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Supplementary material

SUPPLEMENTARY MATERIAL TO

Sulfate radical-based degradation of antraquinone textile dye in a plug flow photoreactor

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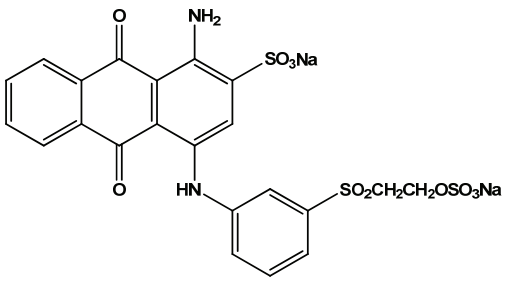
TABLE S-I. General characteristic of RB 19 dye

Property	Dye
Commercial name	Remazol Brilliant Blue R
C. I. number	61200
Apparent color	Blue
Purity	≈50 %
Molecular weight	626 g mol^{-1}
Molecular formula	$C_{22}H_{16}N_2Na_2O_{11}S_3$
Chemical structure	
Maximum absorption wavelength	592 nm
Water solubility	10 g dm^{-3}

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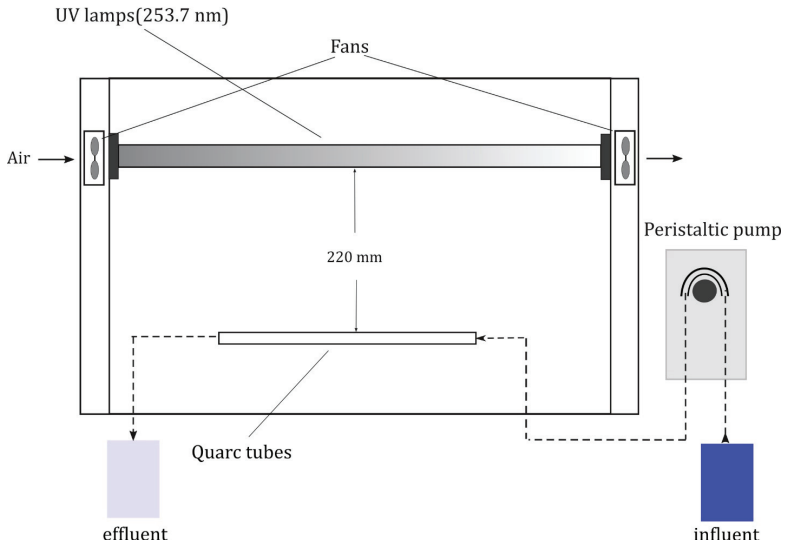

Fig-S-1. Scheme of irradiation system with a plug flow reactor.

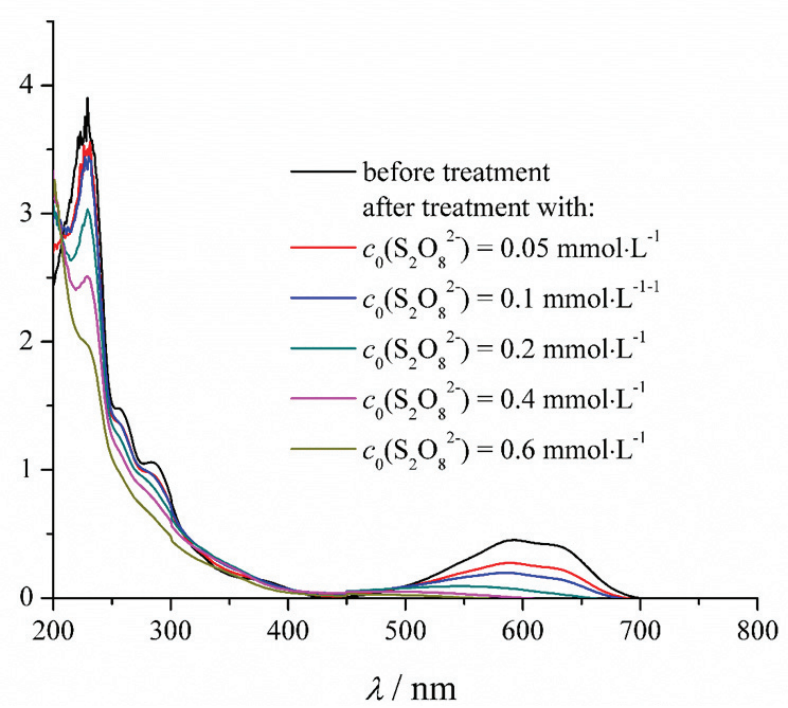

Fig. S-2. Changes in the UV/Vis spectra during UV/$S_2O_8^{2-}$ treatment of RB 19 dye. c_0(RB 19) = 50 mg·L^{-1}, initial $S_2O_8^{2-}$ concentration: a) before treatment, and after treatment with: b) 0.05, c) 0.1, d) 0.2, e) 0.4 and f) 0.6 mmol·L^{-1}, flow rate = 7 mL·min^{-1}, pH 3.0±0.1, UV light intensity = 1950 μW·cm^{-2}, temperature = 25±0.5 °Cl.

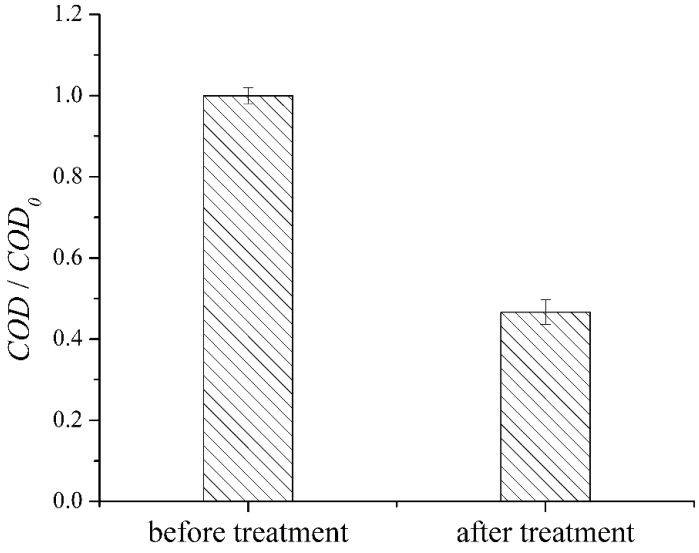

Fig. S-3. *COD* changes before and after UV/$S_2O_8^{2-}$ treatment. c_0(RB 19) = 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 1 mmol·L^{-1}, flow rate 1.5 mL·min^{-1}, pH 3±0.1, UV light intensity 1950 μW·cm^{-2}, temperature 25±0.5 °C.

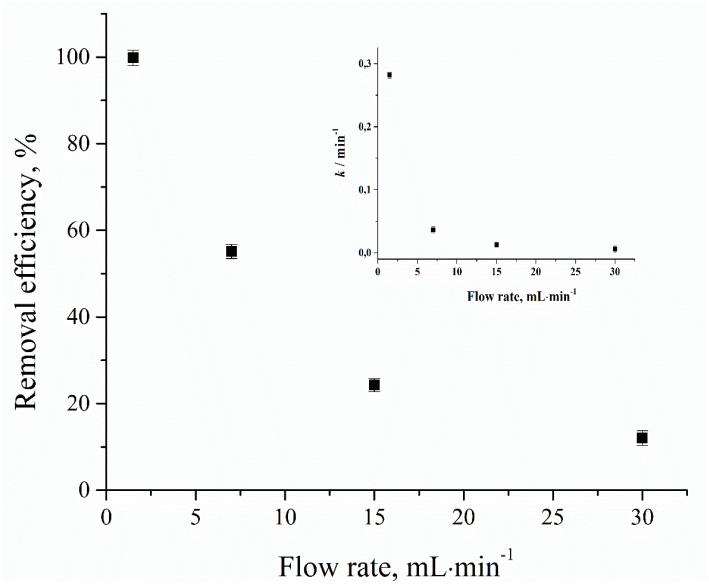

Fig. S-4. The influence of flow rate on RB 19 dye degradation (inset represents changes in *k* at different flow rates). c_0(RB 19) = 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, native pH 3.8±0.1, UV light intensity = 1950 μW·cm^{-2}, temperature = 25±0.5 °C.

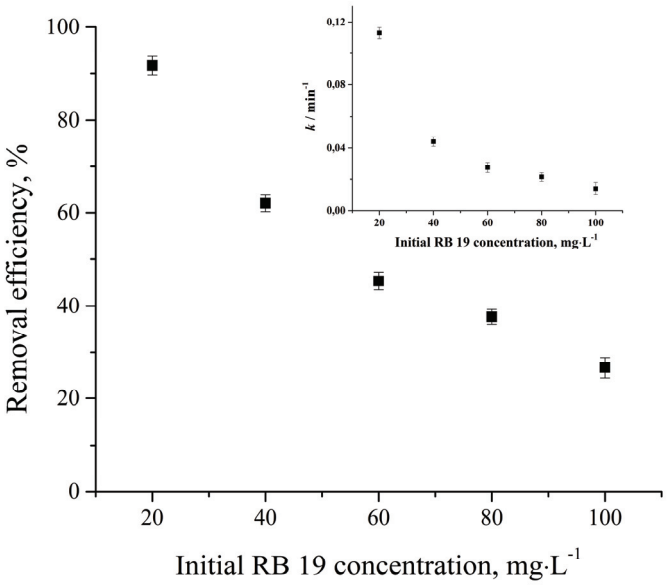

Fig. S-5. The influence of different initial RB 19 concentrations on its degradation (inset represents changes in k at different dye concentrations). $c_0(S_2O_8^{2-}) = 0.1$ mmol·L^{-1}, flow rate = 7 mL·min^{-1}, pH native 3.8±0.1, UV light intensity = 1950 μW·cm^{-2}, temperature = 25±0.5 °C.

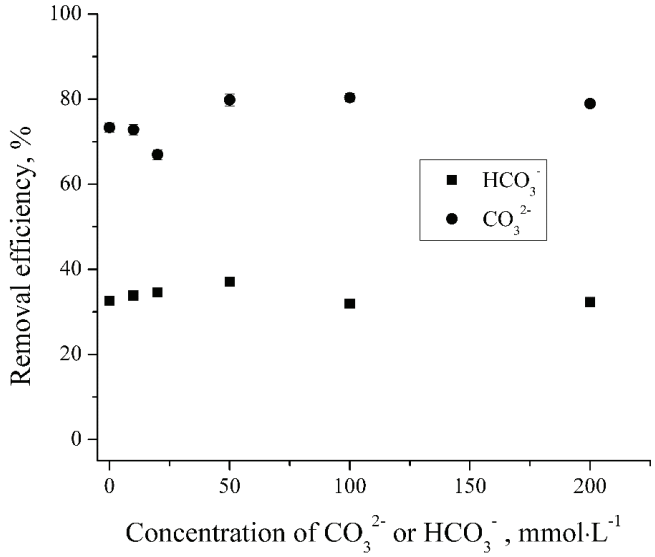

Fig. S-6. Influence of different concentrations of carbonate and bicarbonate anions on the removal efficiency of RB 19. c_0(RB 19)= 50 mg·L^{-1}, $c_0(S_2O_8^{2-}) = 0.1$ mmol·L^{-1}, flow rate 7 mL·min^{-1}, pH 8.0±0.1 (for bicarbonate) 12±0.1 (for carbonate), UV light intensity 1950 μW·cm^{-2}.

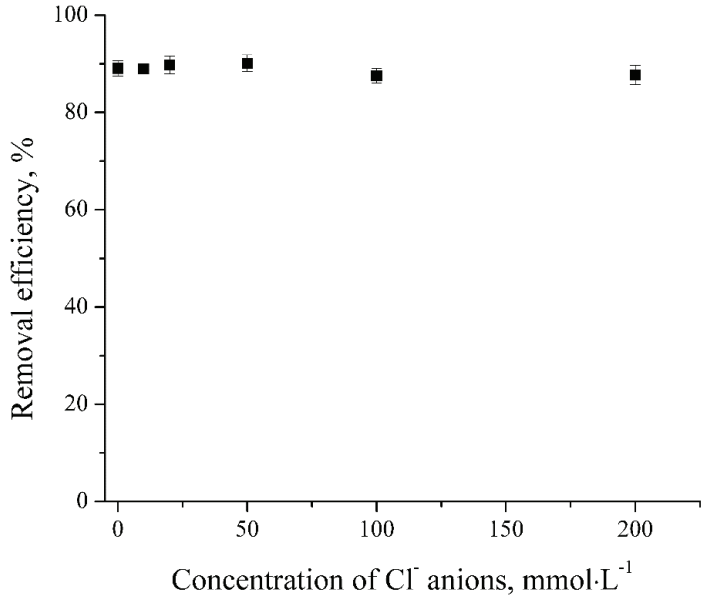

Fig. S-7. Influence of different concentrations of chloride anions on the removal efficiency of RB 19. c_0(RB 19) = 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, flow rate 7 mL·min^{-1}, pH native 3.8±0.1, UV light intensity 1950 μW·cm^{-2}.

Example of k calculation according to Eq. (4):
Experimental conditions:

- initial pH value 3.00±0.1
- initial $S_2O_8^{2-}$ concentration = 0.1 mmol·L^{-1}
- flow rate = 7 mL·min^{-1}
- UV light intensity = 1950 μW·cm^{-2}
- c_0(RB 19) = 50 mg·L^{-1} (before treatment)
- c(RB 19) = 1.64 mg·L^{-1} (after treatment)
- τ = 22 min

$$\tau = \frac{1}{k} \ln \frac{c_0}{c}$$

k = 1/22 min·ln 50/1.64 = 0.155 min^{-1}