

Hypochlorite Ion Electrogeneration using a Dimensionally Stable Anode-type of Ti/PtPd(10%)Ox

T. Zayas⁽¹⁾, M. Morales⁽²⁾, L. Salgado⁽³⁾

⁽¹⁾ *Postgrado en Ciencias Ambientales y Centro de Química, Instituto de Ciencias. Benemérita Universidad Autónoma de Puebla (BUAP), A.P. 1613, C.P. 72000, Puebla, México.
Tel. (52) 222 2297274; E-mail: tzayasp@hotmail.com*

⁽²⁾ *Facultad de Ingeniería Química- Ingeniería Ambiental. BUAP.*

⁽³⁾ *Departamento de Química, Universidad Autónoma Metropolitana Iztapalapa, CDMX.*

1. Introduction – The process of electrochemical oxidation of organic contaminants with dimensionally stable anodes (DSA) is produced by a direct or indirect mechanism. The direct mechanism occurs by the exchange of electrons between the contaminant and the surface of the electrode, while the indirect mechanism requires the electrogeneration of intermediates that make possible the oxidation of pollutants [1]. Physicochemical properties of the materials used as anodes can be promoters of a direct and/or indirect mechanism. The chloride ion plays an important role in the indirect mechanism since its oxidation generates intermediates such as chlorine, hypochlorous acid and hypochlorite ion, known as active chlorine species. The predominance of these species is dependent on the pH conditions. Hypochlorite ions electrogenerated carry out the oxidation of the organic contaminants present in the wastewater [2]. In this work was carried out the study of the electrogeneration of hypochlorite ions by electrolysis in NaCl solutions, using a dimensionally stable type anode of Ti / PtPd (10%)Ox.

2. Experimental - PtPd(10%)Ox-coated titanium (Ti/PtPd(10%)Ox) were used as the anodes, and RuO₂-coated titanium (Ti/RuO₂) was used as the cathode in all cases. The relative amount of each metal in the film (PtPd(10%)Ox) corresponded to the nominal molar percent of the metal in the precursor solution. The area of each electrode was 41.25 cm² (7.5 cm × 5.5 cm). Electrolysis in sodium chloride solutions was performed using the Ti/PtPd (10%)Ox and Ti/RuO₂ electrodes system. The electrochemical oxidation process was performed in an electrochemical cell with a capacity of 150 mL and a sample volume of 100 mL. The parallel electrodes (anode and cathode) were placed vertically and 3 mm apart. NaCl solutions (100 mL) were subjected to electrolysis. The study variables were the electrolyte concentration (NaCl), initial pH, cell voltage and electrolysis time. Quantitative evaluation of hypochlorite ions electrogenerated was performed by UV-Vis spectroscopy.

3. Results and Discussion - The results obtained showed that the electrolysis of a NaCl solution using a dimensionally stable type anode of Ti/PtPd(10%)Ox produces hypochlorite ions (ClO⁻). The production of hypochlorite ions has a direct proportional relationship with the NaCl concentration, the applied cell voltage and the electrolysis time. The electrolysis process modifies the initial pH and is displaced to values higher than 7, which favors the formation of the ClO⁻ species.

4. Conclusions - Ti/PtPd(10%)Ox anode is a promoter of the hypochlorite ion electrogeneration from the oxidation of chloride ions. The observed variation in the concentration of hypochlorite ions as a function of the concentration of chloride ions, cell voltage and time of electrolysis, suggests that the electrode material could have a good performance on the electrooxidation of organic matter through an indirect mechanism.

5. References

- [1] C. Comminellis, In “Environmental Electrochemistry”; C.A.C. Sequeira ed., Elsevier, Amsterdam, 1994.
- [2] M. Panizza, G. Cerisola, Chem. Rev. 2009, 109, 6541–6569