

P50 Optimization of operating conditions in the activation of peroxymonosulfato and H₂O₂ for *Enterococcus sp.* inactivation: water matrix effect

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Water disinfection is a complex process highly dependent on environmental factors and target microorganisms. Chlorination is the most commonly used disinfection agent worldwide. However, the generation of disinfection by-products (i.e. trihalomethanes) has raised significant concern among water treatment plants and regulators.

Advanced oxidation processes (AOPs) are emerging as effective alternative water treatments, which combine the oxidation of contaminants and disinfection. The AOPs based on sulfate radicals (SR-AOP) involve the application of chemical oxidants such as peroxymonosulfate (PMS, HSO₅⁻). PMS by itself, as with H₂O₂, do not show disinfectant activity at low doses, but their action increases significantly when they are activated: i) thermally; ii) by UV radiation; and iii) by the addition of a transition metal [1, 2].

In previous studies, Fe-citrate has demonstrated to be the most efficient iron specie among the studied (Fe₂O₃, FeSO₄, Fe(III)-citrate and Zero Valent Iron (ZVI) nanoparticles) in the activation of persulfate and PMS for the elimination of *Enterococcus sp.* in simulated wastewater [3]. The presence of this microorganism is a common indicator of fecal contamination in the analysis of water and wastewater.

The main objective of this study is the in-depth evaluation of Fe-citrate combined with UV-A irradiation as a metallic activator of PMS and H₂O₂ for the inactivation of wild *Enterococcus sp.* strain present in wastewater, varying the operating conditions (concentration, irradiance and medium).

Disinfection experiments were carried out in two different reactors: batch and tubular reactor (Figure 1). The radiation used was UV-A at a wavelength of 365 nm and the experiment had a maximum duration of 120 mins. Three different aqueous media (distillated water, saline solution and simulated wastewater) were used. The medium was inoculated with wild strains of *Enterococcus sp.* isolated from wastewater from a real wastewater treatment plant to obtain a microorganism concentration of 10⁶ colony forming units (CFU)/L. The determination of *Enterococcus sp.* was performed on the selective culture medium Slanetz&Bartley agar (Scharlau) and the colonies were counted after remaining 48h at 37°C.

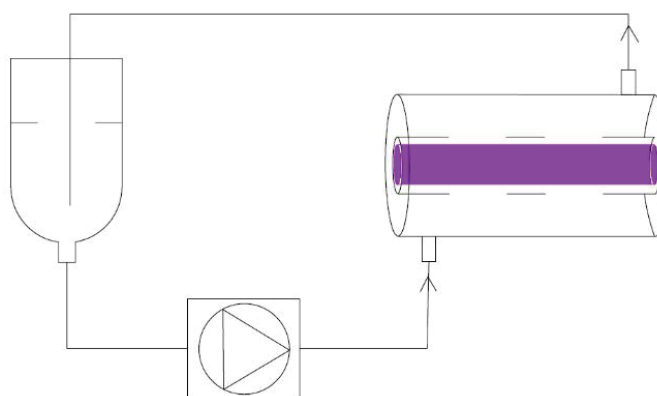


Figure 1. Scheme of the tubular reactor with continuous recirculation.

The optimization of the photo-assisted treatments was carried out with different doses of PMS (0.01 - 1 mM), H₂O₂ (0.01-1.5 mM) and Fe-citrate (0.001-5 mM). Preliminary results reveal the increase of bacteria inactivation efficiency by photocatalytic activation of H₂O₂ and PMS compared to UV-A activation. However, high Fe-citrate concentrations might act as scavenger in H₂O₂ activation since the best performance for H₂O₂ is achieved with a molar ratio 3:1 [H₂O₂/Fe-citrate] when using the batch configuration. Moreover, much better results have been reached in the tubular reactor due to a better distribution of the radiation in the reactor.

Given the interesting results obtained so far, we continue to study the influence of the media and the type of radiation on the disinfection treatments.

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References

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