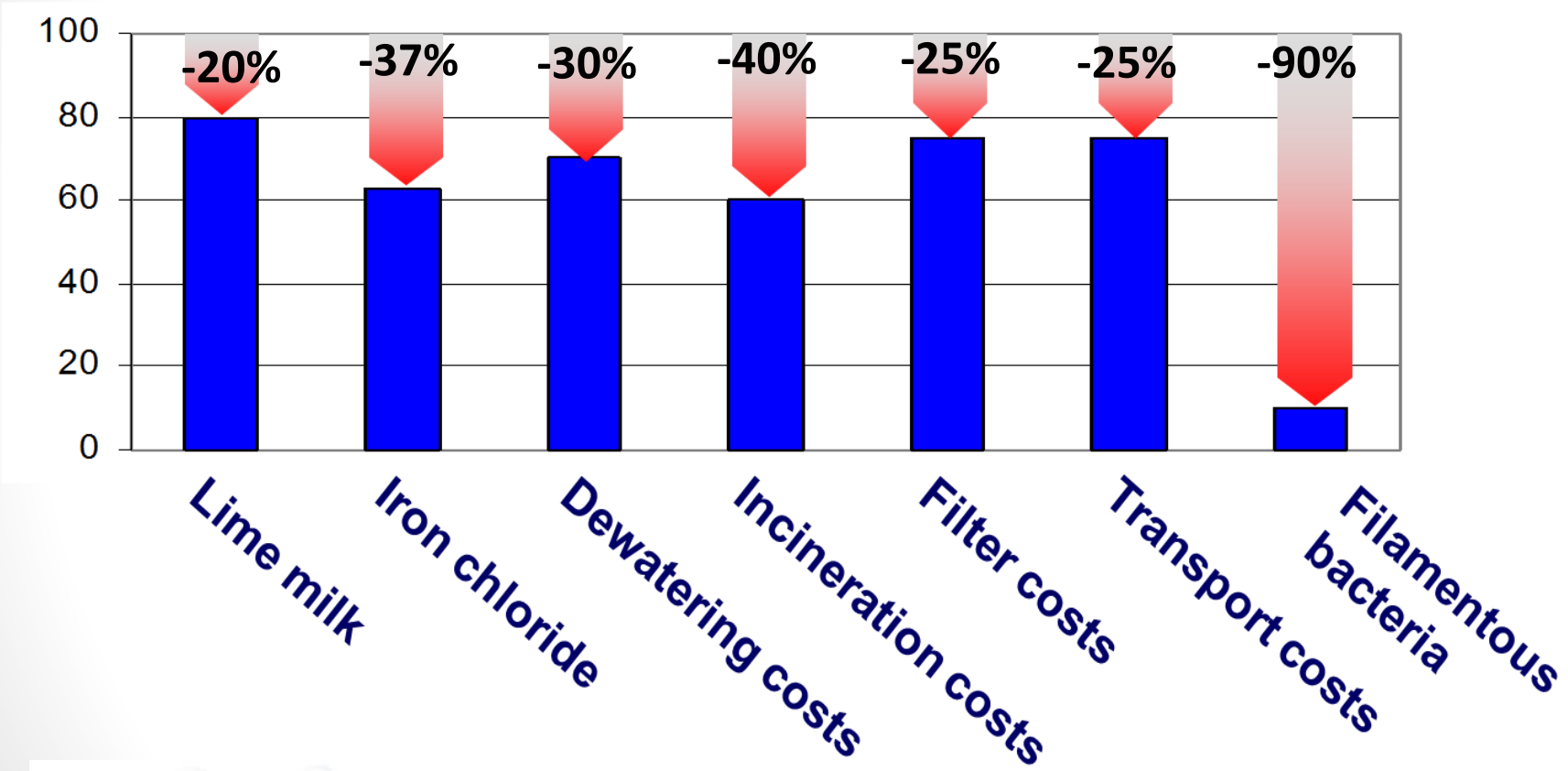
Ozone since 1970 with Passion

Besides the reduction of 40-50% of the excess sludge, there are other positive side effects:



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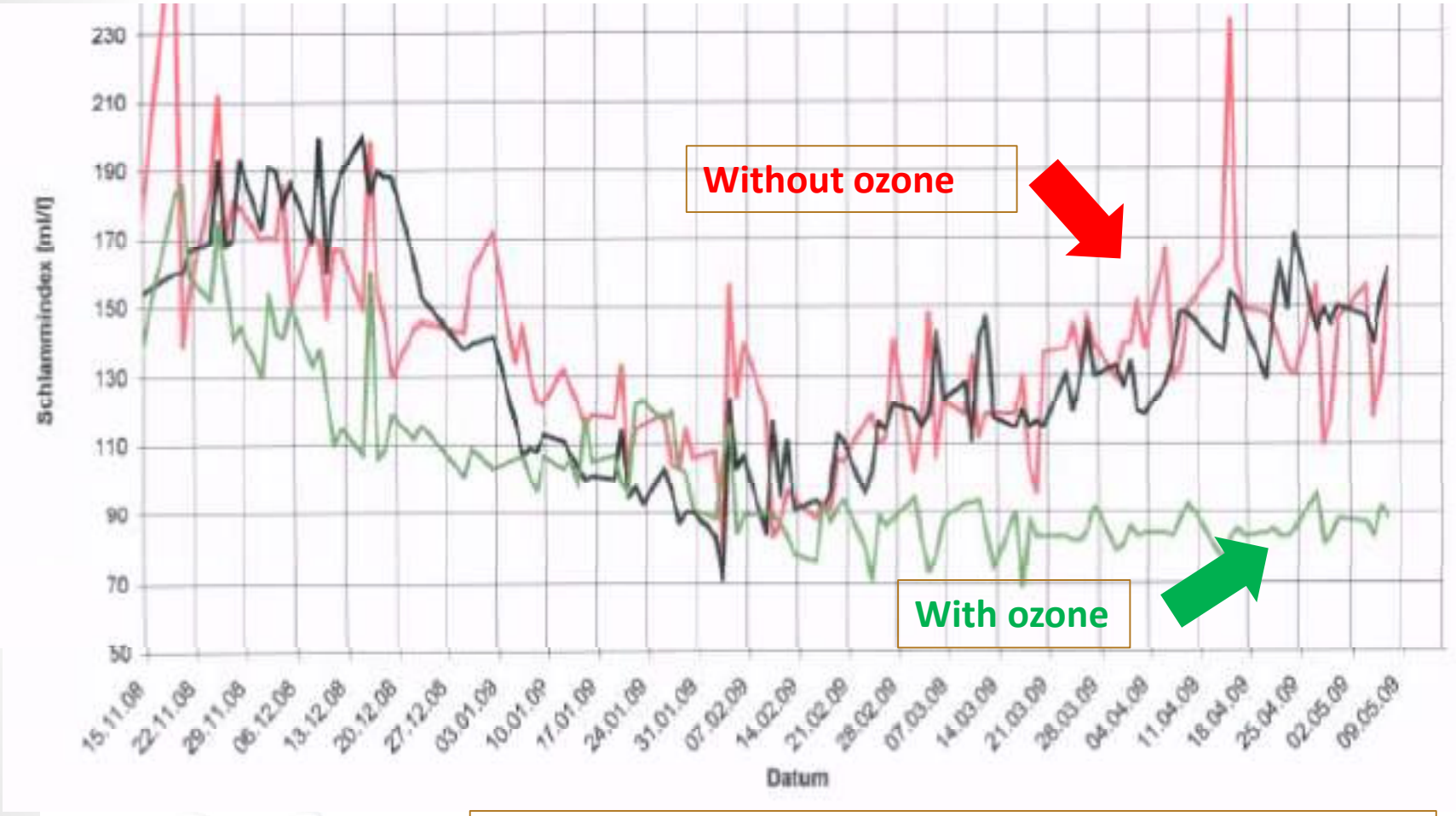
Civil waste water treatment plant in Germany: SVI decrease



Decrease of Sludge Volume Index

40 YEARS
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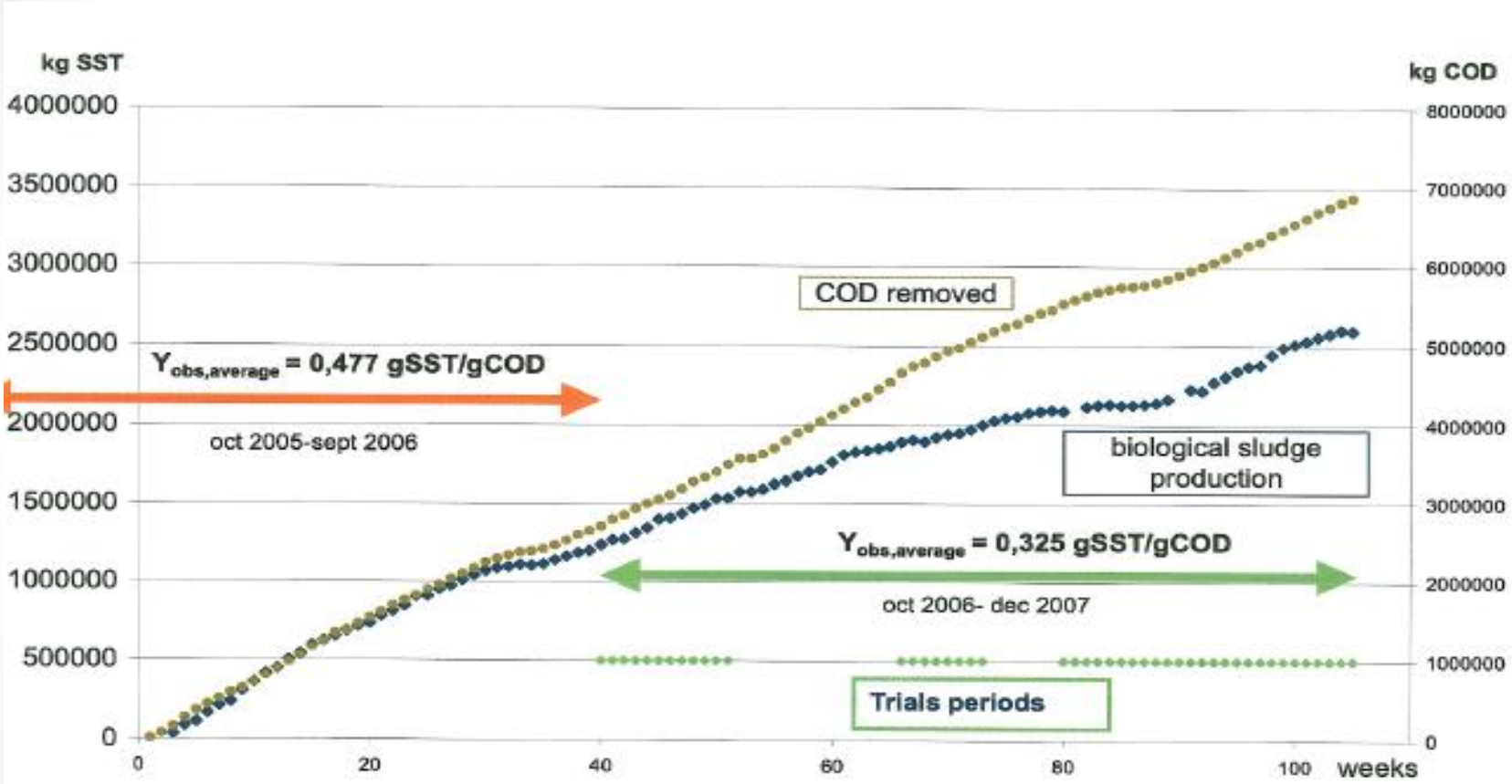
Varese, Italy, public waste water treatment plant: 1500 m3/h. Sludge production: 2011 vs. 2012.

Varese, Italy, public waste water treatment plant.



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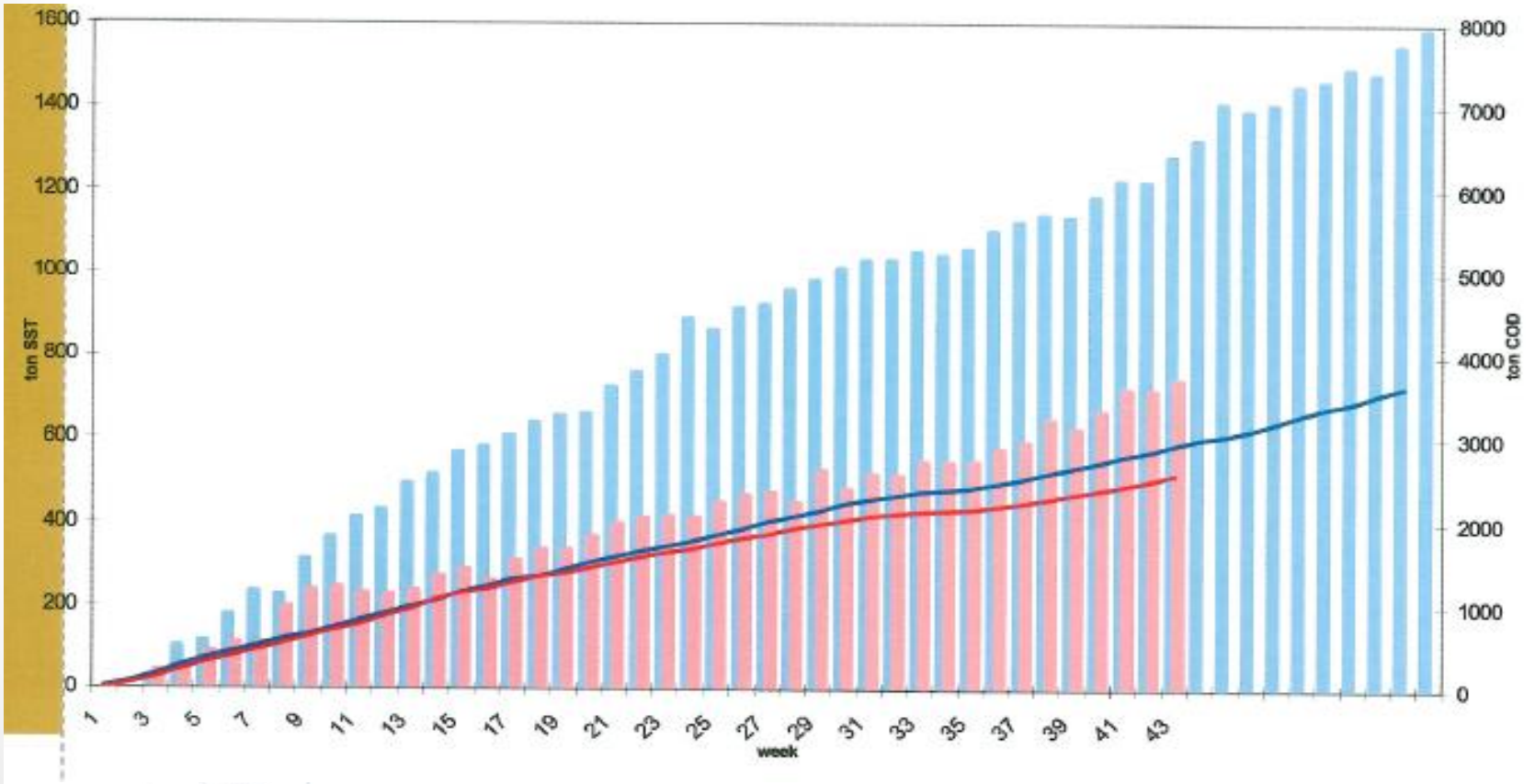
accumulated sludge 2010, accumulated sludge 2011

removed COD 2010, removed COD 2011



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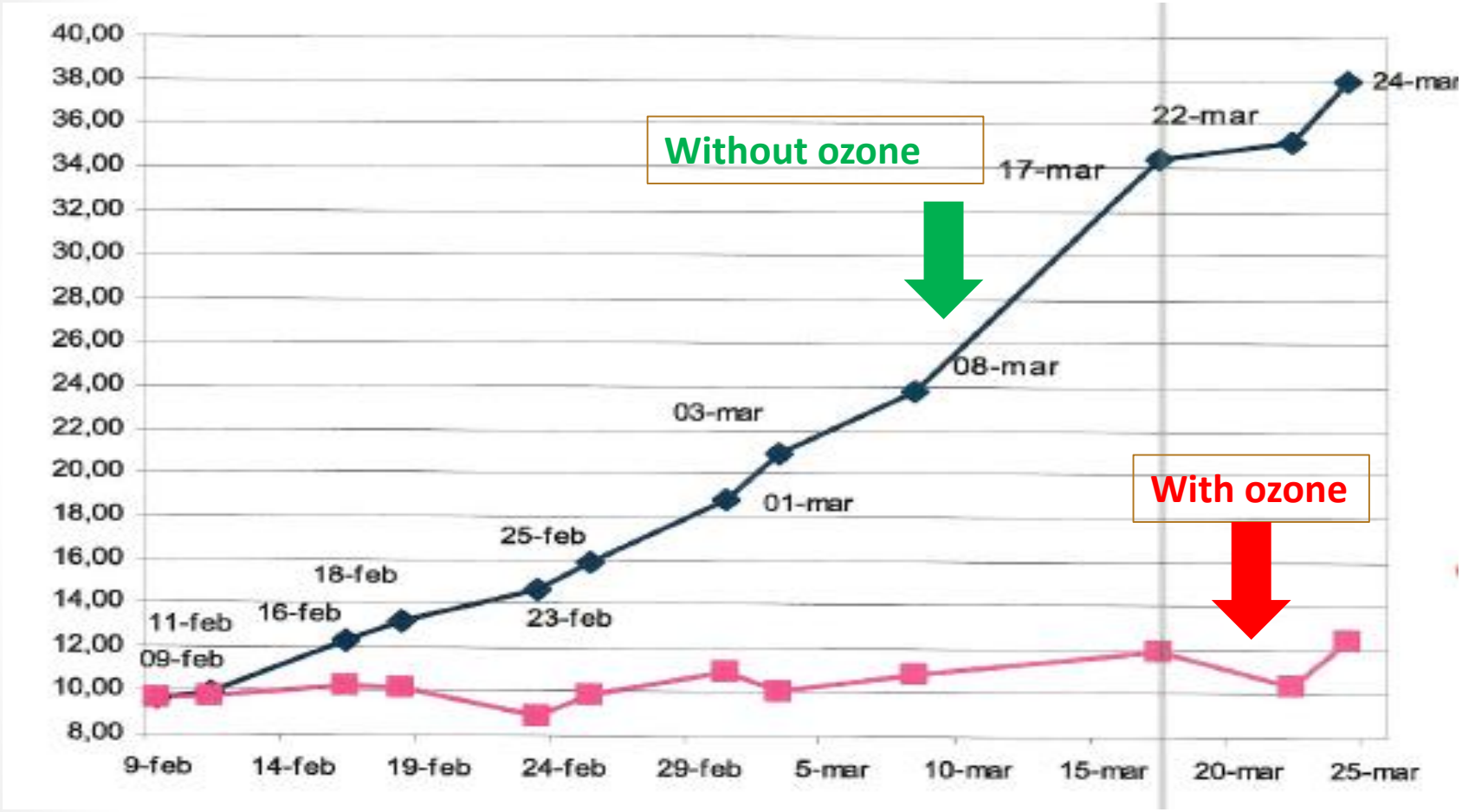
Publiacqua. Firenze, Italy : 125 m3/h



-53% of produced sludge

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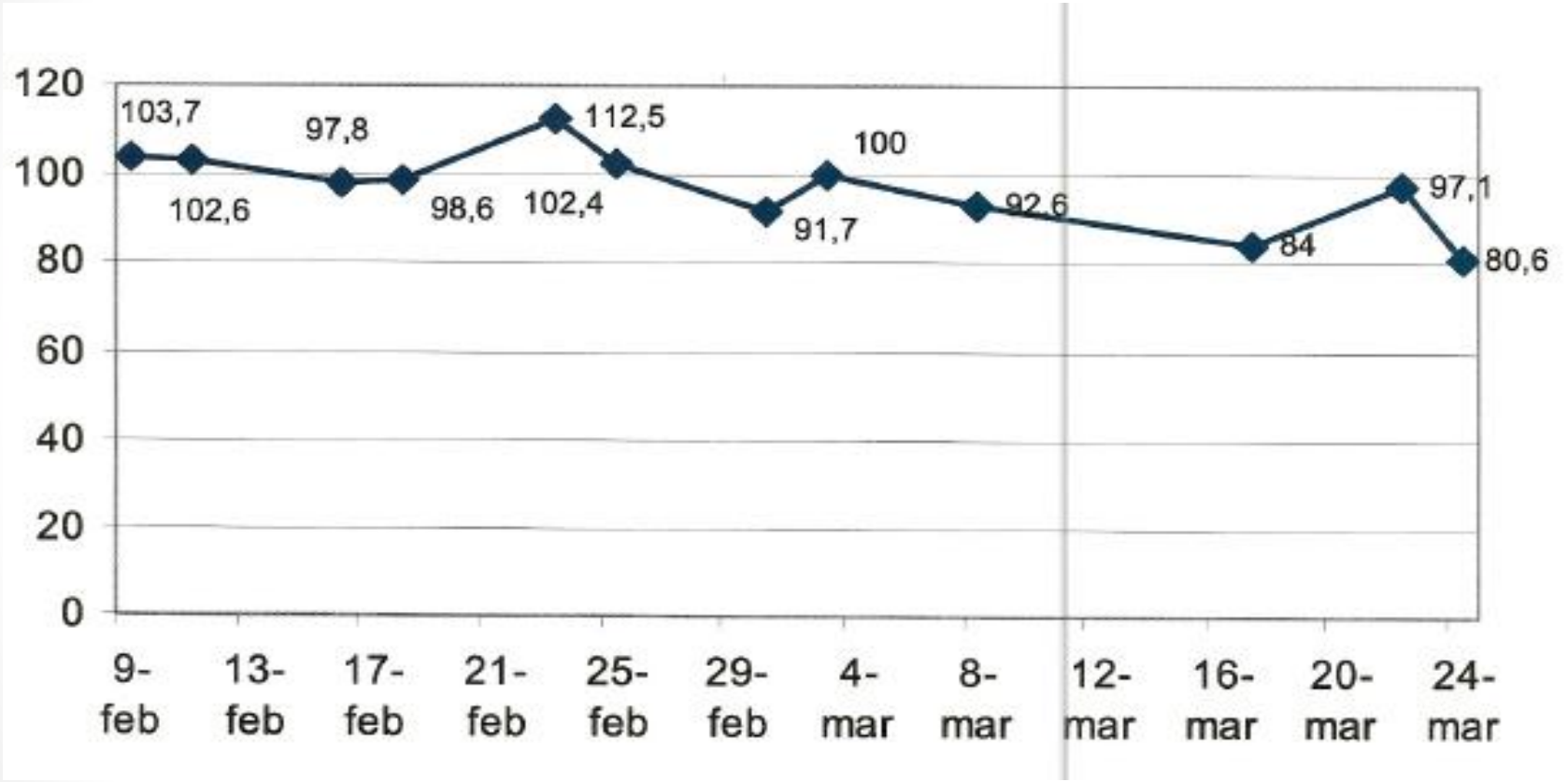
Sludge Volume Index stabilization



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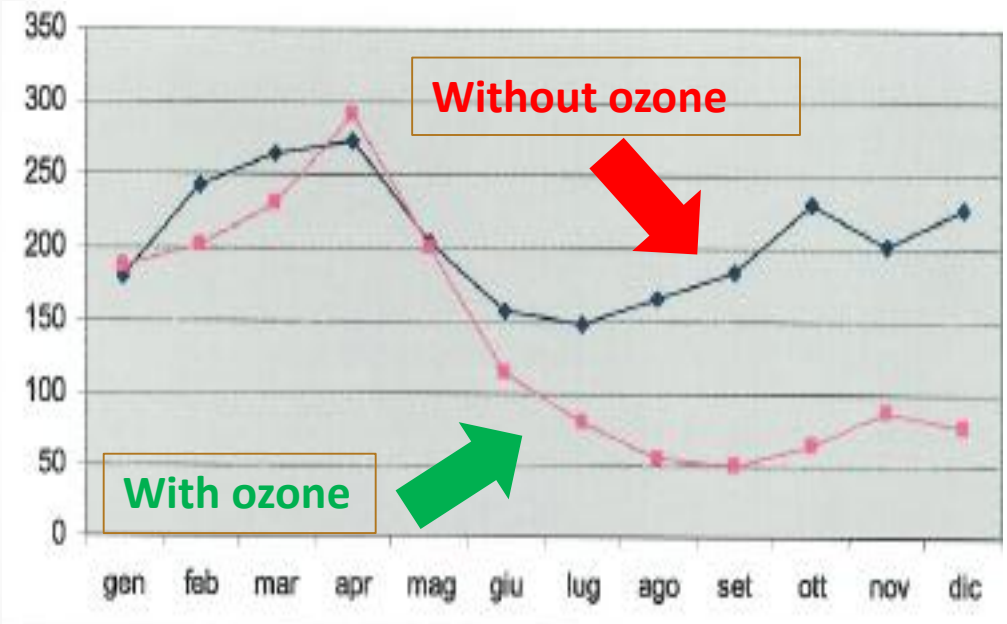
Coelsanus, Food Industry, Italy: 12 m3/h

Monthly SVI



-40% of produced sludge
-35.000€/year for disposal

40 YEARS
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Trento 1, Italy, public waste water treatment plant

-35% of produced sludge

Oxygen by PSA

Trento 2, Italy, public waste water treatment plant

-37% of produced sludge

Oxygen by PSA

40 YEARS
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Other installation and results

Paullo, Milan, Italy: 200 m3/h → **- 30%**

Treviso, Italy: 100 m3/h → **- 40%**

40 YEARS
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Biological Sludge Oxydation and MBR (Membrane Biological Reactor)

MBR Problems:

FOAMING

FOULING

40 YEARS
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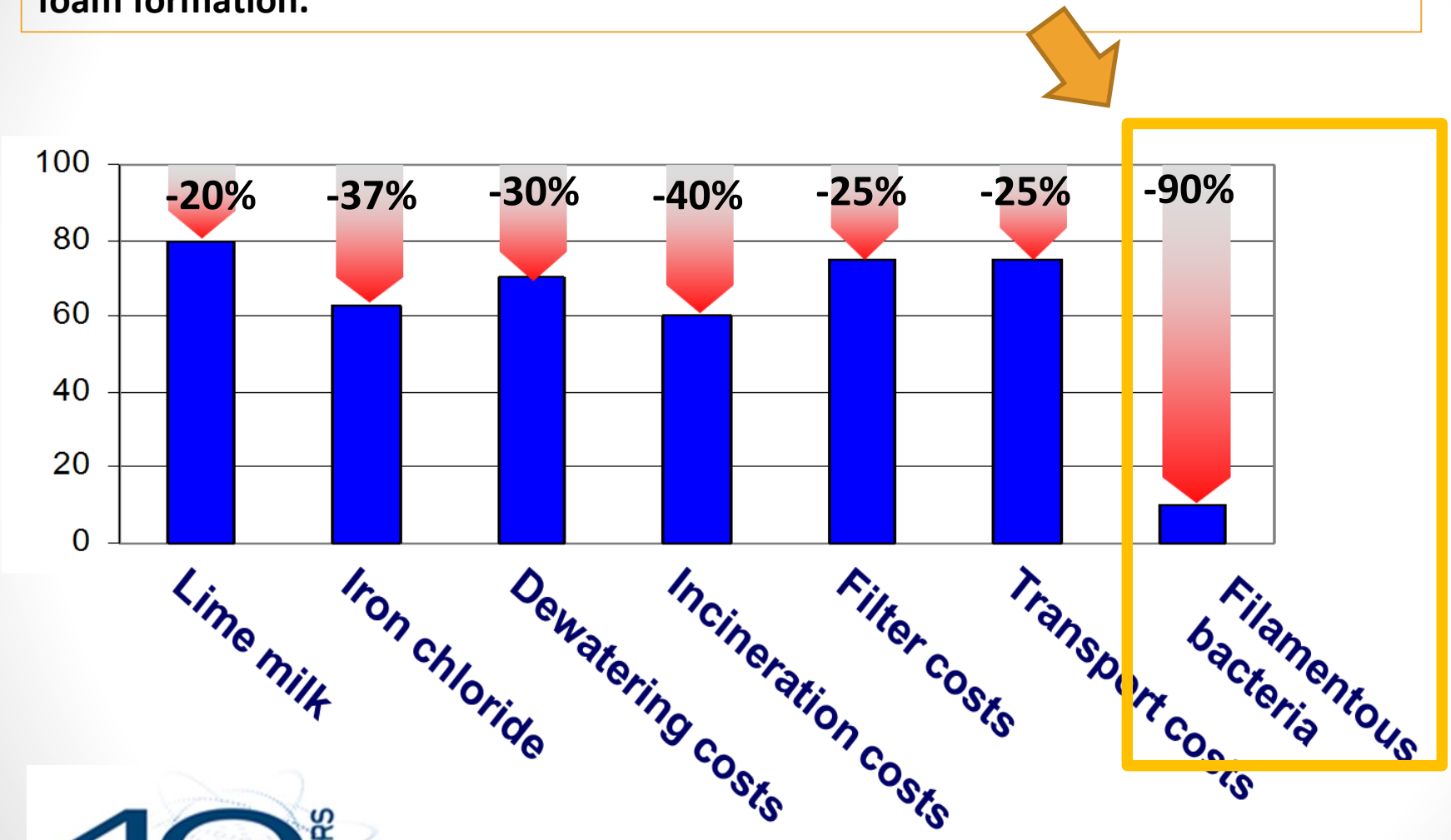
Ozone drastically reduces filamentous bacteria that are the main cause of the foam formation.



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Filamentous bacteria are the main producer of EPS (Extracellular Polymeric Substances). EPS are the main cause of fouling process.

OZONE → **less FILAMENTOUS BACTERIA** → **less EPS** → **DIFFERENT STRUCTURE OF FLAKE** → **less FOULING** →

1) less BACKWASHES
2) less CHEMICALS
3) less MAINTENANCE
4) MEMBRANE LONGER LIFE

and → **-30% of produced sludge**

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