Reactive oxygen species (ROS) detection via spin traps

How does it work?

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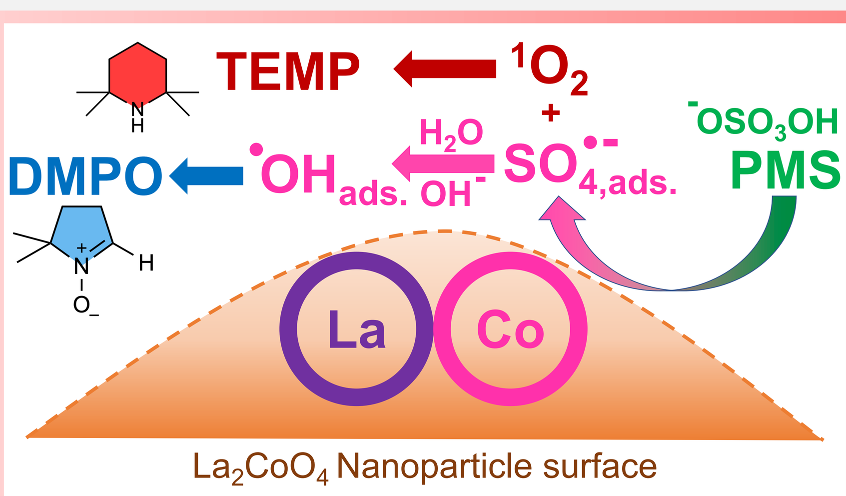
Abstract

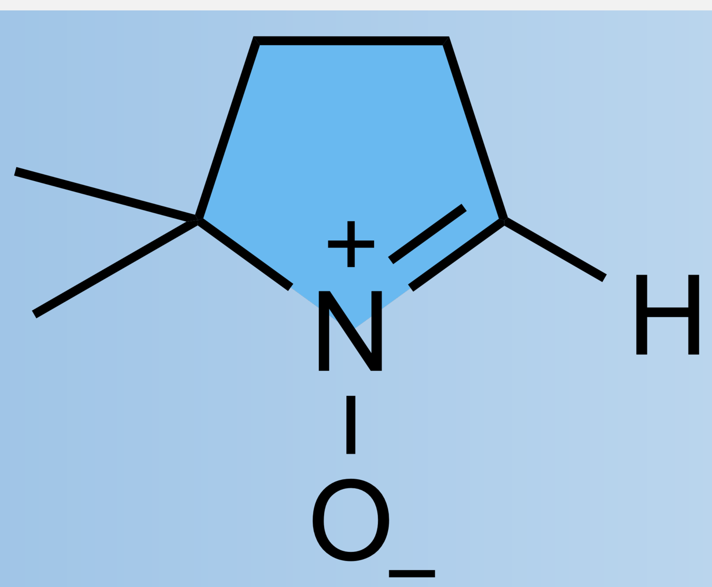
'Reactive oxygen species' (ROS) is a generic term defining a wide variety of highly reactive oxidant molecules. These molecules inhabit vastly different properties ranging from biological functions generated through byproducts of the metabolism of oxygen to important roles in catalytic cycles. The detection of ROS remains challenging due to their short lifetimes. Nonetheless, spin trapping has established itself as a reliable method to transform ROS to a relatively stable radical which can be detected. Herein, the radical scavenging process of La_2CoO_4 nanoparticles as efficient catalyst for activating peroxymonosulfate (PMS) as a catalyzer for organic pollutants is described. [1]

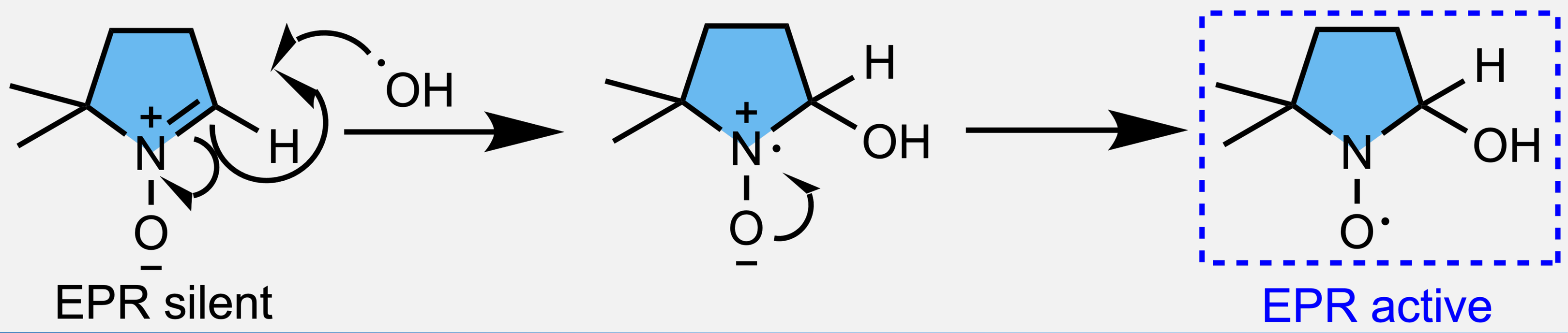


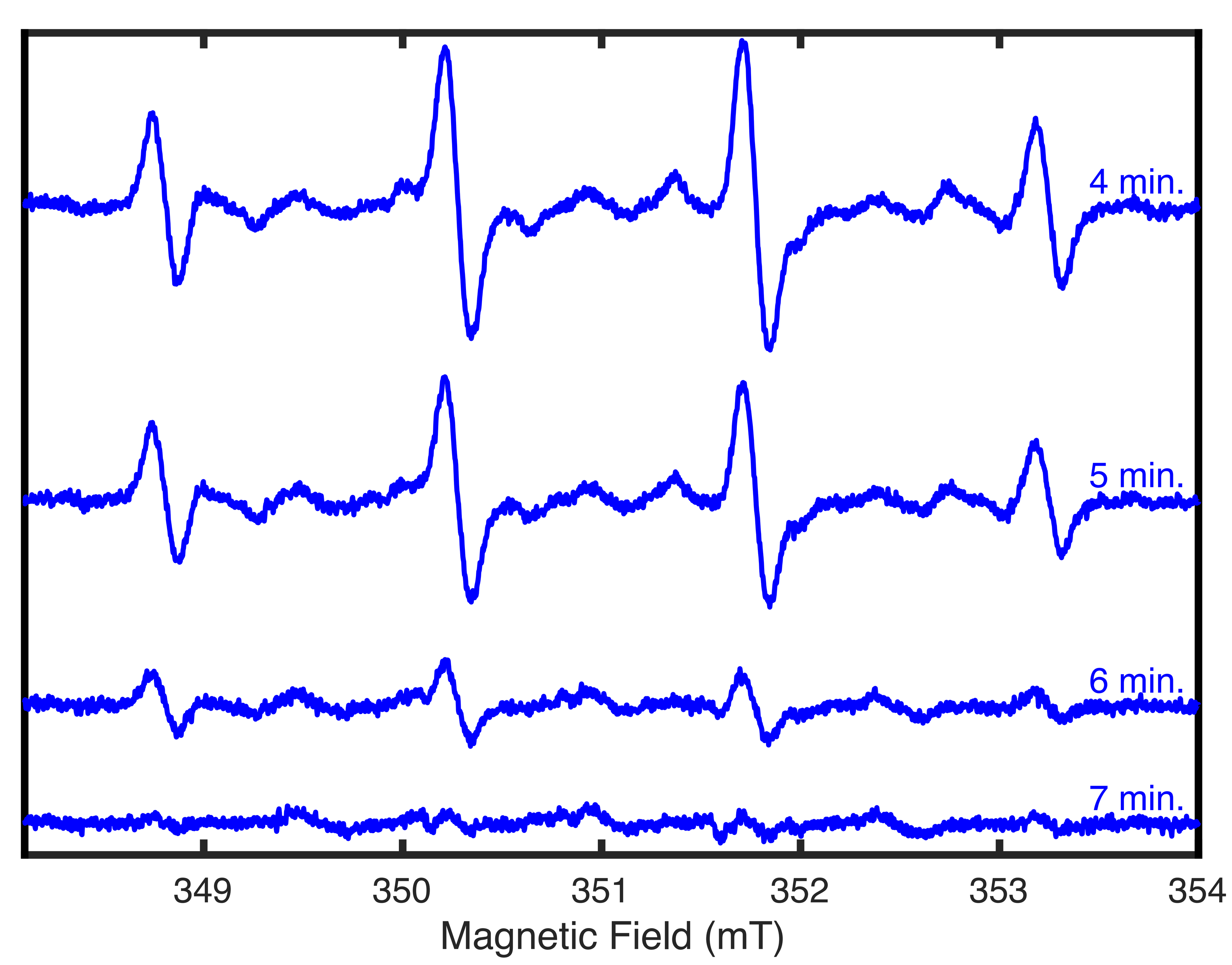
DMPO - OH/SO_4 radical scavenger

- $t_{1/2}$ (DMPO) = 20 min. at pH 7
- Water-soluble (hyperfine couplings solvent dependant)
- Reaction of $OH^•$ with DMPO is very fast and diffusion-controlled [2]
- Experimental Conditions:

[cat.] = 0.2 g/L, [DMPO] = 0.1 mM, [PMS] = 0.09 mM



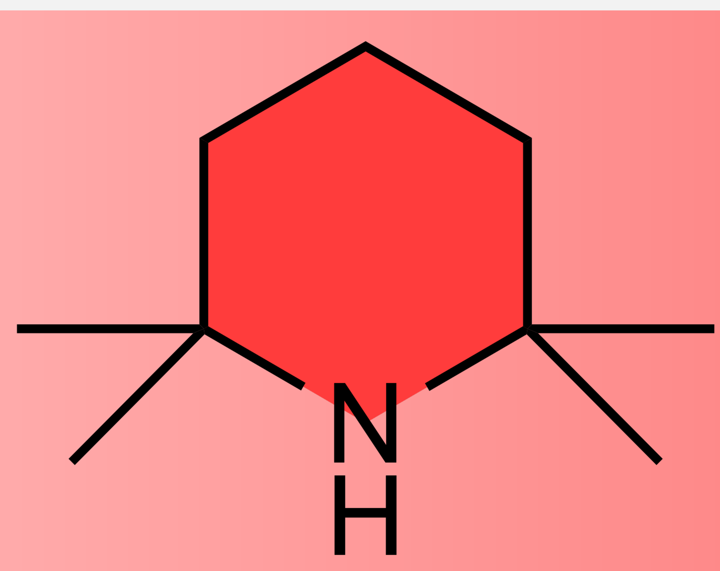


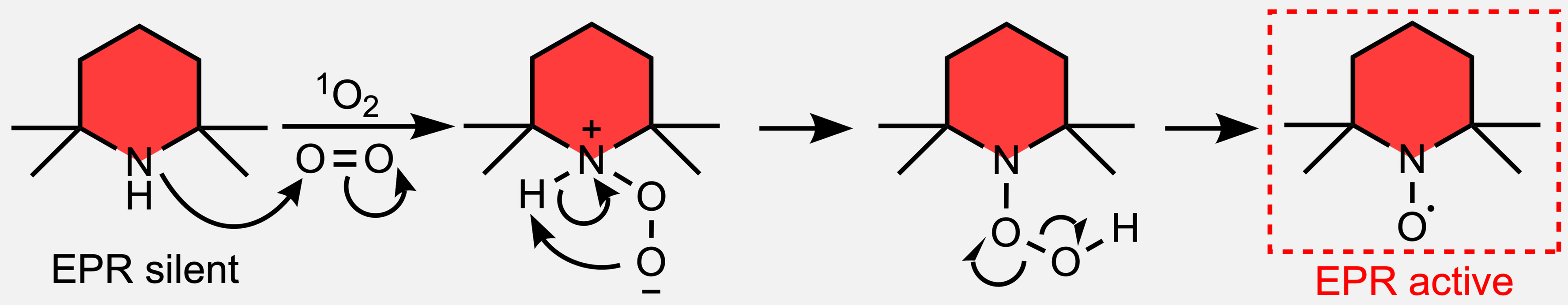


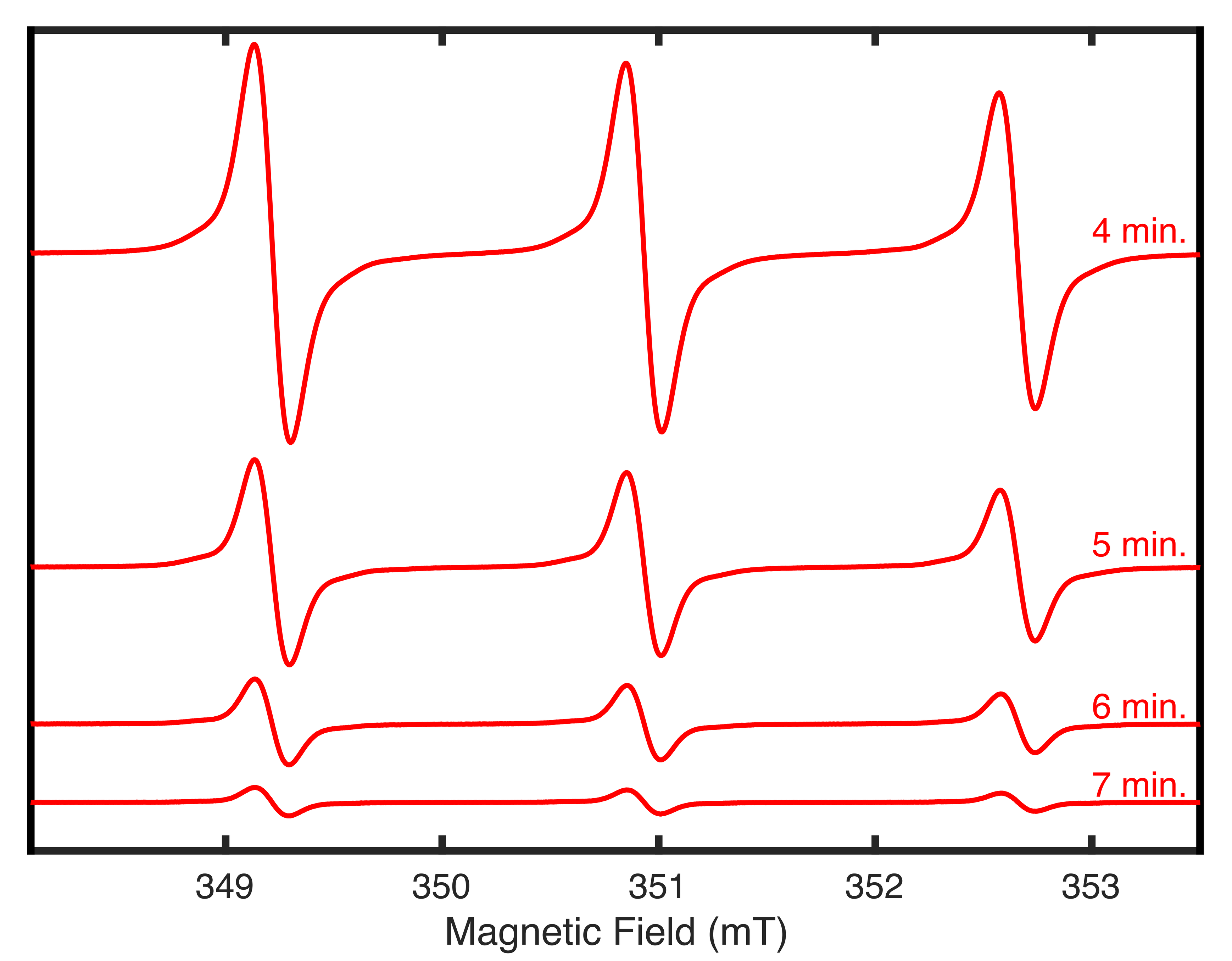
TEMP - $^1O_2$ radical scavenger

- $t_{1/2}$ (TEMPO) = 40 min. (water)
- Lipophile
- Stable radical, reaction with $^1O_2$ is an oxidation reaction [3]
- Experimental Conditions:

[cat.] = 0.2 g/L, [TEMP] = 0.5 mM, [PMS] = 0.45 mM



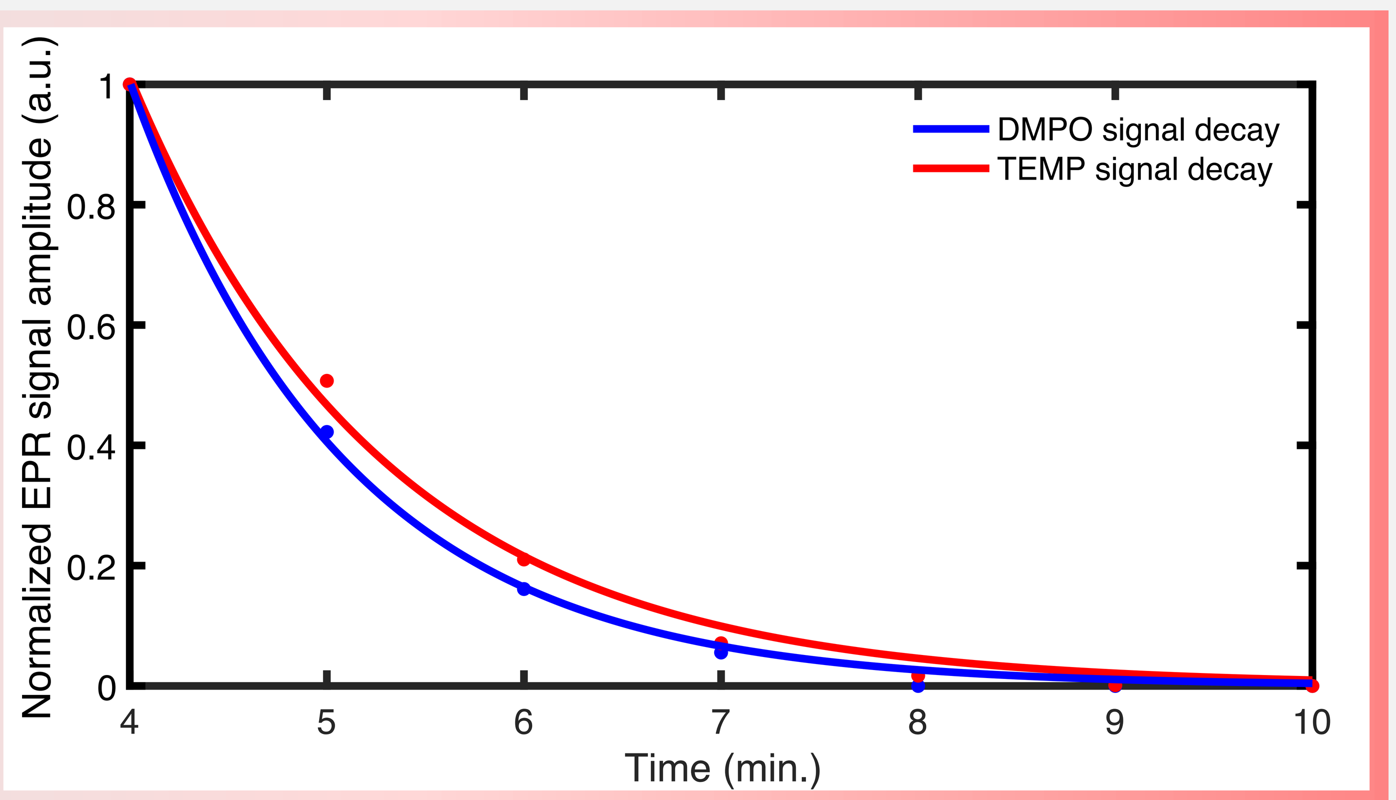




Conclusion and outlook

- ➢ Spin trap studies confirmed the radical quenching experiments done by scavenging tests with β-carotene (degradation in 30 min. from 97% to 6%)
- ➢ **DMPO** as selective towards oxygen-centered radicals could trap the $OH^•$ and $SO_4^•$ radicals (A_H = 1.45 mT, A_N = 1.49 mT)
- ➢ **TEMP** confirmed the existence of $^1O_2$ in the catalysis reaction pathway (A_N = 1.72 mT)
- ➢ Both spin traps show a fast decay after approx. 10 min.

→ usage of other spin traps (e.g. POBN) can give further insights to radical pathways [4]



References

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[4] Barriga-González, G., Aliaga, C., Chamorro, E., Olea-Azar, C., Porcal, W., González, M. and Cerecetto, H., *RSC adv.*, *10*(66), **2020**, 40127-40135.

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