molecules

MDPI

Article

Assessing the Influence of Electrode Polarity on the Treatment of Poultry Slaughterhouse Wastewater

Kulyash Meiramkulova [1,*], Tursynkul Bazarbayeva [2], Raigul Orynbassar [3], Almas Tleukulov [4], Nabiollina Madina [4], Togzhan Mashan [5], Akubayeva Dariya [2], Ainagul Apendina [6] and Nurgul Nurmukhanbetova [7]

1 Department of Environmental Engineering and Management, L.N. Gumilyov Eurasian National University, Satpayev Street 2, Nur-Sultan 010000, Kazakhstan
2 Department of the UNESCO Chair for Sustainable Development, Al-Farabi Kazakh National University, Al-Farabi 71, Almaty 050040, Kazakhstan; tursynkul.bazarbayeva@gmail.com (T.B.); a_dariya@mail.ru (A.D.)
3 Department of Physical Chemistry, Catalysis and Oil Chemistry, Al-Farabi Kazakh National University, Al-Farabi 71, Almaty 050040, Kazakhstan; raihan_06_79@mail.ru
4 Department of Water Resources and Reclamation, Kazakh National Agrarian University, Abaya Ave. 8, Almaty 050000, Kazakhstan; almas58@mail.ru (A.T.); nabiollina73@mail.ru (N.M.)
5 Department of Chemistry, L.N. Gumilyov Eurasian National University, Satpayev Street 2, Nur-Sultan 010000, Kazakhstan; togzhgan-mashan@mail.ru
6 Department of Chemistry and Chemical Technology, K. Zhubanov Aktobe Regional University, A. Moldagulovoi Ave. 34, Aktobe 030000, Kazakhstan; k.ajnagul@mail.ru
7 Department of Chemistry and Biotechnology, Sh. Ualikhanov Kokshetau University, Kokshetau City, Abai Str. 76, Nur-Sultan 020000, Kazakhstan; nn_nurgul@mail.ru
* Correspondence: kuleke@gmail.com

Abstract: Electrochemical methods have been increasingly gaining popularity in the field of wastewater treatment. However, the performance of these methods can be highly affected by the polarity direction as determined by the electrodes arrangement (anode to cathode or cathode to anode); as well as the characteristics of the wastewater to be treated as determined by the type of wastewater. The presented research work investigated the relationship between polarity direction and the removal of pollutants from poultry slaughterhouse wastewater using titanium and aluminium electrode materials. In the first case, the wastewater was exposed to the Ti (anode)-Al (cathode) combination, whereas in the second case the wastewater was subjected to the Al (anode)-Ti (cathode) arrangement. The two cases were designed to see if the polarity direction of the chosen electrode materials affected the removal of pollutants. The removal efficiencies were computed as a ratio of the remaining concentration in the treated effluent to the concentration before treatment. It was observed that the production processes generate highly fluctuating wastewater in terms of pollution loading; for instance, 422 to 5340 Pt-Co (minimum to maximum) were recorded from color, 126 to 2264 mg/L were recorded from total dissolved solids, and 358 to 5998 mg/L from chemical oxygen demand. Also, the research results after 40 min of retention time showed that both electrode arrangements achieved relatively high removal efficiencies; Whereby, the aluminium to titanium polarity achieved up to 100% removal efficiency from turbidity while the titanium to aluminium polarity achieved a maximum of 99.95% removal efficiency from turbidty. Also, a similar phenomenon was observed from total dissolved solids; whereby, on average 0 mg/L was achieved when the wastewater was purified using the aluminium to titanium arrangement, while on average 2 mg/L was achieved from the titanium to aluminium arrangement. A little higher removal efficiency discrepancy was observed from ammonia; whereby, the aluminium to titanium arrangement outperformed the titanium to aluminium arrangement with average removal efficiencies of 82.27% and 64.11%, respectively.

Keywords: electrochemical wastewater treatment; water quality; electrode polarity; physicochemical pollutants; electrode material

Citation: Meiramkulova, K.; Bazarbayeva, T.; Orynbassar, R.; Tleukulov, A.; Madina, N.; Mashan, T.; Dariya, A.; Apendina, A.; Nurmukhanbetova, N. Assessing the Influence of Electrode Polarity on the Treatment of Poultry Slaughterhouse Wastewater. *Molecules* **2022**, *27*, 1014. https://doi.org/10.3390/molecules27031014

Academic Editors: Sandra Pérez and Nicola Montemurro

Received: 7 December 2021
Accepted: 31 January 2022
Published: 2 February 2022