Biofouling control by UV/H$_2$O$_2$ pretreatment for brackish water reverse osmosis process

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Degradation of pCBA involves direct UV photolysis and indirect photo-oxidation by •OH radicals, as described by Rosenfeldt and Linden (2007)\(^1\).

\[
-ln\left(\frac{[p\text{CBA}]_t}{[p\text{CBA}]_0}\right)/t = k_{\text{obs}} = k' + k_{p\text{CBA,•OH}}[•\text{OH}]_s
\]

\(\quad k' = \phi_{p\text{CBA}} \times k_{s,p\text{CBA}} \)

\[
k_{s,p\text{CBA}} = \sum_{200-300} \frac{10^{-3} \times E^0_p(\lambda) \varepsilon_{p\text{CBA}}(\lambda) \left[ -10^{-a(\lambda)z} \right]}{a(\lambda)\varepsilon}
\]

\[
[•\text{OH}]_s = \frac{k_{\text{obs}} - \phi_{p\text{CBA}} \times k_{s,p\text{CBA}}}{k_{p\text{CBA,•OH}}}
\]

Where, \([p\text{CBA}]_0\) and \([p\text{CBA}]_t\) are initial pCBA concentration (M) and its concentration after exposure time \(t\) (sec), respectively. \(k_{\text{obs}}\) and \(k'\) are the observed (total) and direct-photolysis time-based pseudo-first-order degradation rate constants of pCBA, respectively (1/sec). \([•\text{OH}]_s\) is the steady-state •OH radical concentration (M) and \(k_{p\text{CBA,•OH}}\) is the second-order rate constant of pCBA reaction with •OH, reported to be 5×10\(^9\) 1/M s. \(\phi_{p\text{CBA}}\) is the quantum yield for pCBA removal 0.0182 mole/Einstein, \(k_{s,p\text{CBA}}\) is the specific rate of light absorption by pCBA (Einstein/mole sec). \(E^0_p(\lambda)\) is the incident photon irradiance (Einstein/cm\(^2\) sec), \(\varepsilon_{p\text{CBA}}(\lambda)\) is the molar (decadic) absorption coefficient of pCBA (1/M cm), \(a(\lambda)\) is the solution absorption coefficient (1/cm) and \(z\) is the depth of solution (cm).
Fig. S1 RO lab unit experimental photo-image.

Fig. S2 Atlantium hydro-optic-disinfection (HOD™) RZ104-11 MP-UV reactor: (A) photo; (B) schematic illustration.

Reference