

Supplementary Information

Ozone compatibility with polymer nanofiltration membranes

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Degradation of ozone in pure water according to the SBH (Staehelin, Bader and Hoigné) model [1]

Initiation reactions:

$O_3 + OH^- \rightarrow HO_2^- + O_2$	$k=70 \text{ M}^{-1} \text{ s}^{-1}$	(1)
$O_3 + HO_2^- \rightarrow HO^\bullet + O_2^{\bullet -} + O_2$	$k=2.8 \times 10^6 \text{ M}^{-1} \text{ s}^{-1}$	(2)

According to these reactions, the ozone decomposition initiation can be enhanced by increasing the pH or adding hydrogen peroxide.

Propagation reactions:

$O_3 + O_2^{\bullet -} \rightarrow O_3^{\bullet -} + O_2$	$k=1.6 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$	(3)
$HO_3^\bullet \rightarrow HO^\bullet + O_2$	$k=1.4 \times 10^5 \text{ M}^{-1} \text{ s}^{-1}$	(4)
$HO^\bullet + O_3 \rightarrow HO_2^\bullet + O_2$	$2 \times 10^8 \text{ M}^{-1} \text{ s}^{-1} < k < 2 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$	(5)
$HO_4^\bullet \rightarrow HO_2^\bullet + O_2$	$k=2.8 \times 10^4 \text{ M}^{-1} \text{ s}^{-1}$	(6)

Ending reactions:

$HO_4^{\cdot} + HO_4^{\cdot} \rightarrow H_2O_2 + 2O_3$	$k = 5 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$	(7)
$HO_4^{\cdot} + HO_3^{\cdot} \rightarrow H_2O_2 + O_3 + O_2$	$k = 5 \times 10^9 \text{ M}^{-1} \text{ s}^{-1}$	(8)

The reaction rate constant of the reaction (5) is controversial in the literature [2].

Ozonation of PES powder

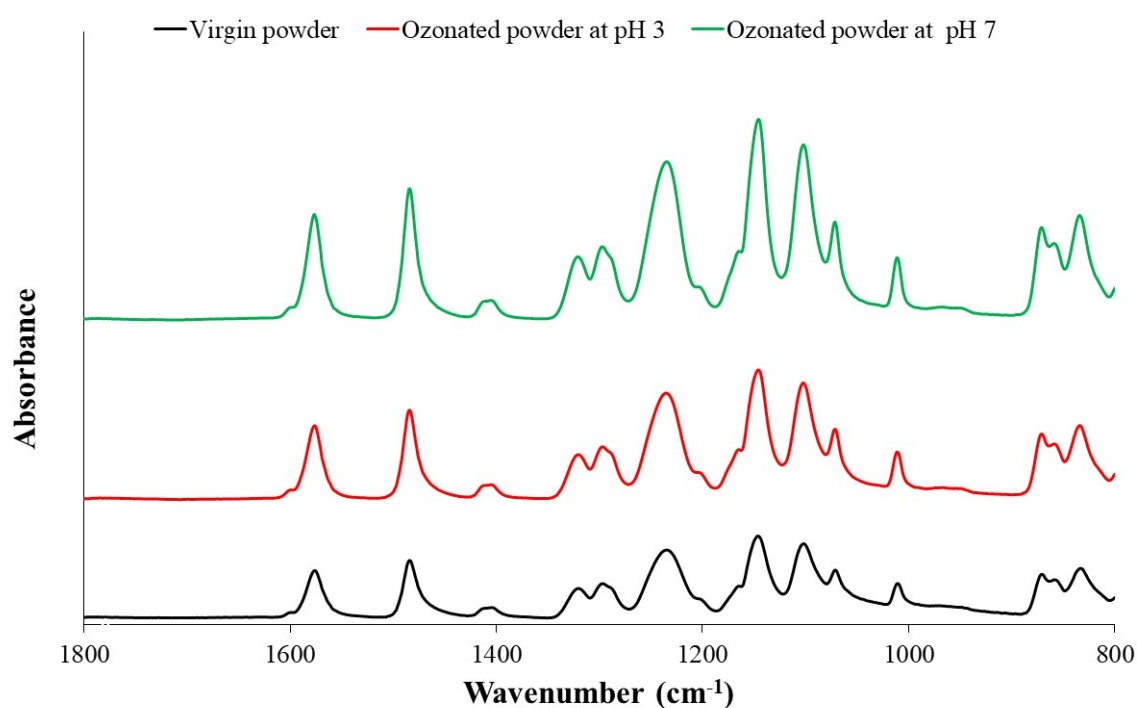


Figure S1. ATR-FTIR spectra of a PES powder (virgin and ozonated at pH 3 and 7).

The ozonation experimentation on the PES powder was performed with the same device and protocol than for the membranes (part 2.3). The flask containing the membrane sample was just replaced by a glass tube filled with 0.3 g of PES powder. Two filters were introduced at the inlet and outlet of the tube to avoid powder leaching in the apparatus.

References

- [1] R.E. Buehler, J. Staehelin, J. Hoigne, Ozone decomposition in water studied by pulse radiolysis. 1. Perhydroxyl (HO₂)/hydroperoxide (O₂⁻) and HO₃/O₃⁻ as intermediates, *The Journal of Physical Chemistry*. 88 (1984) 2560–2564. <https://doi.org/10.1021/j150656a026>.

- [2] U. von Gunten, Ozonation of drinking water: Part I. Oxidation kinetics and product formation, *Water Research*. 37 (2003) 1443–1467. [https://doi.org/10.1016/S0043-1354\(02\)00457-8](https://doi.org/10.1016/S0043-1354(02)00457-8).