

Introduction & Objectives

Moriah Ambiental was requested to propose a solution to substitute an air streaming system. The contaminated groundwater at the site contained the following compounds:

Main Contaminants	Concentration (ppm)
1,1,2 - trichloroetane	64,2
1,2 - dichloroetane	15,7
1,1,2,2 - tetrachloroethane	6,5
chloroform	3,6
trichloroethene	1,5
Total OCC (Organochlorides Compounds)	93,3

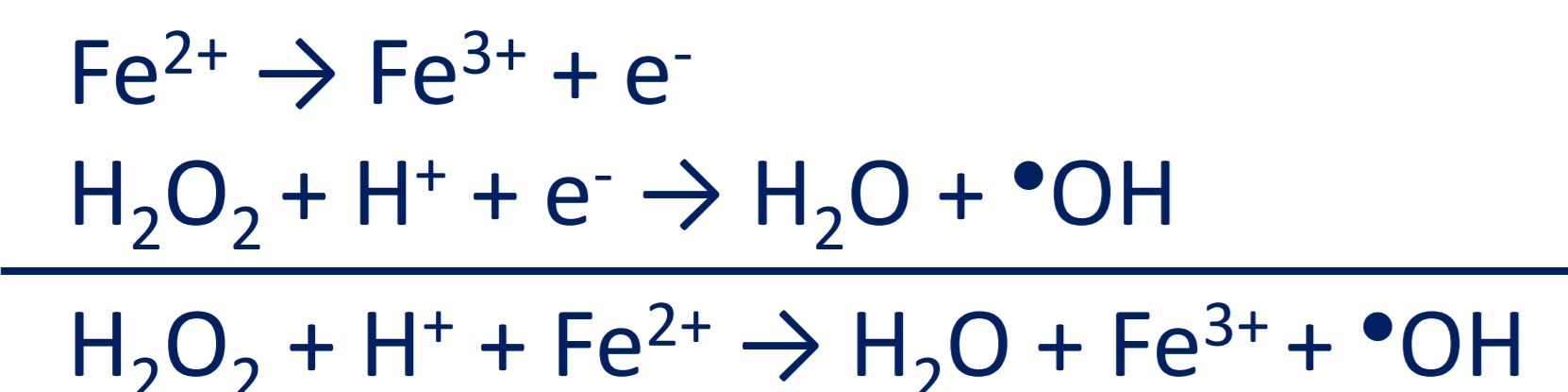
- Decrease the OCC concentration of 93,3 to 0,05 ppm;
- Produce a reliable and robust system;
- Create a low cost system and easy reproducible for future pilot scale;
- Produce minimum or none residues.

Theory

The Fenton Reaction has a radical mechanism which gives the strongest known free radical, called : Hydroxyl Radical $\bullet\text{OH}$



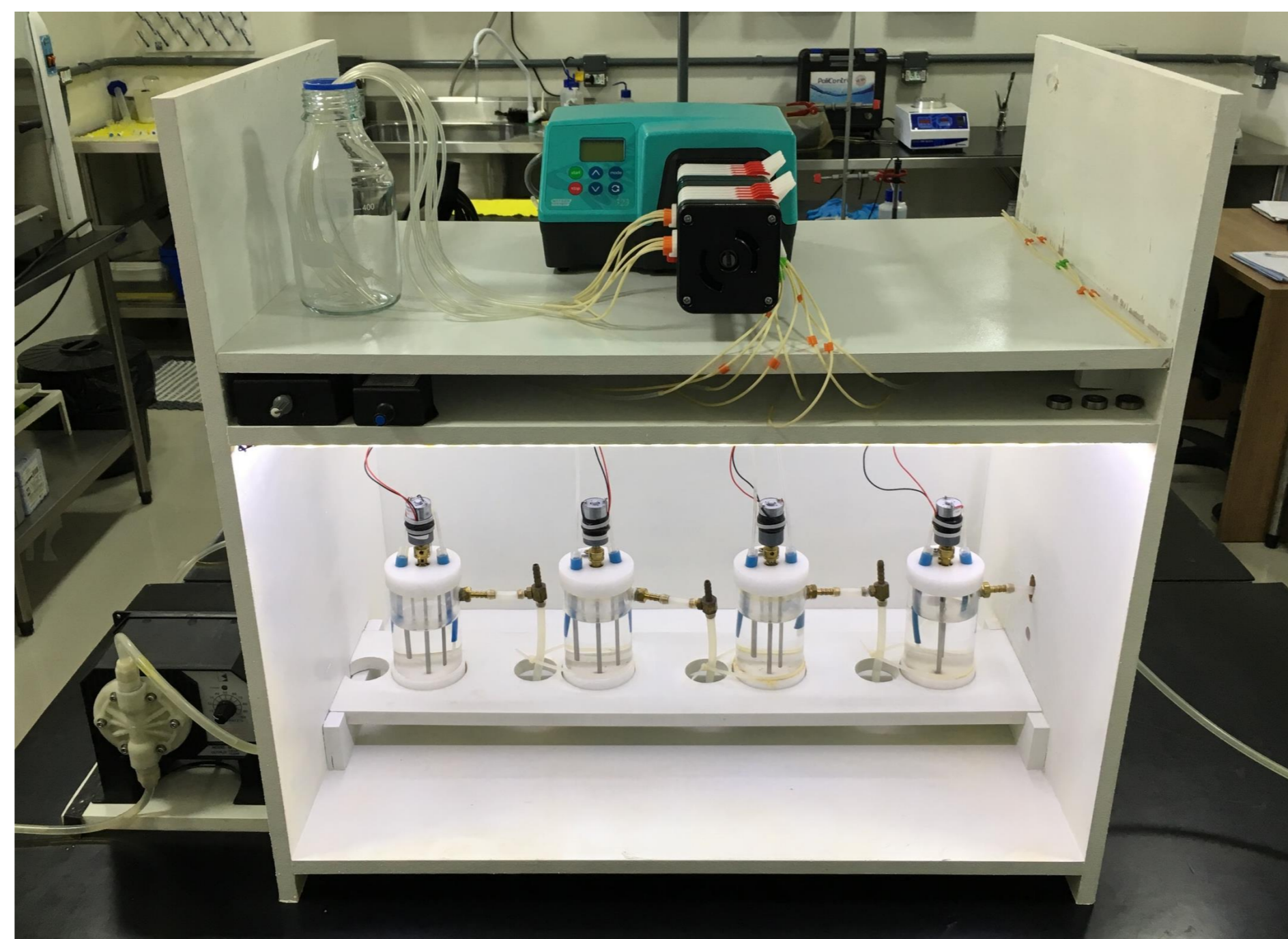
For that it's necessary to mix two reactants, hydrogen peroxide and iron sulphate.



This Radical is capable to break almost all organic bonds, including the OCC ones.

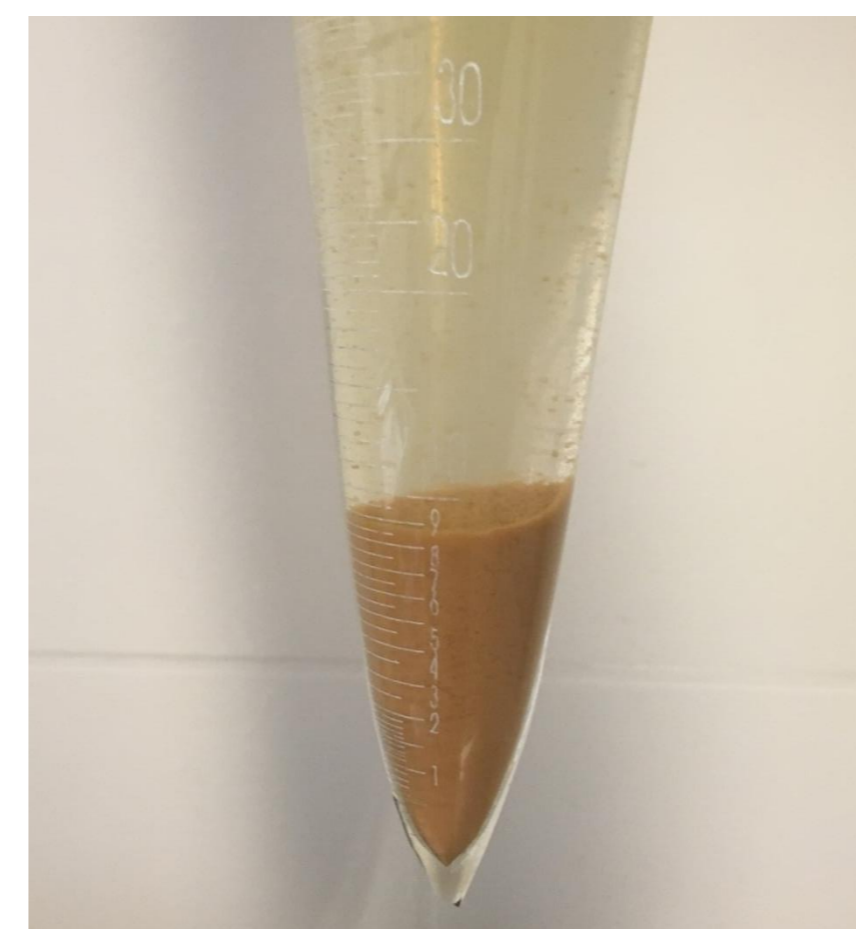
Methodology

In a laboratory scale, compared to other technologies, Fenton Reaction gave the best results. In order to increase the reaction yield, some studies were conducted, and a multistage continuous reaction was developed. Below there is the bench system created.



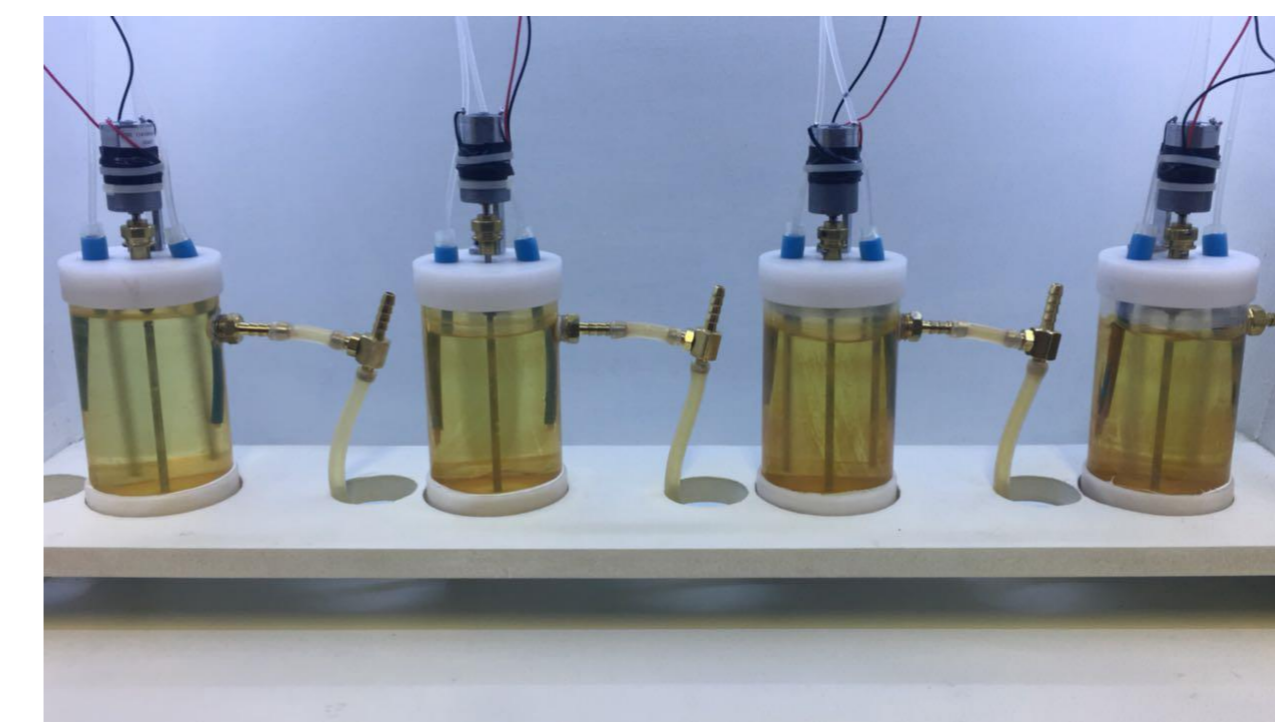
- There was 4 intercommunicated and agitated 250 mL vessels. Reactants were simultaneously and continuously added in each one.

- Once the reaction was completed, at the end of the fourth reactor, a sample was collected at 40 mL vials and analysed through VOC's.



Many stoichiometry were tested in order to find the optimal reactant consumption with the best yield. The best reactant/yield ratio found for the reaction was: 1COD : 2,5 H₂O₂ : 0,15Fe²⁺.

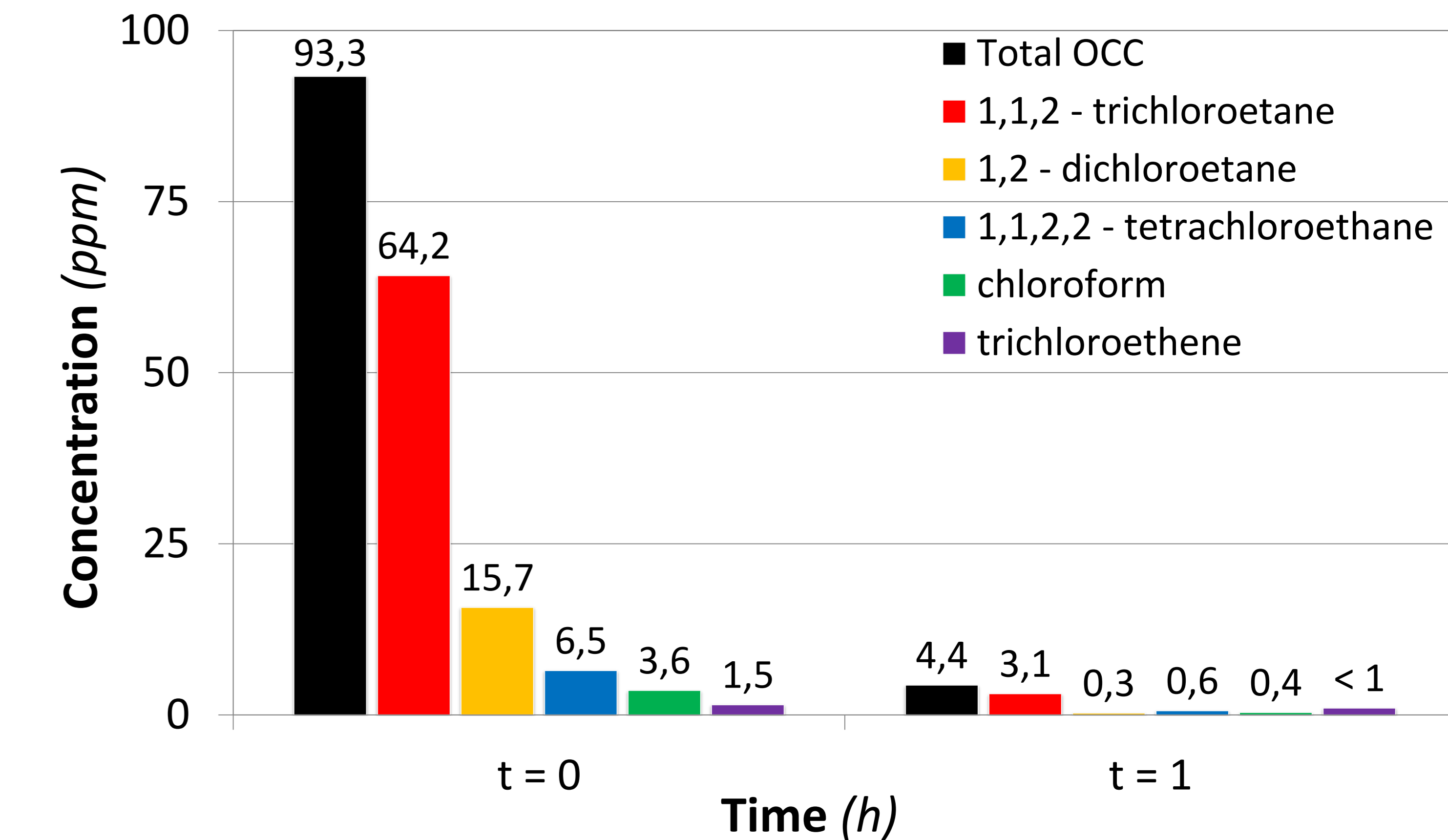
- Dosing pump for the contaminated groundwater. Fixed at **1 L/h**.
- Multichannel peristaltic pump (10 channels) for the two reactants. After many trials, the best volume rate was at **7 mL/h** for each reactant in each vessel.



- Neutralization with CaCO₃ corrected the final pH and also removed the dissolved iron from the solution, reaching imhoff's sediment volume of ≈ 9 mL.

Discussion & Results

The *off situ* reaction is the best option because it avoids peroxide lateral consumes, which would decrease the yield. The decrease of the methodology volume rates by half, increased the reactants contact time, rising the yield to 98.2%. Following the described methodology, it was obtained 95%, as shown below.



Conclusion

The technology development was a success. Prospecting a pilot and full scale, for comply with local laws of disposal in a sewer system, it was needed to complement this technology with an additional stage of pH correction with calcium carbonate (after testing and adjusting imhoff's sediment volume with many neutralizing agents). In order to attend the client legal demand of 0,05 ppm, an additional stage with charcoal column acted as a polishing step, reaching more than 99% of yield.