Supplementary material

Sulfate radicals based degradation of the antraquionone textile dye in plug flow photoreactor

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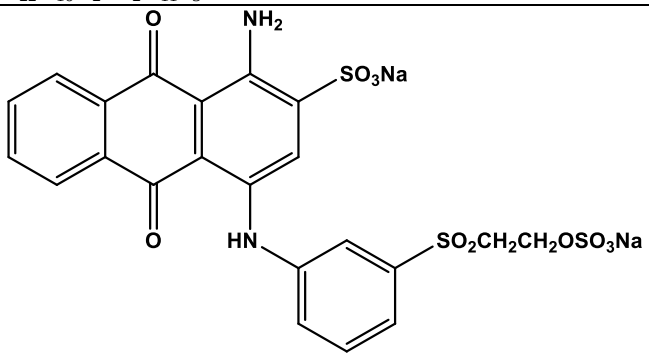
TABLE I. General characteristic of RB 19 dye

Properties	**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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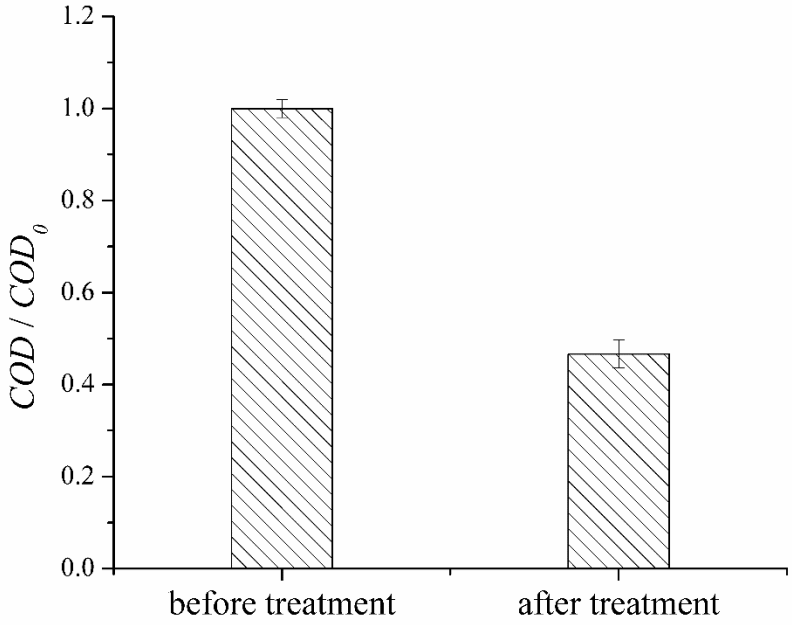

Figure 1. COD changes before and after UV/$S_2O_8^{2-}$ treatment. c_0(RB 19) = 50 mg·L^{-1}, c_0($S_2O_8^{2-}$) = 1 mmol·L^{-1}, flow rate 1.5 mL·min^{-1}, pH 3 ± 0.1, UV light intensity was 1950 μW·cm^{-2}, temperature was 25 ± 0.5 ºC.

TABLE II. Removal of RB 19 dye with UV/$S_2O_8^{2-}$ under different experimental conditions

c_0(RB 19) (mg·L^{-1})	c_0($S_2O_8^{2-}$) (mmol·L^{-1})	Flow rate (mL·min^{-1})	pH	k (min^{-1})	RE (%)
The effect of initial $S_2O_8^{2-}$					
50	0.05	7	4	0.022	39
50	0.1	7	4	0.038	57
50	0.2	7	4	0.083	84
50	0.4	7	4	0.204	98
The effect of initial pH value					
50	0.1	7	3	0.155	99
50	0.1	7	5	0.042	62
50	0.1	7	7	0.032	51
50	0.1	7	9	0.022	40
50	0.1	7	10	0.016	30
The effect of flow rate					
50	0.1	30	4	0.006	12
50	0.1	15	4	0.013	24
50	0.1	7	4	0.036	55
50	0.1	1.5	4	0.282	99
The effect of initial dye concentration					
20	0.1	7	4	0.113	92
40	0.1	7	4	0.044	62
60	0.1	7	4	0.027	45
80	0.1	7	4	0.0215	37
100	0.1	7	4	0.014	26

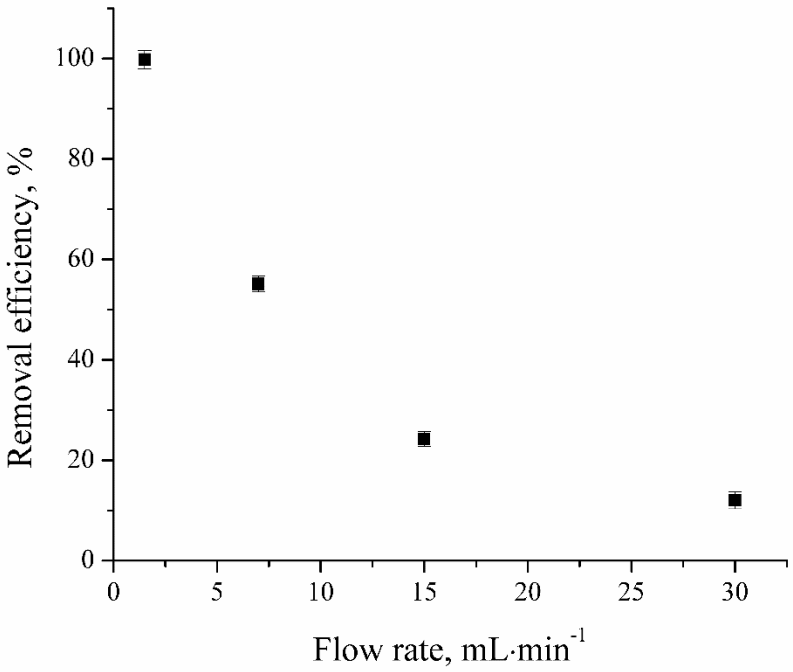

Figure 2. Influence of flow rate on RB 19 dye degradation. c_0(RB 19) = 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, native pH (3.8 ± 0.1) , UV light intensity was 1950 μW·cm^{-2}, temperature was 25 ± 0.5 ºC.

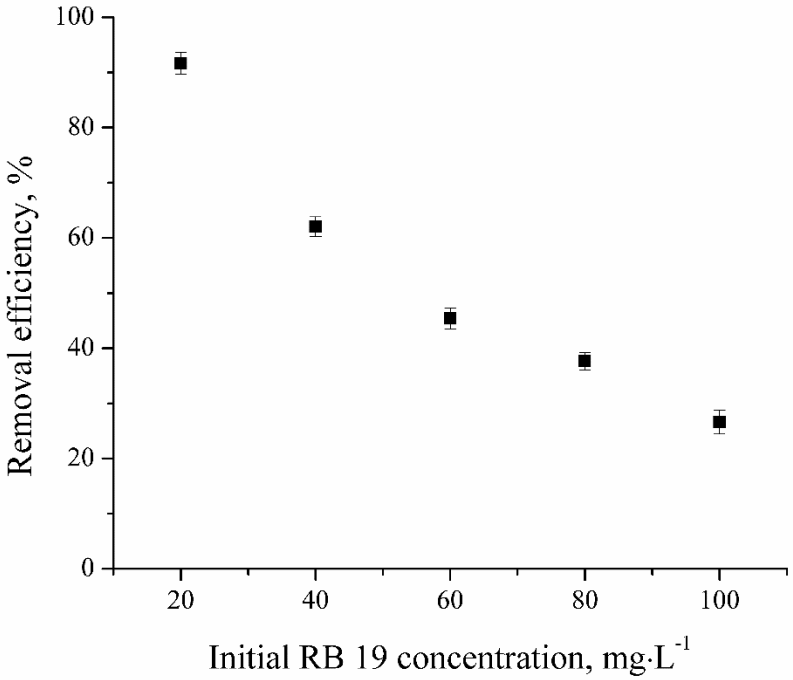

Figure 3. Influence of different initial RB 19 concentration on the its degradation. $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, flow rate 7 mL·min^{-1}, pH native (3.8 ± 0.1), UV light intensity was 1950 μW·cm^{-2}, temperature was 25 ± 0.5 º C

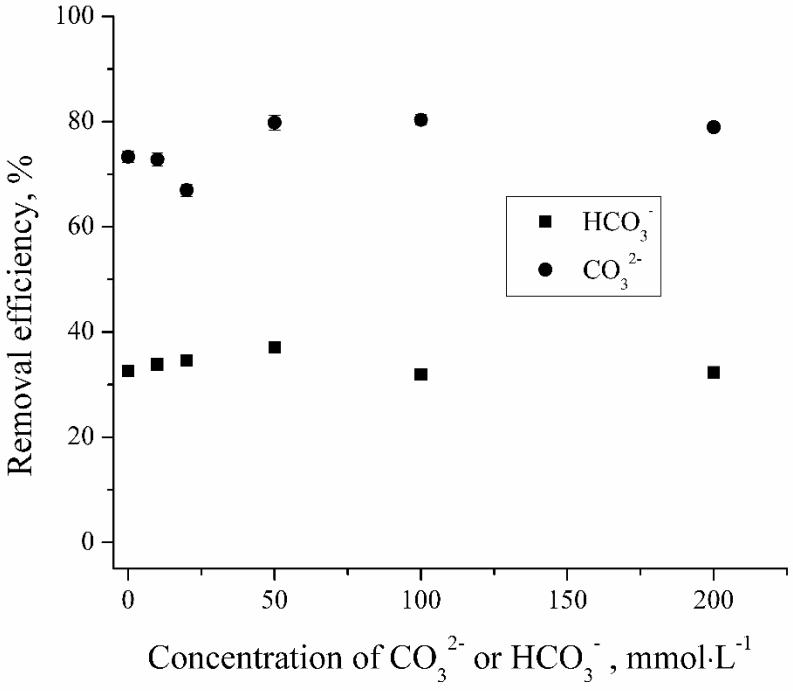

Figure 4. Influence of different carbonate and bicarbonate anions concentrations on the removal efficiency of RB 19. c_0(RB 19)= 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, flow rate 7 mL·min^{-1}, pH 8.0±0.1 (for bicarbonate) 12±0.1 (for carbonate), UV light intensity was 1950 μW·cm^{-2}

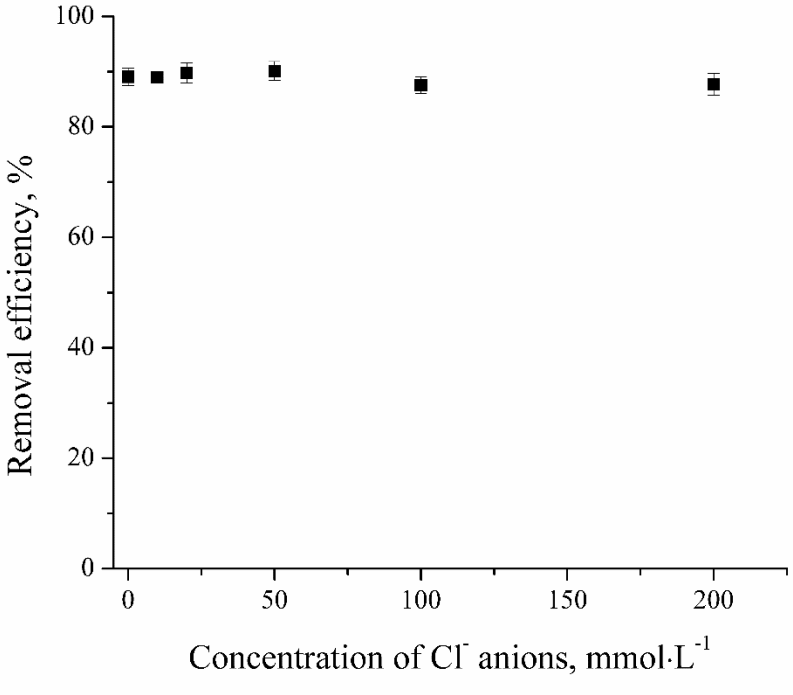

Figure 5. Influence of different chloride anions concentrations on the removal efficiency of RB 19. c_0(RB 19) = 50 mg·L^{-1}, $c_0(S_2O_8^{2-})$ = 0.1 mmol·L^{-1}, flow rate 7 mL·min^{-1}, pH native (3.8 ± 0.1), UV light intensity was 1950 μW·cm^{-2}