

INTRODUCTION

The need to increase the supply of water is linked to both the scarcity of the quantity available and the deterioration of its quality. Agriculture has a major impact on this problem and is responsible for the release of some of these organic pollutants, such as pesticides, which are of global concern because of their toxicity and persistence in the environment [1].

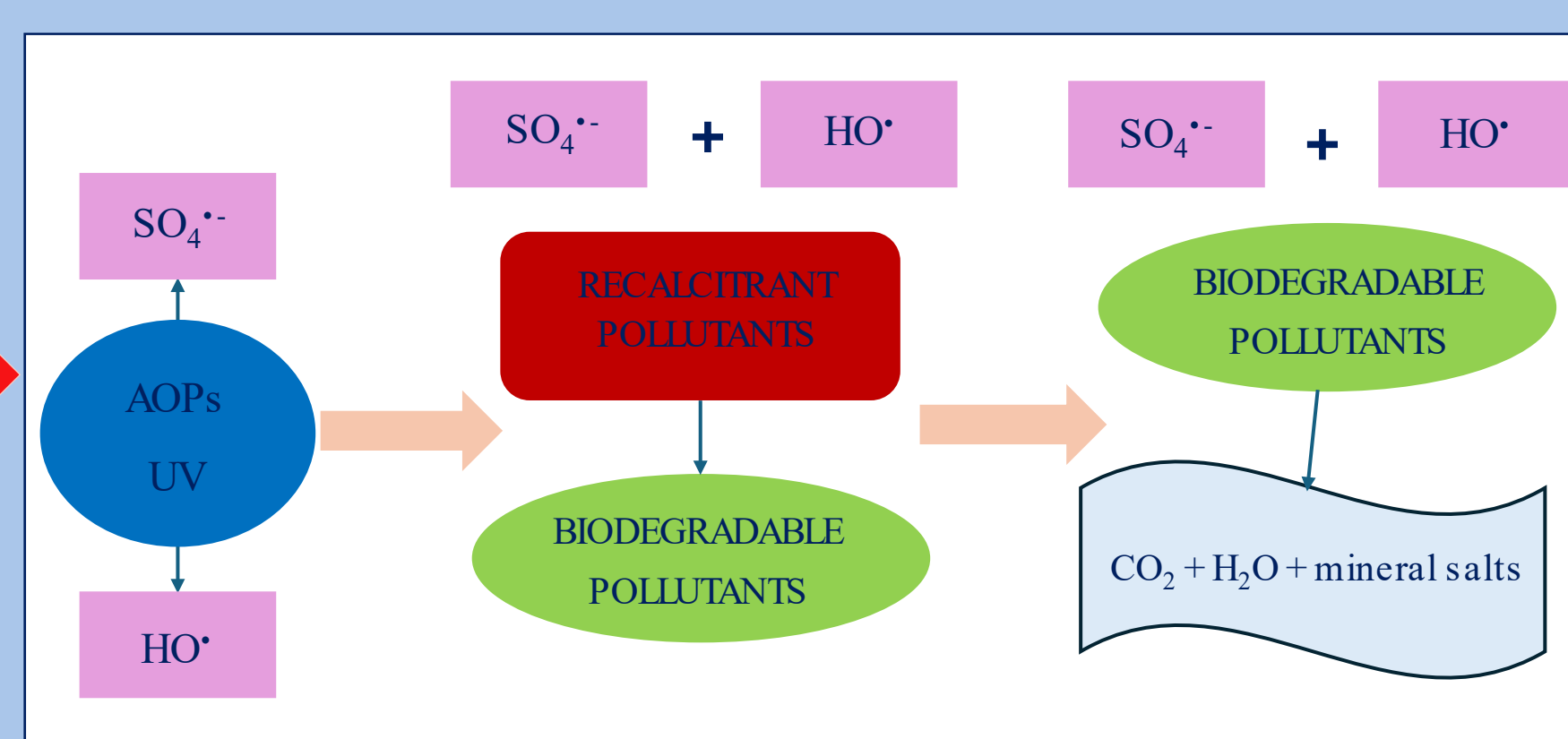
The European Green Deal

REDUCE
REUSE
RECYCLE

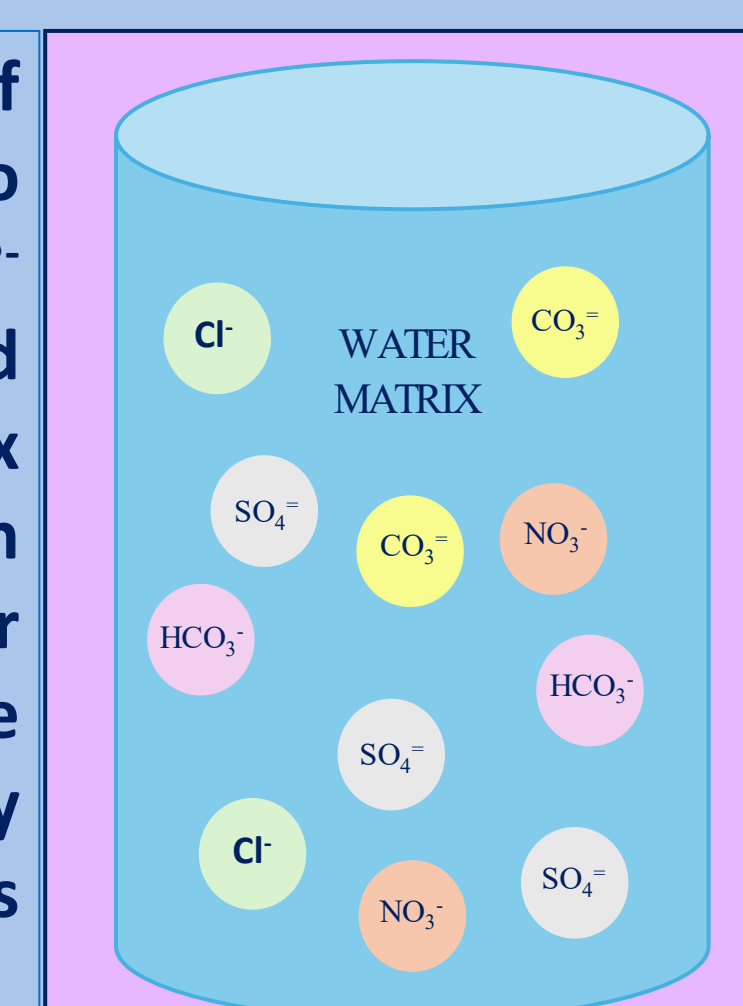
Chemicals Strategy for Sustainability
Towards a toxic-free environment

In light of the current water scarcity, it is crucial to develop remediation techniques that eliminate all traces of pollutants from water to enable its subsequent reuse. This approach aligns with the 3Rs (reuse, recover, recycle) of wastewater treatment in both industrial and agricultural settings, with the ultimate goal of achieving Zero Pollution in line with the European Green Pact and the Chemicals Sustainability Strategy.

Advanced Oxidation Processes (AOPs) are among the most widely researched treatment methods in recent years. They have proven highly effective in removing persistent organic pollutants, including herbicides, from water. These methods are based on generating of highly reactive radicals, mainly $\text{HO}^\bullet$, $\text{SO}_4^{\bullet-}$ and others due to their high oxidizing power. Persulfate ($\text{S}_2\text{O}_8^{2-}$) is a high-energy oxidant that can be activated by heat, UV light, transition metals or a high pH to generating $\text{SO}_4^{\bullet-}$ [2].



Overall, the elimination of pesticides and other micro pollutants by $\text{HO}^\bullet$ and $\text{SO}_4^{\bullet-}$ -based-AOPs is largely influenced by the quality of the water matrix (dissolved constituents), which can have neutral, inhibitory or promoting, depending on the process and the mechanism by which these water constituents react [3].

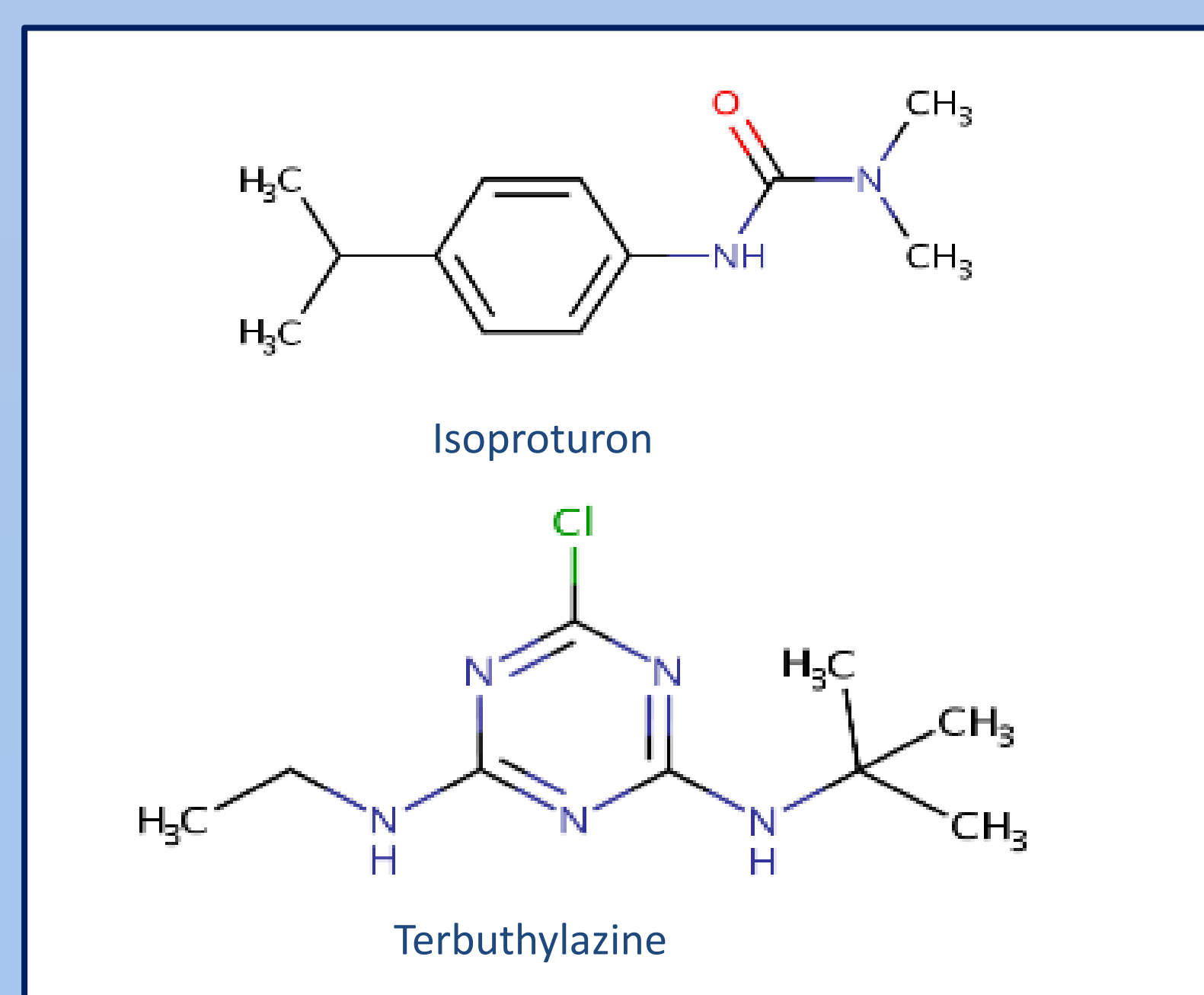


OBJETIVES

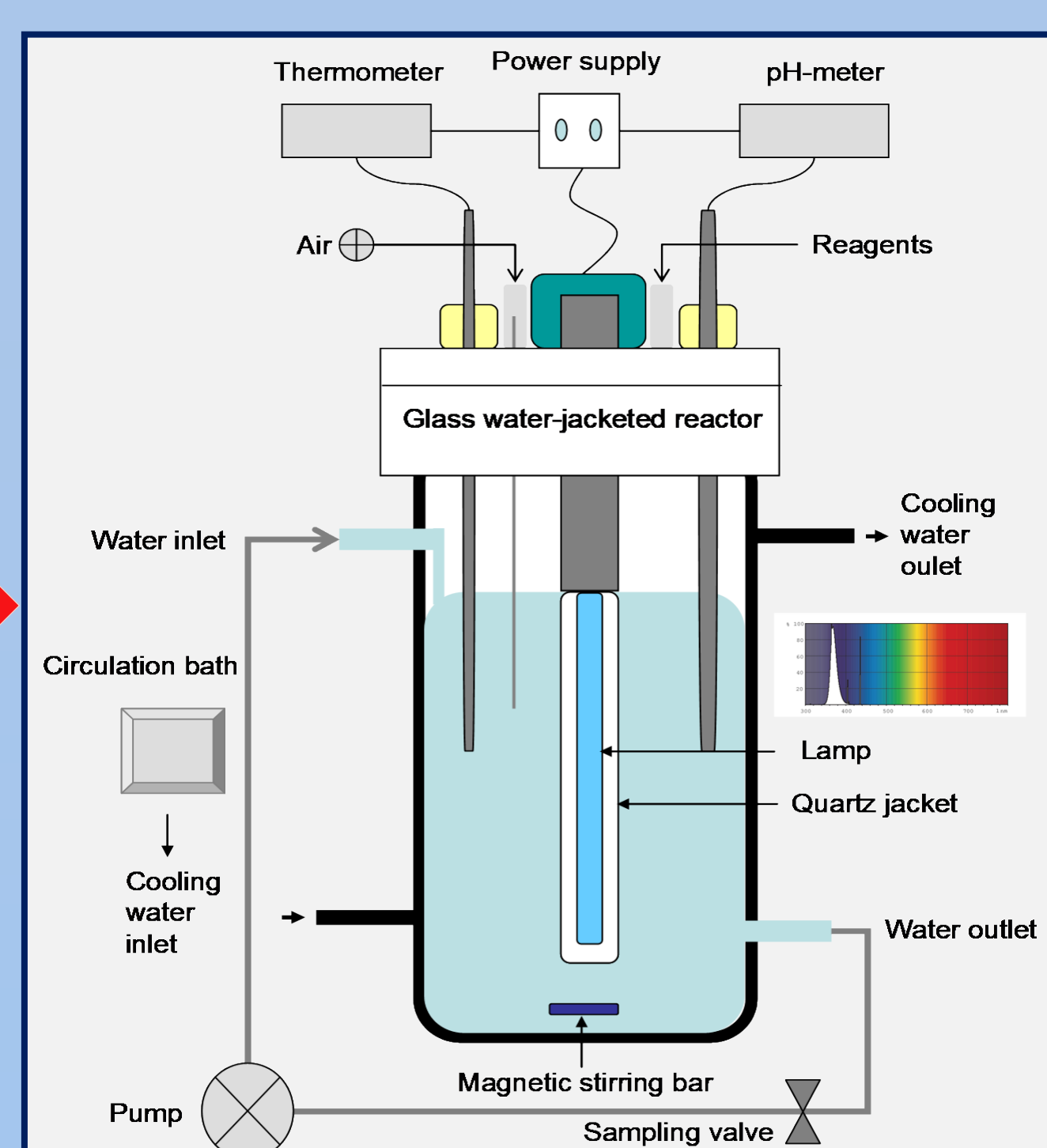
The aim of this work has been to evaluate the impact of inorganic ions on the removal of two herbicides, isoproturon (ISP) and terbuthylazine (TBZ) commonly found in wastewater using UV/persulfate-based advanced oxidation under laboratory conditions.

MATERIALS & METHODS

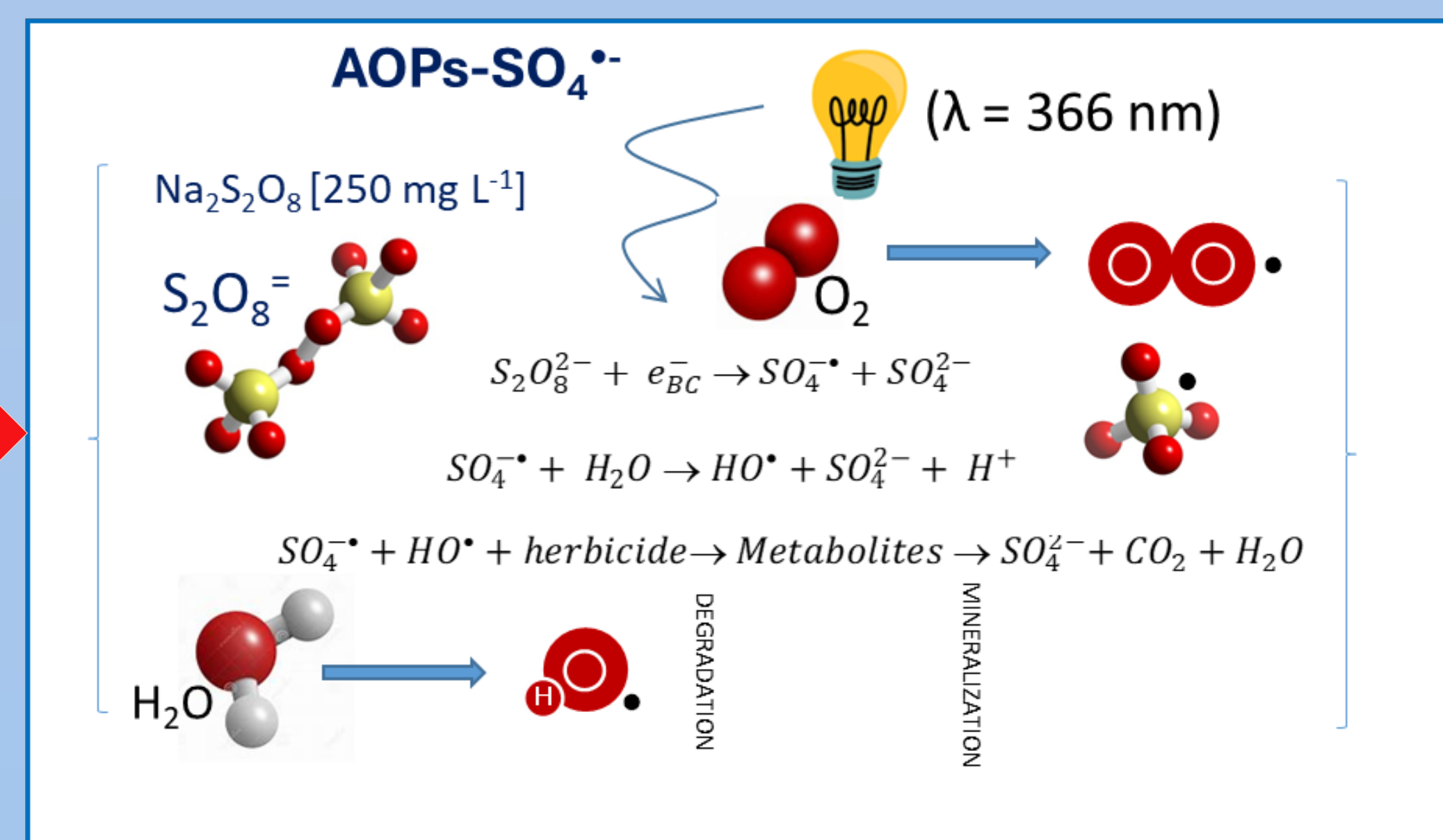
Selected Herbicides



Photoreactor [4]



Photocatalytic Process ($\text{UV}/\text{S}_2\text{O}_8^{2-}$)



ANALYTICAL DETERMINATIONS

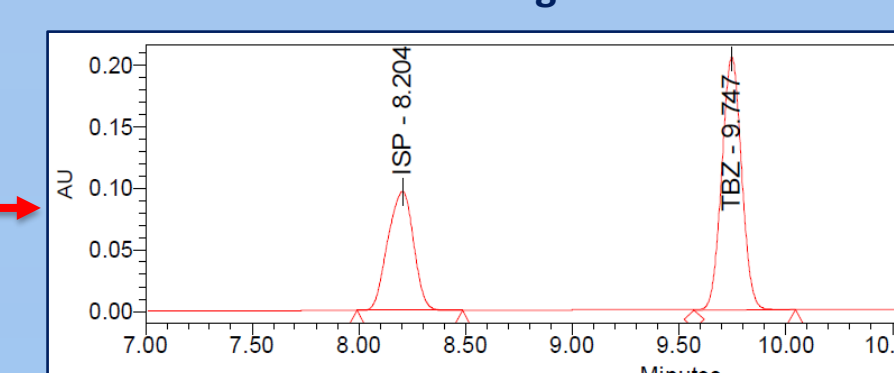
HERBICIDES

10 mL sample + 10 mL CH_3CN + 2 g NaCl by centrifugation (15 min at 4000 rpm at 4 °C)

Supernatant filtration (0.45 μm nylon)

HPLC Water Alliance 2695 / 996

Chromatogram



RESULTS & DISCUSSIONS

The kinetic study of the experimental results showed that the degradation process of both herbicides under UV basically conformed to the single first-order (SFO) kinetic model ($C_t = C_0 e^{-kt}$). Figures 1 and 2 shows the effect of inorganic anion content ($\text{Cl}^- = 150 \text{ mg L}^{-1}$, $\text{SO}_4^{2-} = 250 \text{ mg L}^{-1}$ and $\text{HCO}_3^- = 125 \text{ mg L}^{-1}$) concentrations in water on herbicide photodegradation using $\text{UV}/\text{Na}_2\text{S}_2\text{O}_8$. As can be seen, there is a significant influence ($p < 0.05$) due to the presence of Cl^- and especially HCO_3^- in the case of TBZ, since the disappearance time (DT_{50}) increases considerably, whereas for ISP only significant differences were observed in the case of water containing HCO_3^- , although the differences with salt-free water are less marked than for TBZ.

Figure 1. Half-lives ($t_{1/2}$) obtained for the degradation of herbicides in saline water.

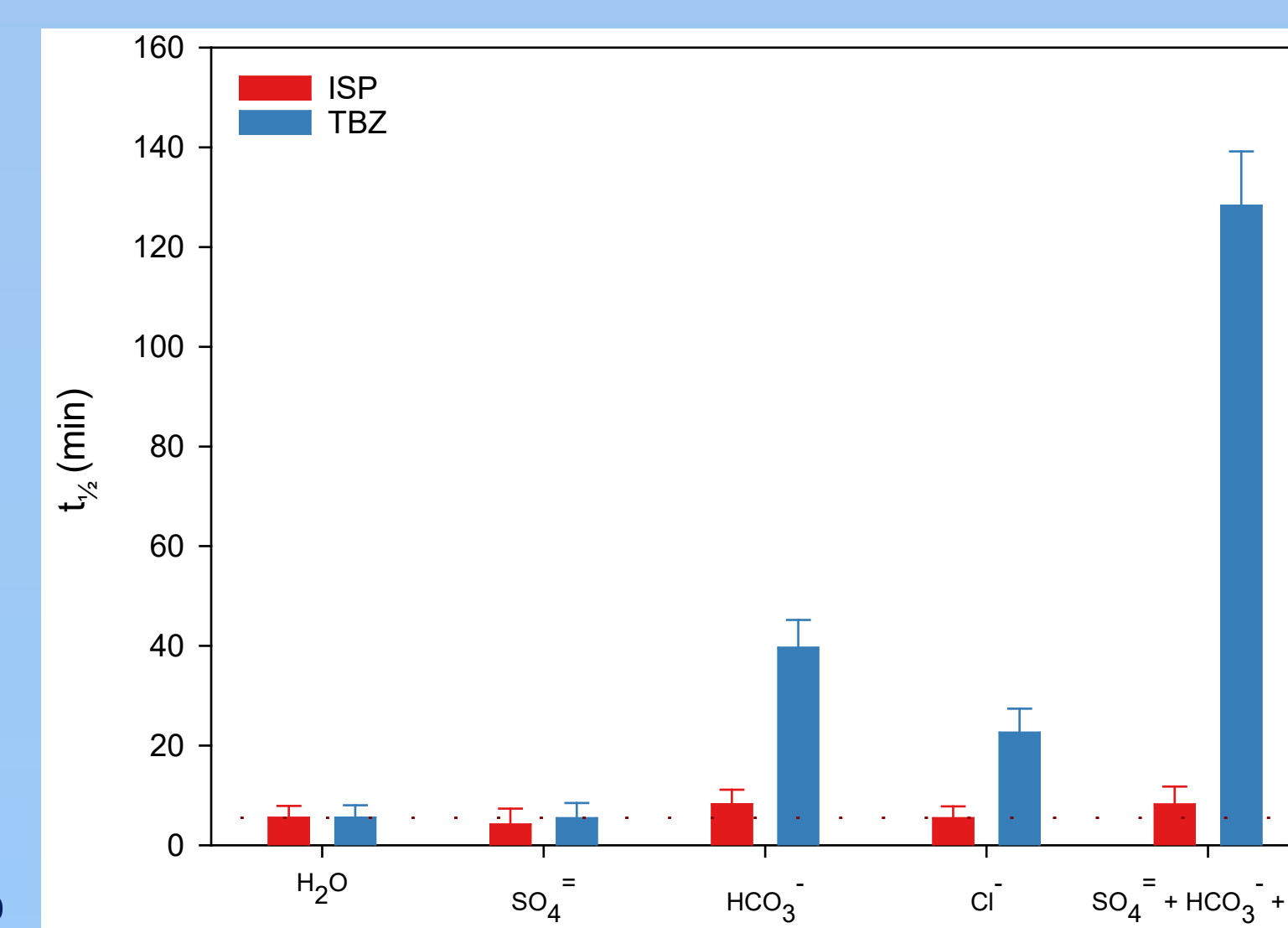
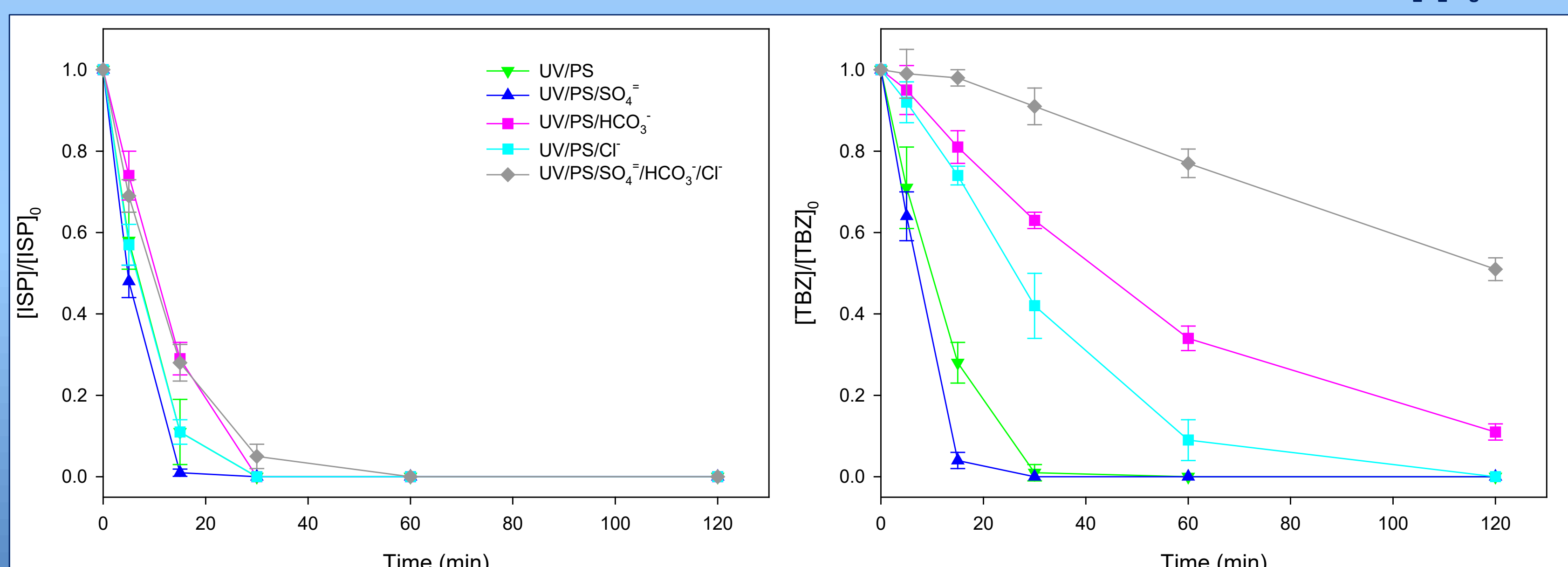


Figure 2. Impact of inorganic anions on the photodegradation of ISP and TBZ in water using $\text{UV}/\text{Na}_2\text{S}_2\text{O}_8$



CONCLUSIONS

The unfavorable effects of some inorganic anions such as Cl^- and $\text{HCO}_3^-/\text{CO}_3^{2-}$, among others can be explained by the fact that they reduce the oxidising power of the solution by scavenging of $\text{HO}^\bullet$ and $\text{SO}_4^{\bullet-}$, generating the corresponding radicals such as $\text{ClOH}^\bullet$, $\text{Cl}^\bullet$, $\text{Cl}_2^{\bullet-}$, $\text{CO}_3^{\bullet-}$, $\text{HCO}_3^{\bullet-}$, which have a lower E^0 than $\text{HO}^\bullet$ and $\text{SO}_4^{\bullet-}$.

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