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Ecotoxicological evaluation of the effects caused by transformation- and byproducts from chemical treatment

Maritha Hörsing^{1,2}, Sara Furuhausen³,
Maria G. Antoniou², Anna Ledin^{1,2},
Magnus Breitholtz³ and Henrik Rasmus Andersen²

¹ Department of Chemical Engineering,
Lund University, Sweden

² Department of Environmental Engineering,
Technical University of Denmark, Denmark

³ Department of Applied Environmental Science,
Stockholm University, Sweden

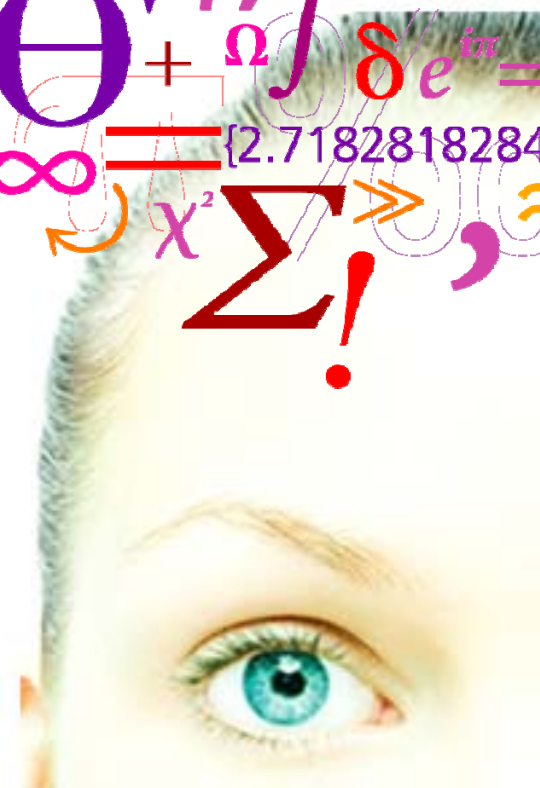
$$f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^i}{i!} f^{(i)}(x)$$

$$\int_a^b \epsilon \Theta^{\sqrt{17}} + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$$

$$\chi^2 \Sigma !$$



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1.st objective of study

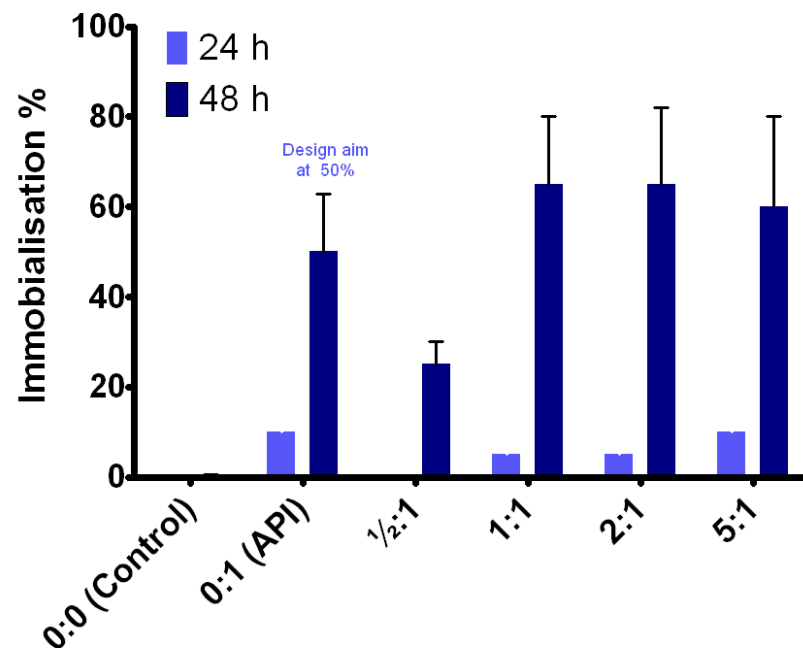
Does O_3 or ClO_2 treatment of pharmaceuticals create toxicity?

Treatment of mixture of 114 pharmaceuticals with molar ratios of oxidants from $1/2:1$ to $5:1$.

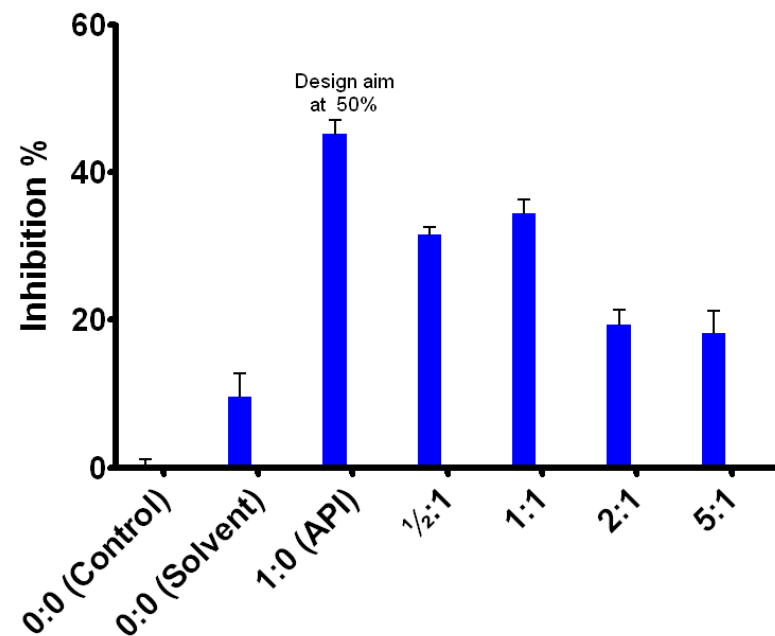
Test at concentration equal to EC_{50} of the untreated mixture to detect increase or decrease in toxicity.

Ia. Ozonation of pharmaceuticals

Daphnia magna immobilisation, O₃



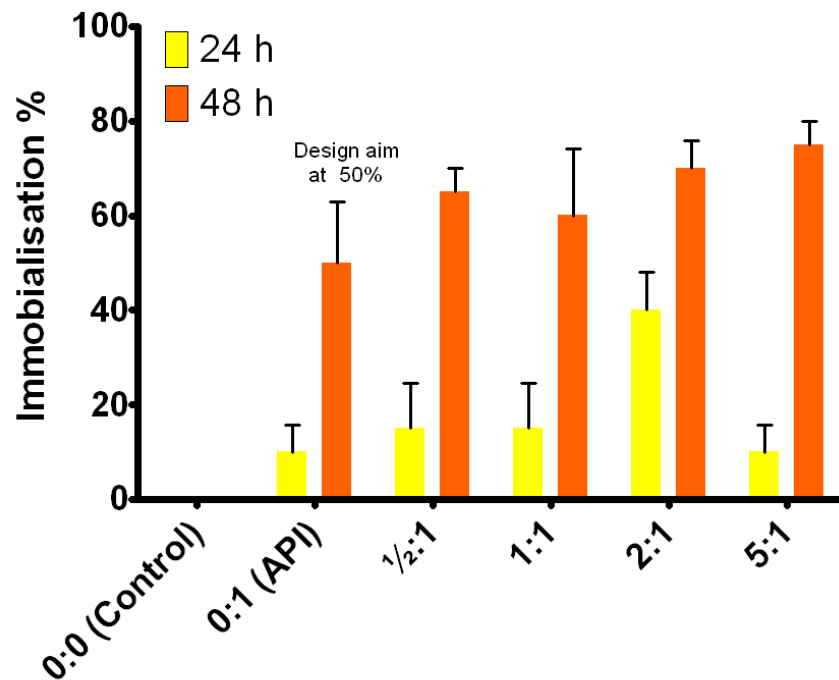
P. Subcapita growth inhibition, O₃



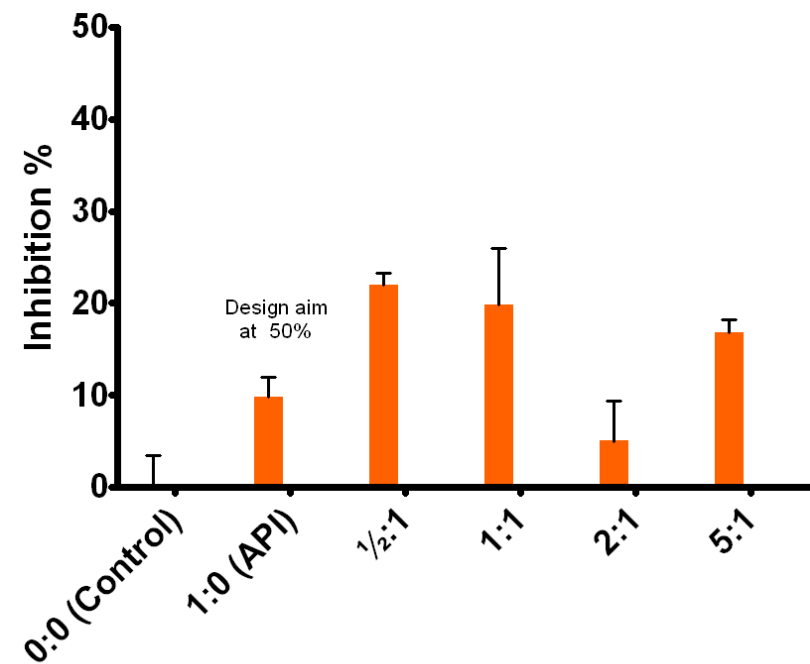
Treatment of water spiked with 114 pharmaceuticals with ozone did not change the toxicity to *Daphnia*, but a dose dependant trend for reduced toxicity was seen in the alga toxicity.

Ib. ClO₂ treatment of pharmaceuticals

Daphnia magna immobilisation, ClO₂



P. Subcapita growth inhibition, ClO₂



ClO₂ did not as change the toxicity to alga, but a trend for increased *Daphnia* toxicity is seen after 48 h exposure.

2nd objective of study

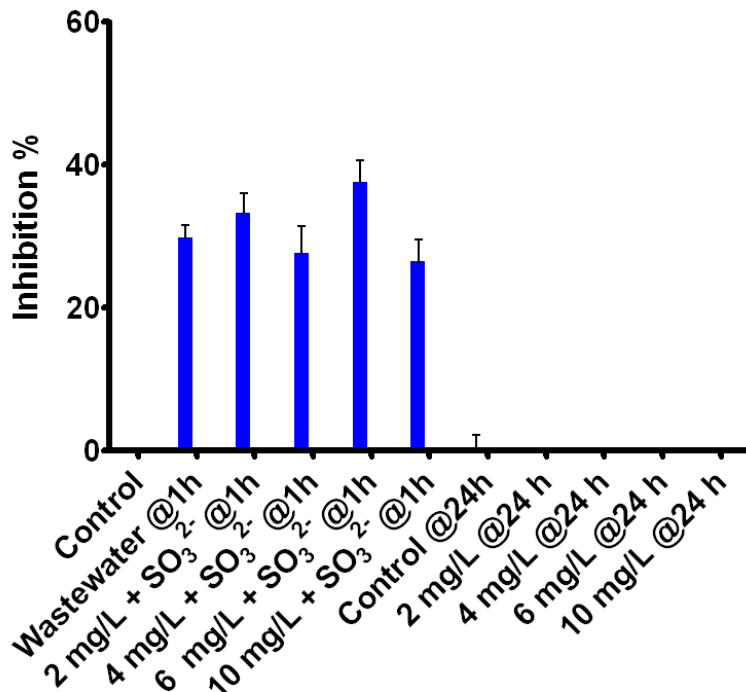
Does O_3 or ClO_2 treatment of wastewater create toxicity?

Treatment with oxidant concentration 2-10 mg/L.

- I. Start test by destroying residual with sulphite after 1h treatment.**
- II. Start test after 24 h with no residual destruction.**

Ozonation of biologically treated wastewater

Alga (P. Subcapita) growth inhibition
O₃ treated WW

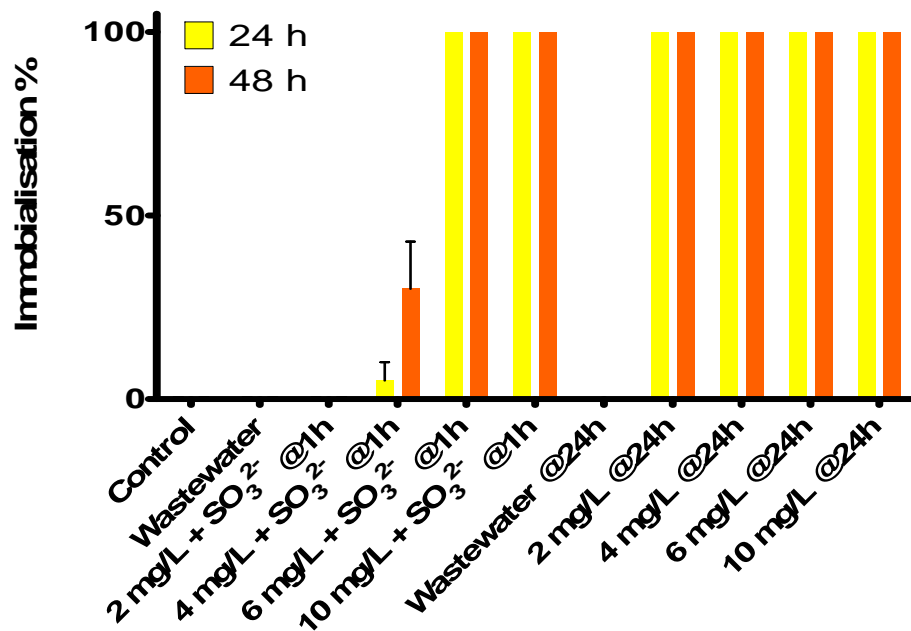


No effect on Daphnia !
 The toxicity of WW to alga did not change in the 1h experiment with dose.

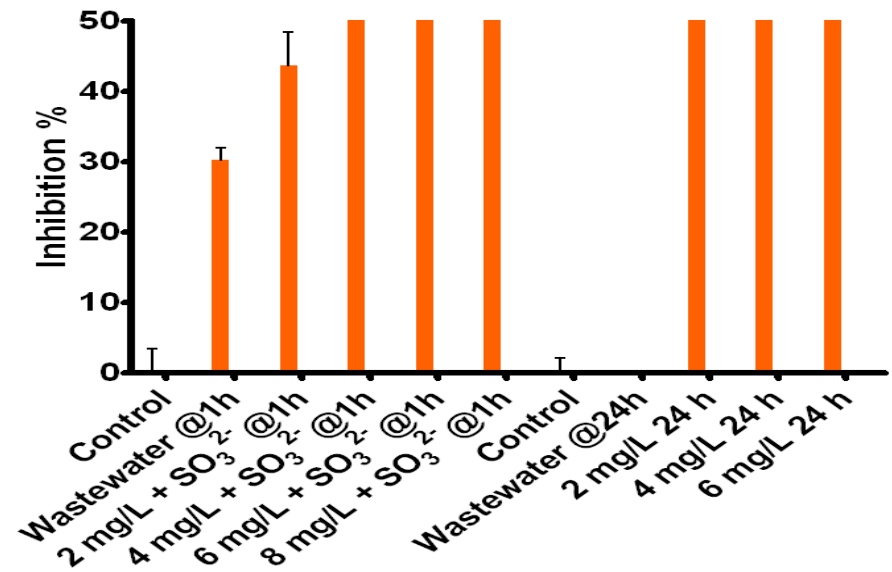
In the 24h treatment the alga control growth was lower than all test concentration, which makes the results unreliable.

ClO₂ treatment of biologically treated wastewater

Daphnia magna immobilisation, ClO₂

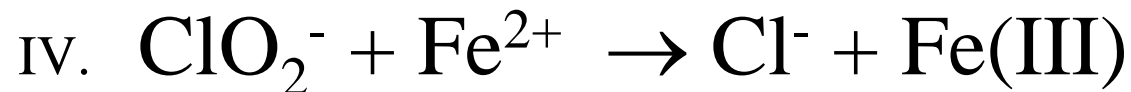
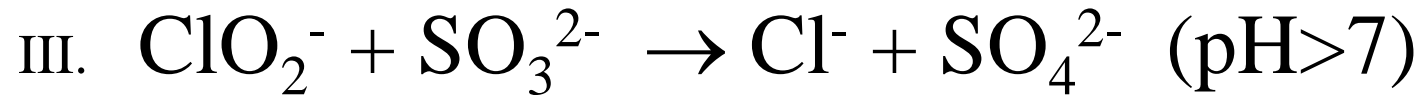
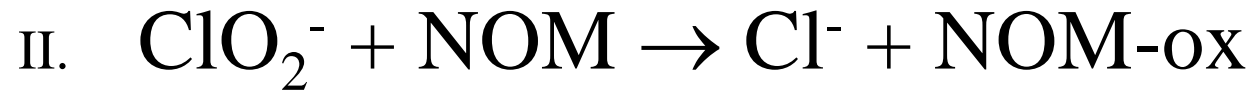


Alga (P. Subcapita) growth inhibition ClO₂ treated WW



ClO₂ did not change toxicity at 2 mg/L, but at 4 mg/L and higher significant toxicity was seen to both alga and *Daphnia*. Chlorite residuals (ClO₂⁻) is suspected to be responsible. (Control growth in alga @24h is too low)

Reactions

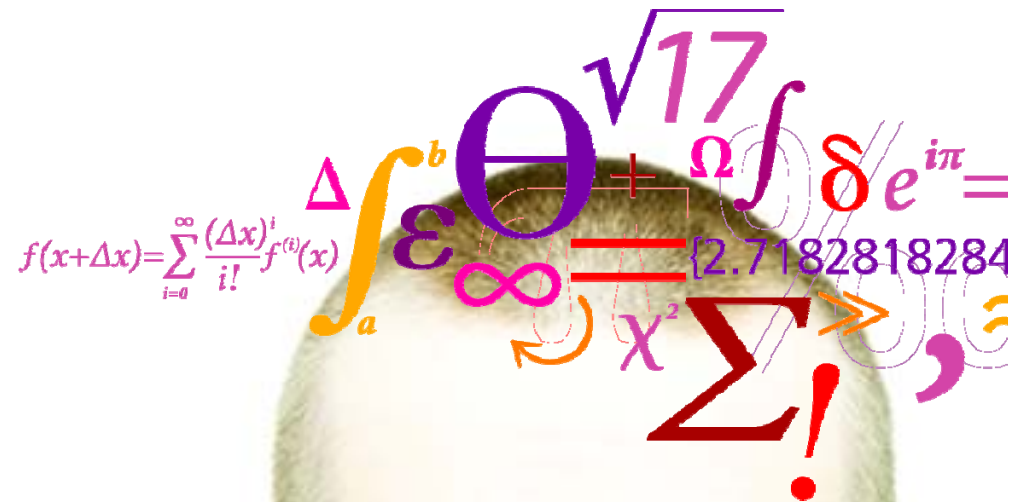


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