

Activ'H₂O, innovative electrochemical process for water disinfection, efficiency evaluation and influencing factors

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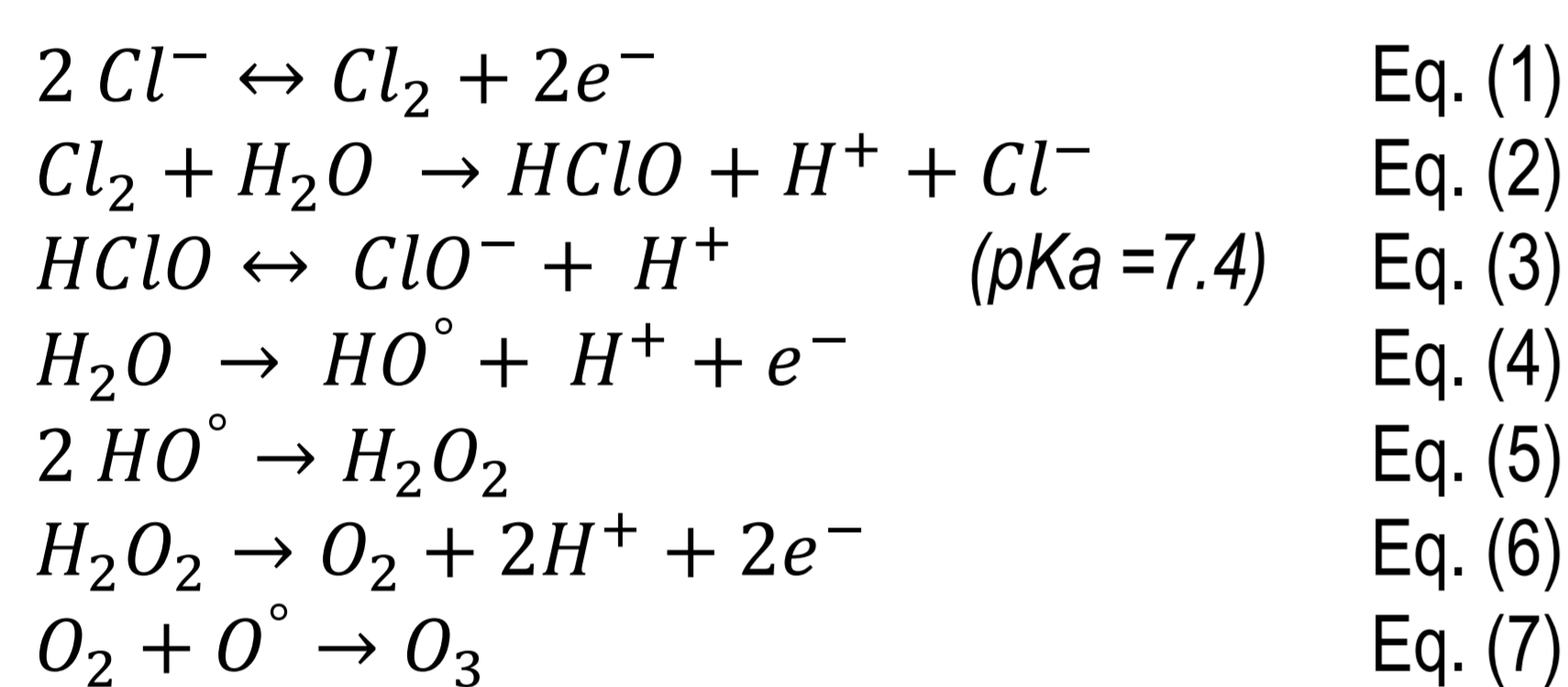
Objectives

- Water disinfection process
- In-situ production of oxidizing agents
- Evaluate the water disinfection performance
- Identifying the influencing factors

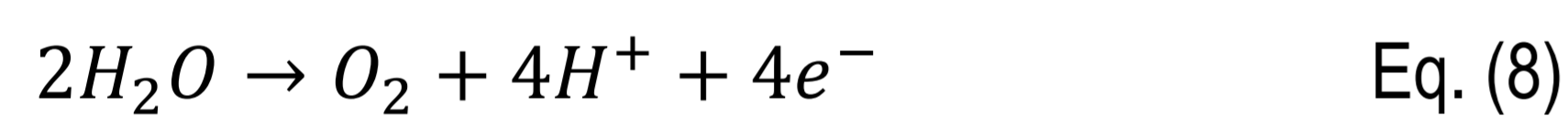
Context

- Drinking water protection against germs
- Ensuring the microbiological safety of water
- Healthy water for farming and food industry
- Green disinfection process

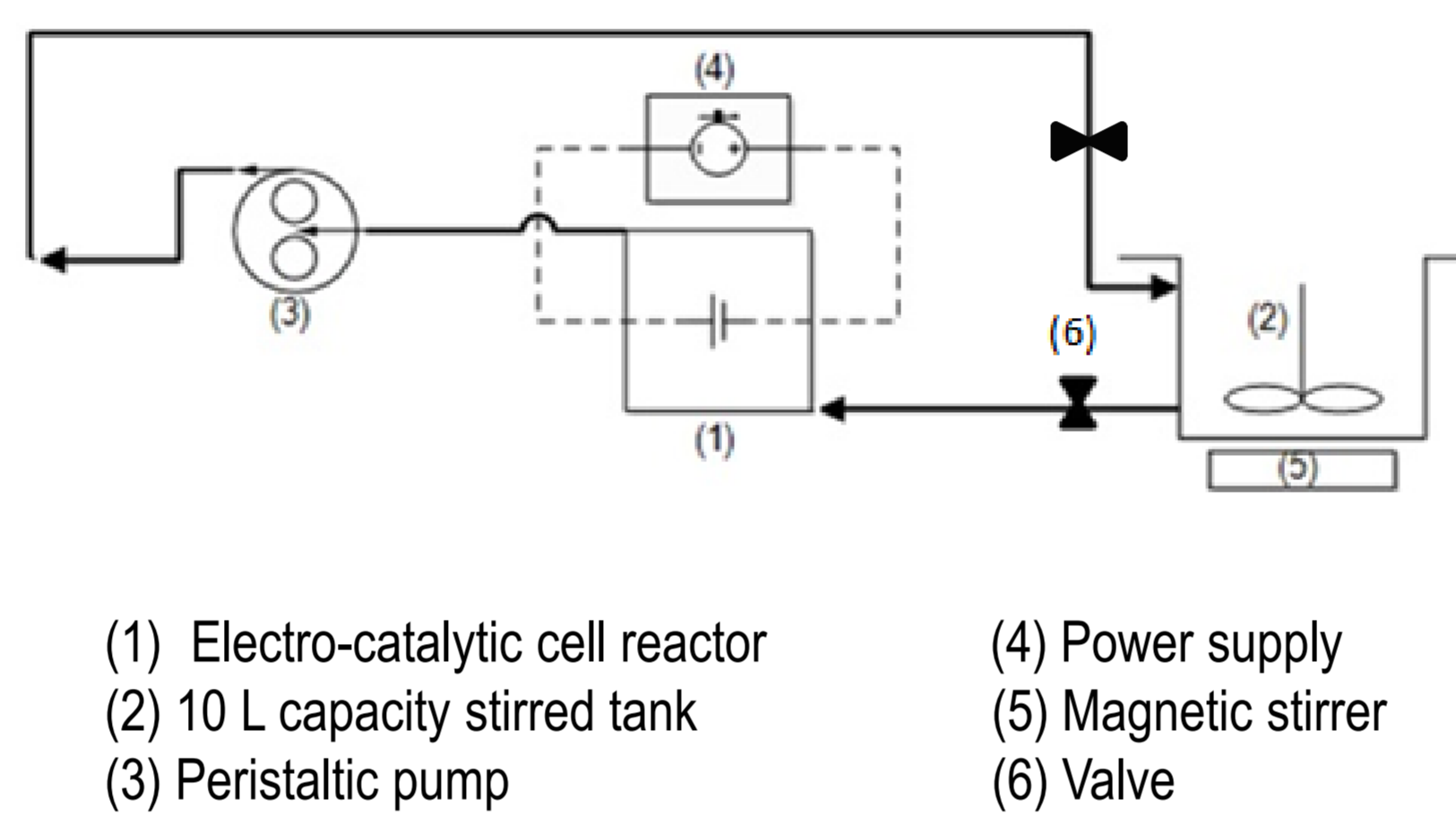
Oxidizing species production mechanism



Parasitic reactions (water oxidation)



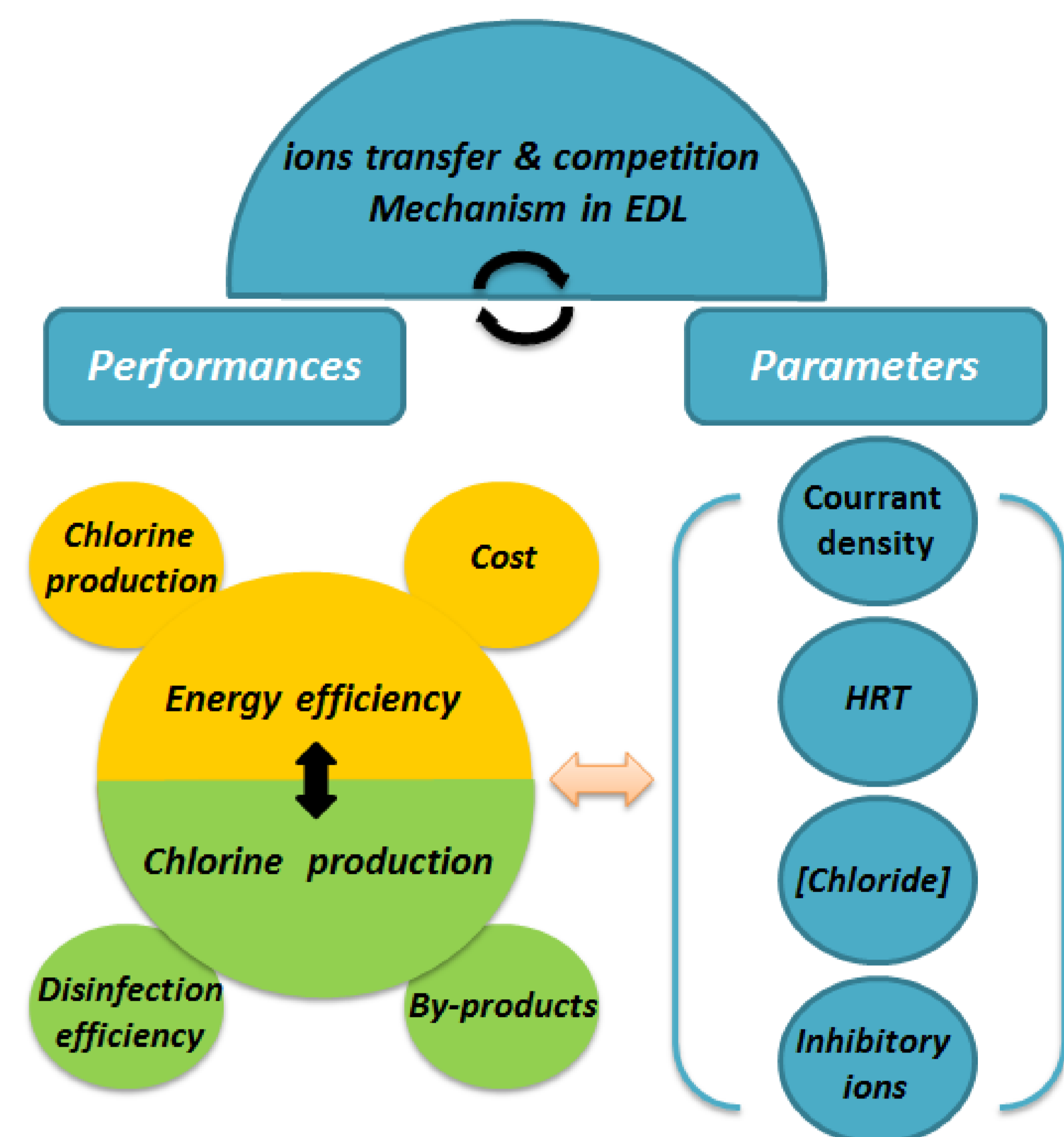
Electrochemical reactor



- (1) Electro-catalytic cell reactor
- (2) 10 L capacity stirred tank
- (3) Peristaltic pump
- (4) Power supply
- (5) Magnetic stirrer
- (6) Valve

Figure.1. Experimental electrochemical reactor scheme used for water disinfection.

Graphical summary



Performances (synthetic solutions)

- Active chlorine production increases linearly with chloride ions concentration as well as the electrical charge applied.
- High chloride concentration combined with low current density lead to higher current efficiency and a very weak chlorates production. when the current is too high for a given surface area, the inflow of chloride ions will be limiting compare to the electro-oxidation reaction leading to more parasitic reaction formation.
- Only 10% of produced active chlorine disappeared after an open storage period of 15 days.
- Water composition has a significant effect on active chlorine production rate; non electroactive anions had a negative effect on the active chlorine production rate. Inhibiting rate order was correlated with the molar concentration ratio of parasitic ions, with migration rate and with hydration radius of each non electroactive anion.
- Switching polarity slightly enhanced the active chlorine production (more accentuated when the polarity frequency increase).

Conclusion

- ActivH₂O system ensures a very well microbiological quality of water without any chemical addition.
- ActivH₂O system ensures water safe during its course through the distribution system for more than 15 days.
- Active chlorine is the main produced oxidizing specie, a very low production of ROS and RNS has been observed. No production of H₂O₂.
- chlorate generation can only occur under extreme treatment conditions (high production of active chlorine).

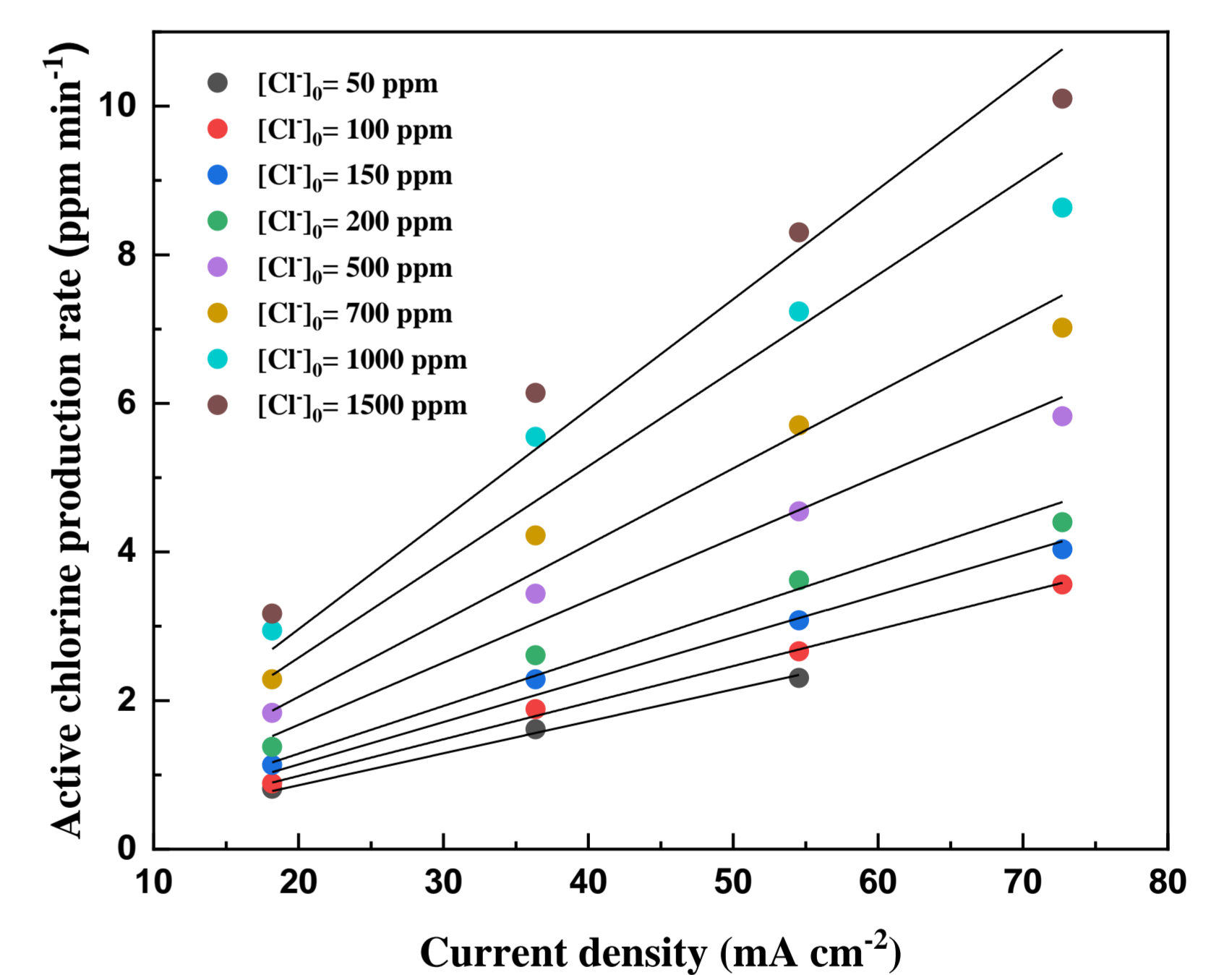


Fig.2. Active chlorine production rate according to chloride ions initial concentration and current density (flow =22,8 l.h⁻¹).

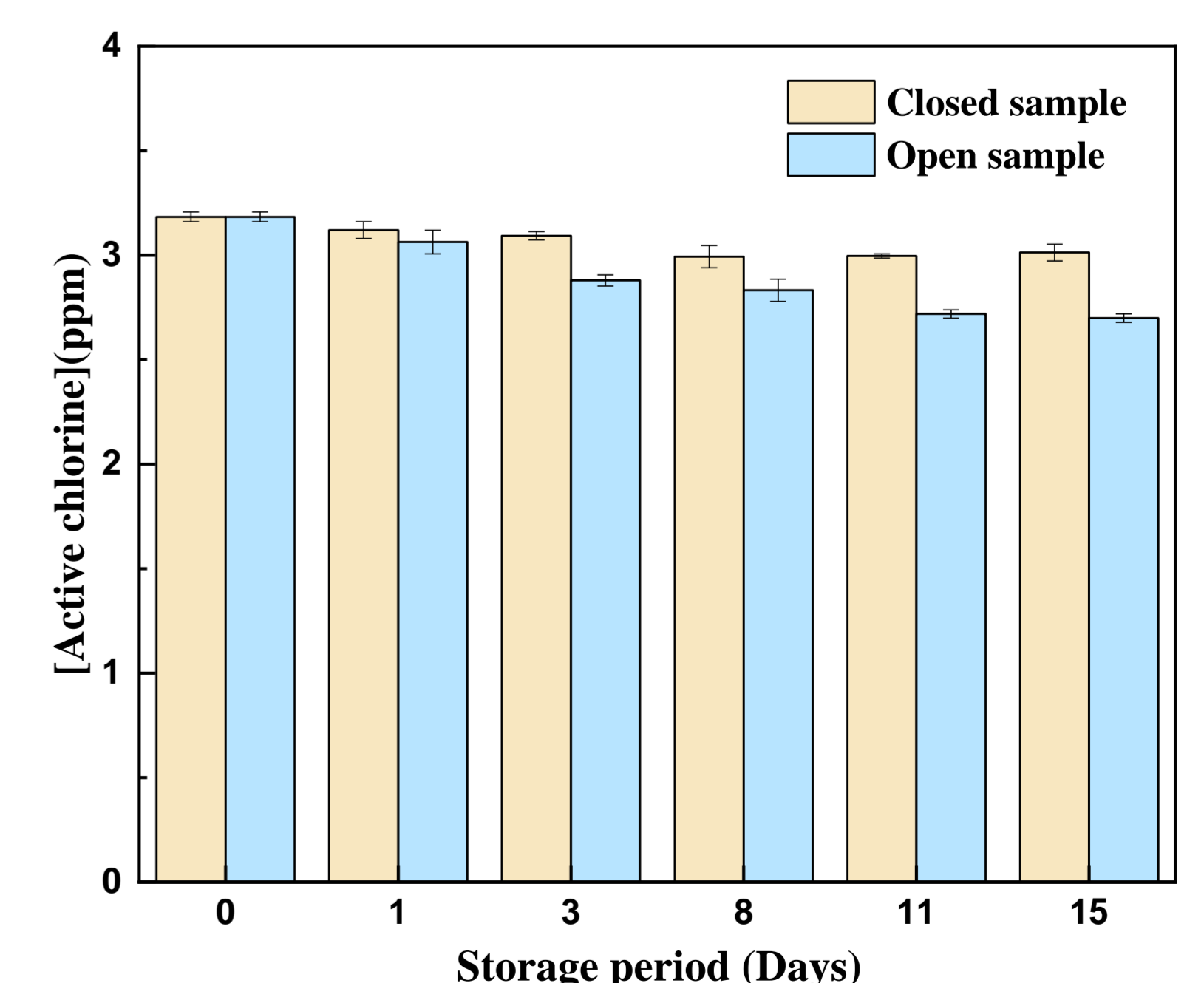


Fig.3. Evolution of active chlorine concentration in two samples (open and closed) over storage time.