

Supplementary Material

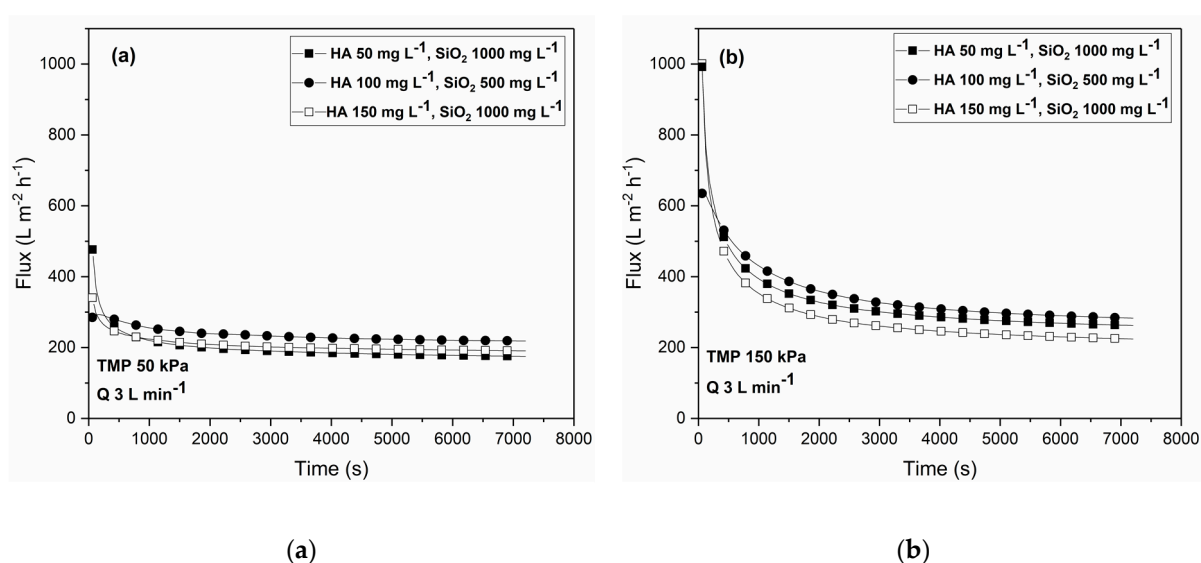
# New Insights into the Fouling of a Membrane during the Ultrafiltration of Complex Organic–Inorganic Feed Water

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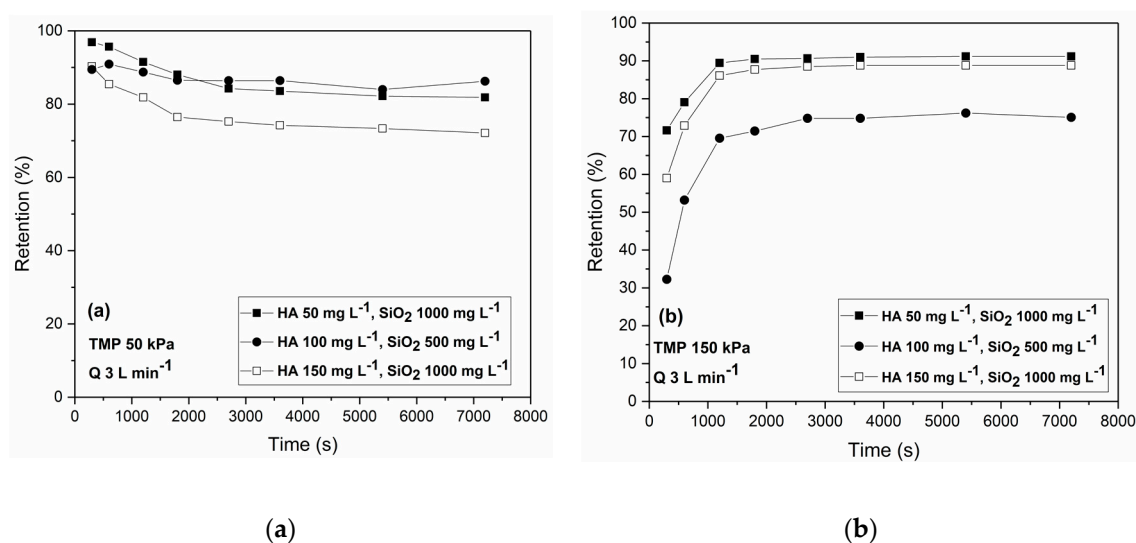
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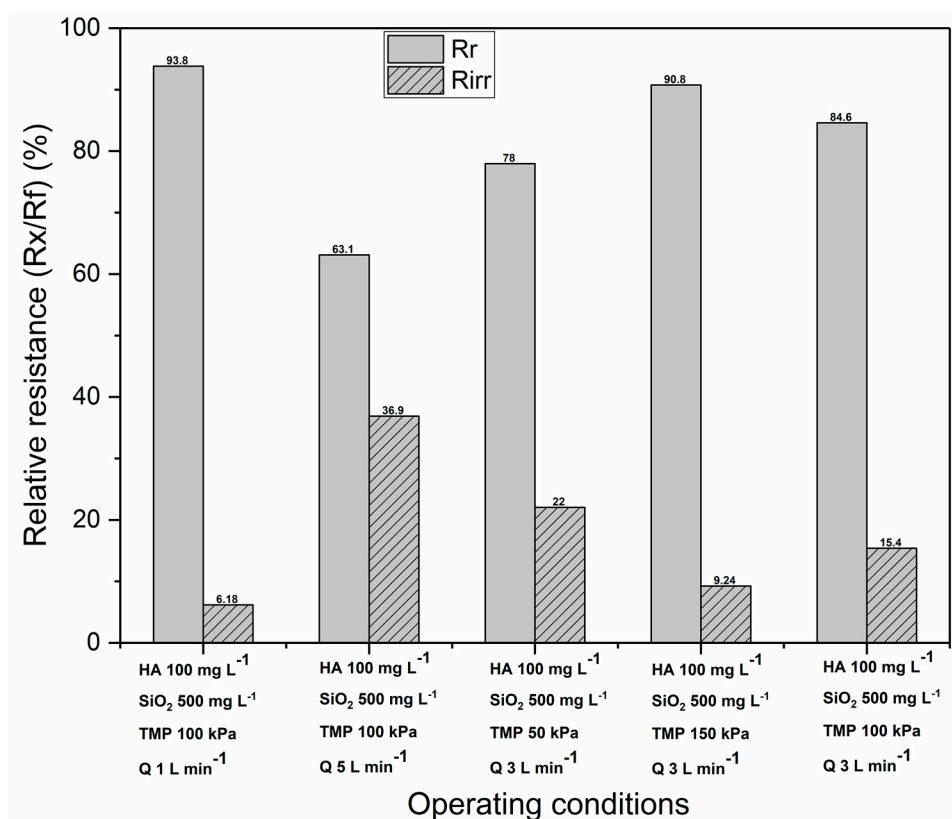
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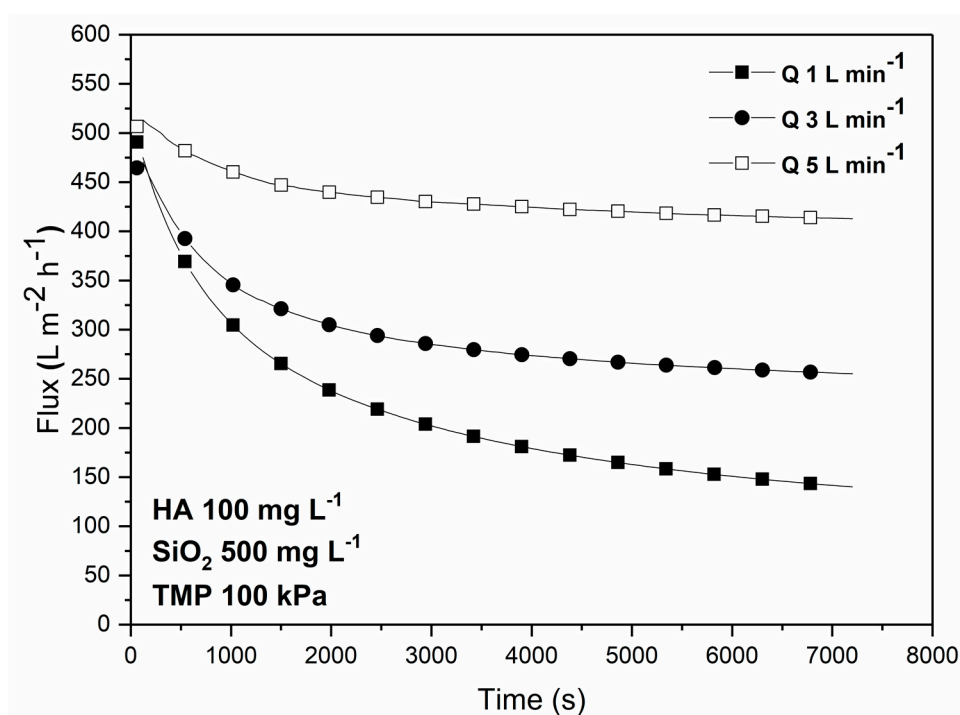
**Figure S1.** Time dependency of permeate flux at (a) transmembrane pressure of 50 kPa and (b) transmembrane pressure of 150 kPa. The concentration of humic acid (50, 100, 150 mg L<sup>-1</sup>) and colloidal silica (500, 1000 mg L<sup>-1</sup>) are varied. The cross-flow rate of 3 L min<sup>-1</sup> was constant.



**Figure S2.** Time dependency of retention of humic acid at (a) transmembrane pressure of 50 kPa and (b) transmembrane pressure of 150 kPa. The concentration of humic acid (50, 100, 150 mgL<sup>-1</sup>) and colloidal silica (500, 1000 mgL<sup>-1</sup>) are varied. The cross-flow rate of 3 Lmin<sup>-1</sup> was constant.



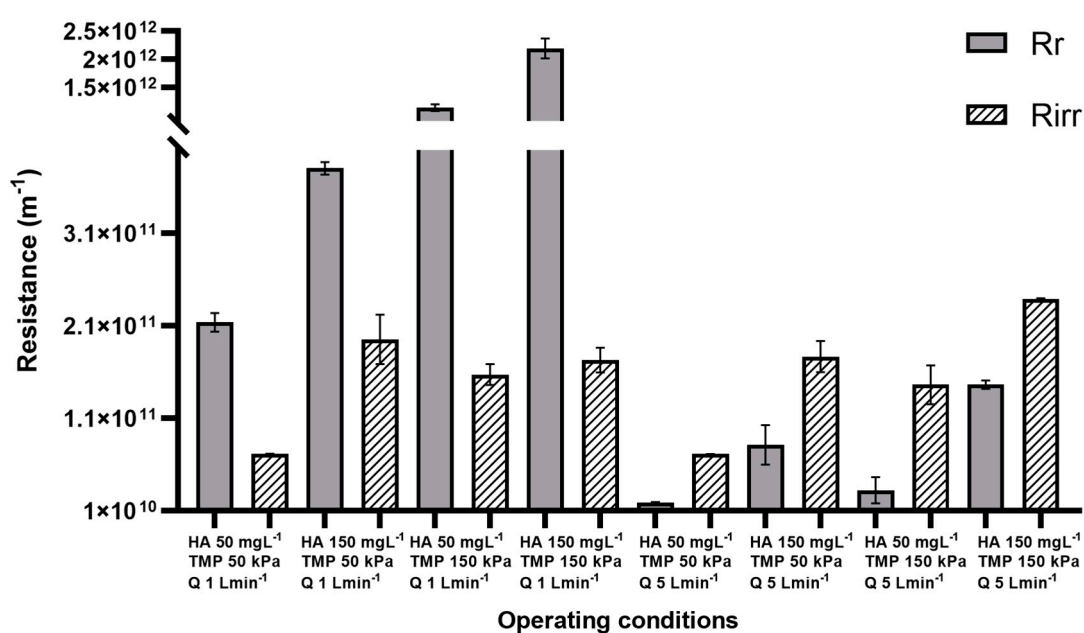
**Figure S3.** The relative values of irreversible (Rirr) and reversible resistance (Rr) during the ultrafiltration of a complex mixture of humic acid with colloidal silica.



**Figure S4.** Time dependency of permeate flux during ultrafiltration of the mixture of humic acid and colloidal silica at the different cross-flow rates.

**Table S1.** Absolute values of reversible (Rr) and irreversible resistance (Rirr) at humic acid filtration.

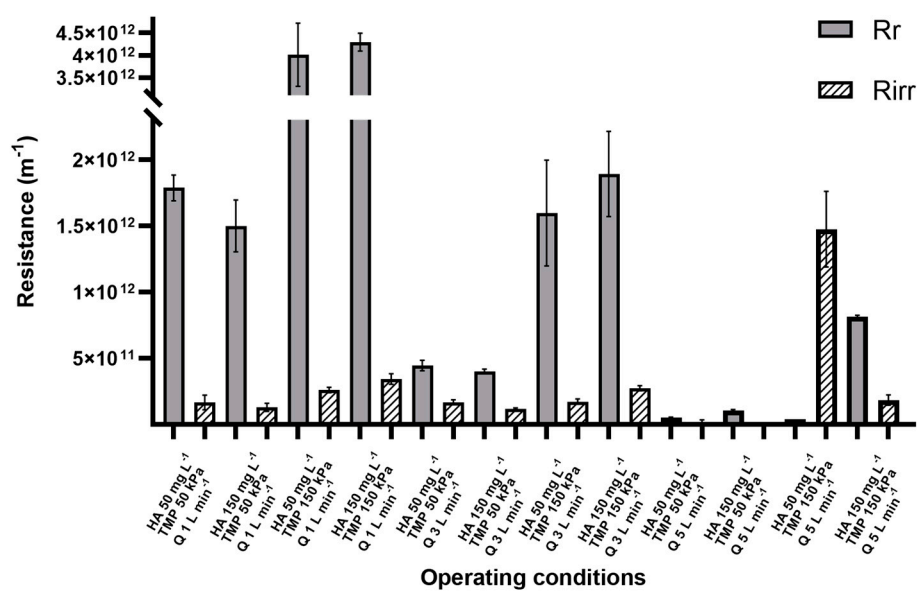
Operating conditions	Mean absolute values of Rr resistance with $\pm$ STDEV ( $\times 10^{10} \text{ m}^{-1}$ )	Mean absolute values of Rirr resistance with $\pm$ STDEV ( $\times 10^{10} \text{ m}^{-1}$ )
HA 50 mg L <sup>-1</sup> ; TMP 50 kPa Q 1 L min <sup>-1</sup>	21.4 $\pm$ 1	7.18 $\pm$ 0.01
HA 150 mg L <sup>-1</sup> ; TMP 50 kPa Q 1 L min <sup>-1</sup>	38 $\pm$ 0.67	19.5 $\pm$ 2.66
HA 50 mg L <sup>-1</sup> ; TMP 150 kPa Q 1 L min <sup>-1</sup>	114 $\pm$ 5.98	15.7 $\pm$ 1.14
HA 150 mg L <sup>-1</sup> ; TMP 150 kPa Q 1 L min <sup>-1</sup>	220 $\pm$ 17.7	17.3 $\pm$ 1.34
HA 50 mg L <sup>-1</sup> ; TMP 50 kPa Q 5 L min <sup>-1</sup>	1.93 $\pm$ 0.01	7.16 $\pm$ 0.01
HA 150 mg L <sup>-1</sup> ; TMP 50 kPa Q 5 L min <sup>-1</sup>	8.13 $\pm$ 2.13	17.7 $\pm$ 1.68
HA 50 mg L <sup>-1</sup> ; TMP 150 kPa Q 5 L min <sup>-1</sup>	3.24 $\pm$ 1.43	14.6 $\pm$ 2.11
HA 150 mg L <sup>-1</sup> ; TMP 150 kPa Q 5 L min <sup>-1</sup>	14.7 $\pm$ 0.44	23.9 $\pm$ 0.04



**Figure S5.** Absolute values of reversible (Rr) and irreversible resistance (Rirr) at humic acid filtration.

**Table S2.** Absolute values of reversible (Rr) and irreversible resistance (Rirr) during the ultrafiltration of a complex mixture of humic acid with colloidal silica.

Operating conditions	Mean absolute values of Rr resistance with $\pm$ STDEV ( $\times 10^{10} \text{ m}^{-1}$ )	Mean absolute values of Rirr resistance with $\pm$ STDEV ( $\times 10^{10} \text{ m}^{-1}$ )
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 1 L min <sup>-1</sup>	179 $\pm$ 9.71	16.7 $\pm$ 5.45
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 1 L min <sup>-1</sup>	150 $\pm$ 19.6	13.1 $\pm$ 3.
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 1 L min <sup>-1</sup>	401 $\pm$ 70.6	26.1 $\pm$ 2.05
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 1 L min <sup>-1</sup>	430 $\pm$ 20	34.4 $\pm$ 4
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 3 L min <sup>-1</sup>	44.7 $\pm$ 4.03	16.9 $\pm$ 1.91
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 3 L min <sup>-1</sup>	40.3 $\pm$ 1.6	11.9 $\pm$ 0.8
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 3 L min <sup>-1</sup>	160 $\pm$ 39.9	17.4 $\pm$ 2
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 3 L min <sup>-1</sup>	189 $\pm$ 32.1	27.4 $\pm$ 2
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 5 L min <sup>-1</sup>	5.27 $\pm$ 0.31	1.99 $\pm$ 1.54
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 50 kPa; Q 5 L min <sup>-1</sup>	10.6 $\pm$ 0.73	1.53 $\pm$ 0.07
HA 50 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 5 L min <sup>-1</sup>	4.21 $\pm$ 0.09	148 $\pm$ 28.5
HA 150 mg L <sup>-1</sup> ; SiO <sub>2</sub> 1000 mg L <sup>-1</sup> ; TMP 150 kPa; Q 5 L min <sup>-1</sup>	81.5 $\pm$ 1.09	18.6 $\pm$ 3.83



**Figure S6.** Absolute values of reversible ( $R_r$ ) and irreversible resistance ( $R_{irr}$ ) during the ultrafiltration of a complex mixture of humic acid with colloidal silica.