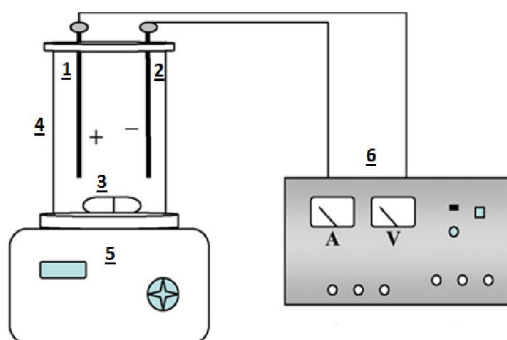


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$\bar{y} / \bar{y} /$

L
 $NaCl$
 min : V
 g/L : cm : min : V / g/L : cm
 $\bar{y} \bar{y} \bar{y}$: COD

!

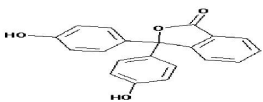
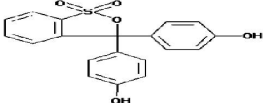


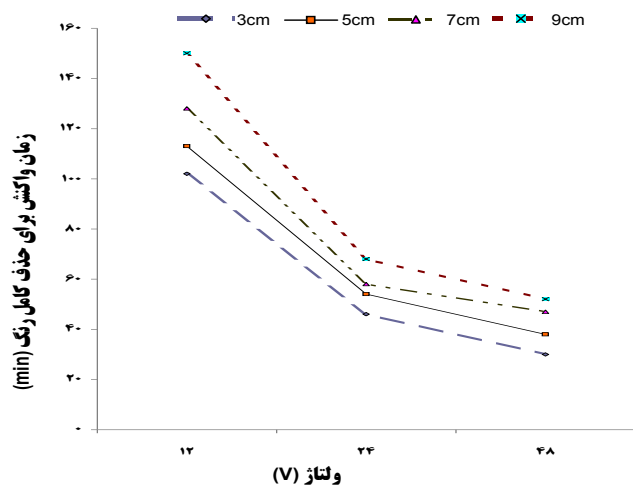
در این آزمایش، برای بررسی کارایی فرایند الکترولیز با الکترودهای مختلف، یک سلول الکتروشیمیایی طراحی شد. در این سلول، دو الکترود (1 و 2) در یک محلول (3) قرار داده شد. یک آمپرمتر (A) و یک ولتمتر (V) به الکترودها متصل شدند. یک همزن مغناطیسی (5) نیز در محلول قرار داده شد. در ادامه، با تغییر پارامترهای مختلف، کارایی فرایند الکترولیز بررسی شد.

پارامترهای مورد بررسی عبارتند از: نوع الکترود، دما، pH، غلظت محلول، و زمان الکترولیز. نتایج نشان داد که کارایی فرایند الکترولیز با تغییر پارامترها متغیر می‌گردد.

در ادامه، برای بررسی کارایی فرایند الکترولیز با الکترودهای مختلف، یک سلول الکتروشیمیایی طراحی شد. در این سلول، دو الکترود (1 و 2) در یک محلول (3) قرار داده شد. یک آمپرمتر (A) و یک ولتمتر (V) به الکترودها متصل شدند. یک همزن مغناطیسی (5) نیز در محلول قرار داده شد. در ادامه، با تغییر پارامترهای مختلف، کارایی فرایند الکترولیز بررسی شد.

پارامترهای مورد بررسی عبارتند از: نوع الکترود، دما، pH، غلظت محلول، و زمان الکترولیز. نتایج نشان داد که کارایی فرایند الکترولیز با تغییر پارامترها متغیر می‌گردد.

ماده رنگ‌زا	ساختار شیمیایی	گروه شیمیایی	ماکزیمم طول موج (nm)	وزن مولکولی (g/mol)
فنل فتالین		هیدروکسیل تری آریل متان	۵۵۲	۳۱۸/۳۲
فنل رد		تری آریل متان	۴۳۱	۳۵۴/۳۹



شکل ۱: زمان واکنش برای حذف کامل رنگ (min) در مقابل ولتاژ (V) برای فواصل الکترود ۳، ۵، ۷ و ۹ سانتی‌متر.

NaCl

pH

COD ; Corning 120

pH

Open Reflux-Colorimetric-5220B

nm

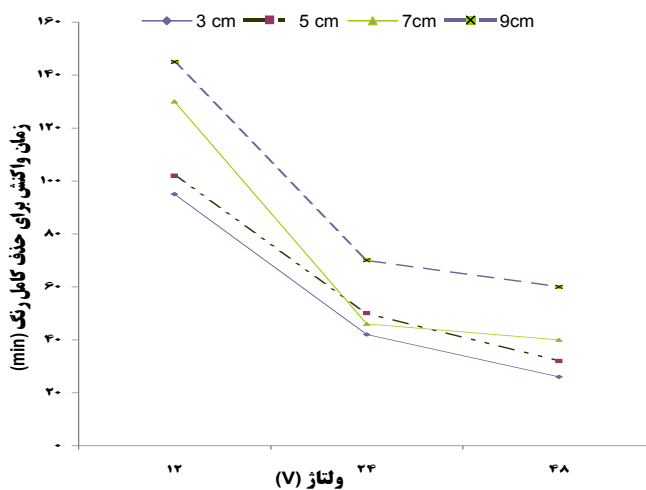
(λ_{max})

DR5000

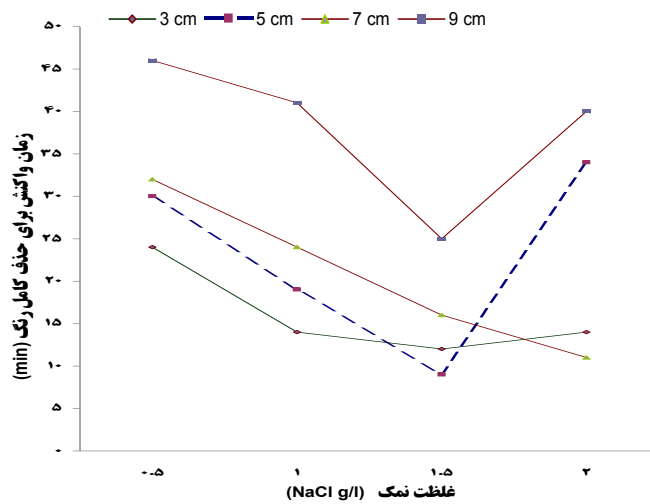
cm

SPSS (Version 18)

Excel

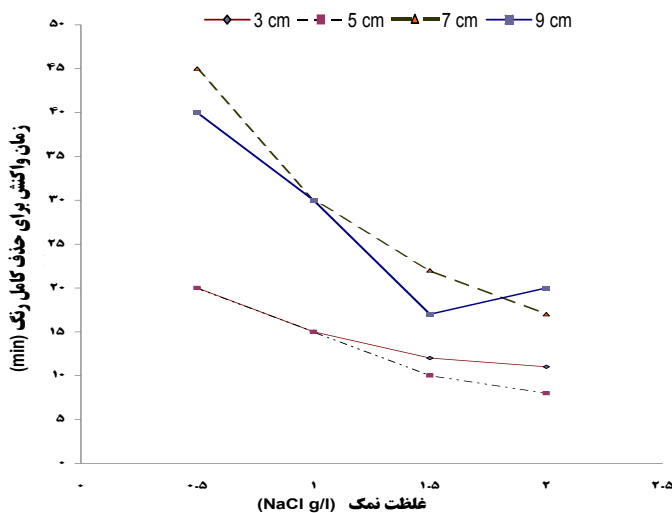


شکل ۲: زمان واکنش برای حذف کامل رنگ (min) در مقابل ولتاژ (V) برای فواصل الکترود ۳، ۵، ۷ و ۹ سانتی‌متر.



شکل ۶: تاثیر غلظت نمک NaCl بر حذف رنگ فنل فتالتین بر اساس زمان واکنش در فواصل مختلف ۳، ۵، ۷ و ۹ با ولتاژ ثابت ۷۸ v

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شکل ۷: تاثیر غلظت نمک NaCl بر حذف رنگ فنل رد بر اساس زمان واکنش در فواصل مختلف ۳، ۵، ۷ و ۹ با ولتاژ ثابت ۷۸ v

- 1- Zin, NSB. Decolorization of dye solution containing azo acid orange 7 by electricity [dissertation]. Malaysia: Faculty of Civil Engineering University Technology Malaysia; 2005:7-10.
- 2- Daneshvar N, Vatanpour V, Khataee AR, Rasoulifard MH, Rastegar M. Decolorization of mixture of dyes containing malachite green and orange II by fenton-like reagent. *Journal of Color Science and Technology*. 2008;1:83-89.
- 3- Chen X, Chen G, Yue PL. Investigation on the electrolysis voltage of electrocoagulation. *Journal of Chemical Engineering Science*. 2002;57:2449-2455.
- 4- Daneshvar N, Ashassi-Sorkhabi H, Tizpar A. Decolorization of orange II by electrocoagulation method. *Journal of Separation and Purification Technology*. 2003;31:153-62.
- 5- Dalvand A, Jonidi jafari A, Gholami M, Ameri A, Mahmoodi NM. Treatment of Synthetic Wastewater Containing Reactive Red 198 by Electrocoagulation Process. *Iranian Journal of Health and Environment*. 2011;4(1):11-22 (in Persian).
- 6- Diez MC, Mora ML, Videla S. Adsorption of phenolic compounds and color from bleached Kraft mill effluent allophonic compounds. *Journal of Water Research*. 1999;33(1):125-30.
- 7- Clark T, Bruce M, Anderson S. Decolorization of extraction stage bleach plant effluent by combined hypochlorite oxidation and anaerobic treatment. *Journal of Water Science Technology*. 1994;29(5-6):421-32.
- 8- Kobya M, Can OT, Bayramoglu M. Treatment of textile wastewaters by electrocoagulation using iron and aluminum electrodes. *Journal of Hazardous materials*. 2003;100:163-78.
- 9- Naddafi K, Nabizadeh Nodehi R, Jahangiri rad M. Removal of Reactive Blue 29 Dye from Water by Single-Wall Carbon Nanotubes. *Iranian Journal of Health and Environment*. 2011;3(4):359-68 (in Persian).
- 10- Panizza M, Bocca C, Giacomo C. Electrochemical treatment of wastewater containing polyaromatic organic pollutants. *Journal of Water Research*. 2000;34(9):2601-605.
- 11- Radha KV, Sridevi V, Kalaivani K. Electrochemical oxidation for the treatment of textile industry wastewater. *Journal of Bioresource Technology*. 2009;100:987-90.
- 12- Vlysside AG, Papaioannou D, Loizidou M, Karlis PK, Zorpas AA. Testing an electrochemical method for treatment of textile dye wastewater. *Journal of Waste Management*. 2000;20:569-57.
- 13- Zaroual Z, Azzi M, Saib N, Chaint E. Contribution to the study of electrocoagulation mechanism in basic textile effluent. *Journal of Hazardous materials*. 2005;131:73-78.
- 14- Rajeshwar K, Ibanez J G, Swain G M. Electrochemistry and environment. *Journal of applied electrochemistry*. 1994;24:1077-91.
- 15- Jia J, Yang J, Liao J, Wang W, Wang Z. Treatment of dyeing wastewater with ACF electrodes. *Journal of Water Research*. 1999;33(3):881-84.
- 16- Chandra mouli P, Venkata Mohn S, Jayarama Reedy S. Electrochemical processes for remediation of wastewater and contaminated soil: emerging technology. *Journal of Scientific & Industrial research*. 2004;63:11-19.
- 17- Daneshvar N, jafarzadeh N. Treatment of textile wastewater containing basic dyes by electrocoagulation process. *Journal of Water and wastewater*. 2009;57:22-29. (in Persian).
- 18- Ahmadi Moghadam M, Amiri H. Investigation of TOC Removal from Industrial Wastewaters using Electrocoagulation Process. *Iranian Journal of Health and Environment*. 2010;3(2):185-94 (in Persian).
- 19- Eaton, AD, Clesceri L.S, Greenberg A.E. Standard Methods for the Examination of water and wastewater. 20th ed. American public Health Association; 1998.
- 20- Ugurlu M, Karaoglu M H, Kula I. Experimental investigation of chemical oxygen demand, lignin and phenol removal from paper mill effluents using three-phase three-dimensional electrode reactor. *Journal of Environ.Stud*. 2006;15(4):647-54.

- 21- Li Xu , Wei Wang, Mingyu Wang, Yongyi Cai. Electrochemical degradation of tridecane dicarboxylic acid wastewater with tantalum-based diamond film electrode. *Journal of Desalination*. 2008;222:388–93.
- 22- Dalvand A, Gholami M, Joneidi A, Mahmoodi NM. Investigation of electrochemical coagulation process efficiency for removal of reactive red 198 from colored wastewater. *Journal of Color science and technology*. 2009; 3:97-105.(in Persian)
- 23- Malekotian M, Mansourian H J, Mousazadeh M. Performance evaluation of electrocoagulation process using rod iron electrodes for removal of hardness from drinking water. *Proceeding of the 12th national Environmental Health Conference*;2009 Nov; Iran, Kerman. (in Persian)
- 24- Sengil I A, Ozacar M. The Decolorization of C.I reactive black 5 in aqueous solution by electrocoagulation using sacrificial iron electrodes. *Journal of Hazardous Materials*.2009 ; 161: 1369-76.
- 25- Vlyssides A G, Papaioannou D, Loizidou M, Karlis P, Zorpas A A. Testing an electrochemical method for treatment of textile dye wastewater. *Journal of Waste Management*. 2000; 20: 569-74.
- 26- Mohana N, Balasubramanian N, Basha C A. Electrochemical oxidation of textile wastewater and its reuse. *Journal of Hazardous Materials*. 2007;147:644–51.

Investigation the Efficiency of Electrolysis Process using 3 Dimensional Graphite Electrodes for Decolonization of Phenolphthalein and Phenol red from Aqueous Environments

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ABSTRACT

Background and Objectives: The presence of chemical dyes in the water resources not only pollutes them, but also brings about death of organisms and serious indemnities to the environment through stopping oxygen production and preventing penetration of the sunlight. In this study, we investigated the efficiency of the electrolysis process for decolonization of phenolphthalein and phenol red from aqueous environment.

Materials and Methods: The experiments were conducted in an electrochemical reactor having a working volume of 1 liter equipped with 2 graphite electrodes. This study was conducted at laboratory scale. Samples were prepared by dissolving two phenol red and phenolphthalein dyes in drinking water. Then, the effect of operating parameters such as voltage, inter-electrode distance, and NaCl concentration on the complete dye removal was determined considering optimum retention time using Factorial variance analyses and the graphs were plotted using MS Excel software.

Results: the results showed that the optimum conditions for completely removal of phenolphthalein was achieved applying a voltage of 48 V, the retention time of 9 minutes, 5 cm inter-electrode distance, and the salt concentration of 1.5 g/l, whereas, complete removal of phenol red was achieved applying a voltage of 48 V, the retention time of 8 minutes, 5 cm inter-electrode distance, and the salt concentration of 2 g/l. Under these conditions, COD removal efficiency for phenol red and phenolphthalein was 85 and 80 percent respectively.

Conclusion: This study revealed that electrolysis process is an effective method to remove both phenolphthalein and phenol red dyes from effluent, because it can completely remove the dyes in a short time.

Keywords: Electrolysis, Decolonization, Phenolphthalein, Phenol red

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