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(TKN ،COD ،BOD5)

mg/L

TSS

min

(PAC)

BOD5, COD

(mg/L)

TSS, TKN

mg/L

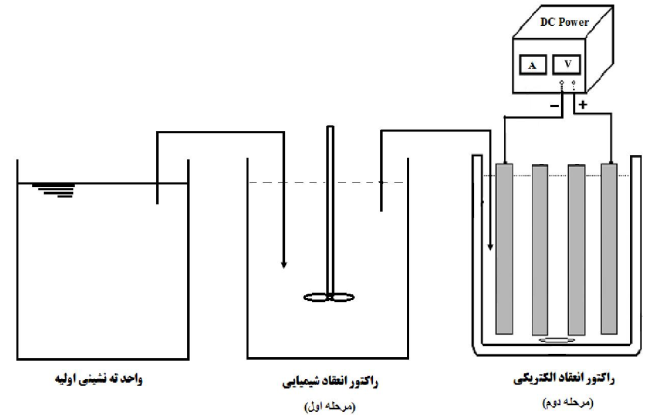
BOD5, COD, TSS, TKN

[illegible] (BOD$_5$) [illegible] (COD) [illegible]

[illegible] (Dissolved Air Flotation :DAF) [illegible] (Total Suspended Solids: TSS) [illegible]

[illegible] (COD) [illegible] (PAC) [illegible]

[illegible] $Al(OH)_3$ [illegible] pH [illegible] (PAC) [illegible]



ǫŀY ǿĶūƷĶǇŧŧ ƙÊlǰĶǝ ǴǿÅdžơ ƷY ǿYĶÅǇƽŀ YƷǸǭ ÆŨǻƩǇŨŀ YĶǻūŀ Ü ÆǻĶǿƷǿǁ YĶǻūŀ ƷǸǇŧŀƷ ŦǿĶƷǁ ţƩǍ : ĤǨŨǁ

ǴĶ Ƙǵ ǀ ǻĶǭƩƋ .Уǁ ǴǁƽĶƮǭ YǸƩǸǭ ÆǈƩƪơ ǌǈƿƷ ǴĶ ǴƩǸơ ĶǶ ŦƷŧ ĶĶ ǵǿYǩǿYǩ ÆǭĶƷơ ƿ ƠƋƩǻžǫĶƪǁ ƷŀƩŨơ ƷĶĶ Ǵƽ ƟƷǸDž ǿУǁ ǿYǩY ǀ ǻĶƷ ǰǿŬǁĶǭ ƟƷǸDž ǴĶ ƿ ǥƿŀУƩ ƿ ǨǵƷŀYǸƷǁ ƟǁƽĶƮǭ ƠǁƩ Excel Ʒŀƻŀ ǫƩǁ ƩŀYǸǁÆǭ ƷĶŧǁ ƩǍĶƮ .Ơƽŀ .УǻYƩū ǿYĶÅǇƽŀ ĶǵǿYǩY ǨǿǫƮơ ƿ ǴǻƺƪơƿÅƷĶǭƋ.

ĶǵǀǻĶǭƩƋ

ƩYĶǭ ǻĶǵǿУǁǻȅƋ ,BOD$_5$,COD ǻĶǻǵǿĶ ƠǻŀǥǾ ¡BOD$_5$ ¡ÆŨǻƩǇŨŀ ƠǻŀǥǾ ¡pH ƷţƿƩǿǁ Ƙŧ ¡(TSS) ÅǇūǭ ƟŀǥǭĶƩ Ƙŧ ¡(TS) ƟŀǥǭĶƩ Ƙŧ (TKN) ǥŀǫǇţ ǿŀƽƷŀǁĶǇƽŀ ƿƿƷ Ķǃ ÅǃĶǍǭ .(Ĥī)Уǁ ǰǿǿūơ

ǿĶŬǇƽY ĶǃǬǿÆǇƽǭ ǀ ǁǁƝǸƠ ƿ COD ƷǸǇŧŀƷ ƩŀǿYĶÅǇƽŀ ĶǃCOD ƩĶǿǁǁ YƷǸǭ ǩǮǿƽŧŀ ƿ (DR/5000, HACH, USA)ƩǇǭǸǇƿƩǇŨŚƽŀ ĶǃĶ (Ŧ ǻƩǇǭǸǁĶǭ) Æǀ ǃƽƷĶŧǝ ƿƿƷ ǴĶ (BOD$_5$) ǿƩƿƷ ƨǃǩ ÆǻĶǿƷǿǁǸǿĶ BSB-Controller Model 620 T)) ƷǨǿƽŧ ÙƩdžǭ ƷŀƷǿǭ ǀ ǃƽ ƩŀǿYĶÅǇƽŀ ĶǃĶ ÆŨǻƩǇŨŀ ƠǻŀǥǾ ƿ pH .Уǁ ǻƩǿūǿƩŀУǁ ((WTW (Metrohm Herisau, Switzerland) E520 ǥǿǭ ƩǇǭ pH .Уǁ ǻƩǿūǿƩŀУǁ CONSORT C 831 ǥǿǭ ƨǃƽƠǻŀǥǾ ƿ ĤǏ ƩǿƷƲơ ƿƿƷ ĶĶ (MPN) YŀǥǿŨơ ǰǻƩơǨƷǇƮǭ ƿƿƷ ǰǿǃšǬǥ ǫƩÅǿǭŧ ƿ (TC) Ƙŧ ǫƩÅǿǭŧ ǻĶǥǻƩǇŧĶ ƿƷǨƷǁ ǻŀƩĶ ǻŀ ǴǻǸĶ .(Ĥī)Уǁ ƷŀƩǻ ǿYĶÅǇƽŀ YƷǸǭ (FC) ÆŨǸǝǿǭ.

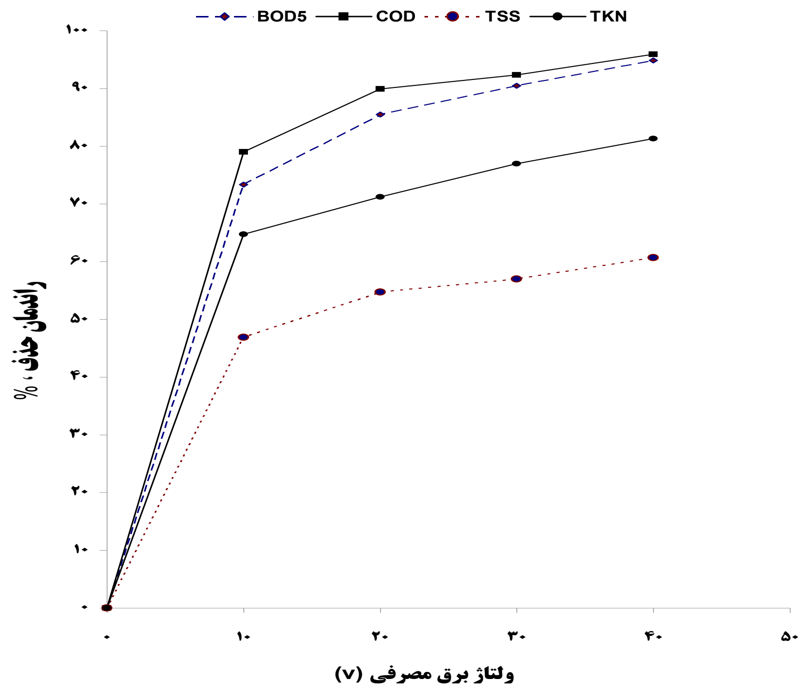
ǴūǀĶǍǭ YƷǸǭ ǿĶūƷĶǇŧŧ ǫĶƮ ƙÊlǰĶǝ ƟĶdžǙŧǭ :Ĥ ǥƿУƩ

پارامتر	فاضلاب خام (انحراف معیار ± میانگین)	فاضلاب ته نشین شده (پس از ۲۴ ساعت)	استاندارد ایران
تعداد نمونه‌ها	۴۸	۴۸	--
pH	۷/۳۱ ± ۰/۱۲	۷/۴۴ ± ۰/۱۶	۶/۵–۸/۵
COD (mg/L)	۵۸۱۷ ± ۴۷۳	۴۱۵۹ ± ۲۸۱	۶۰
BOD_5 (mg/L)	۲۵۴۳ ± ۳۶۲	۲۲۰۴ ± ۱۷۷	۳۰
TSS (mg/L)	۳۲۴۷ ± ۸۴۵	۱۱۷۲ ± ۸۴	۶۰
TKN (mg/L)	۱۳۷ ± ۱۲	۹۲ ± ۱۲	--
چربی، روغن و گریس(mg/L)	۳۴ ± ۹	۳۲ ± ۷	۱۰
هدایت الکتریکی (µs/cm)	۹۱۴۰ ± ۱۵۱۲	۹۰۶۱ ± ۱۴۰۰	--
کلیفرم کل (تعداد در ۱۰۰ mL)	$۲/۸ \times ۱۰^{۹}$	$۲/۳ \times ۱۰^{۹}$	۱۰۰۰
کلیفرم مدفوعی (تعداد در ۱۰۰ mL)	$۱/۹ \times ۱۰^{۸}$	$۱/۷ \times ۱۰^{۸}$	۴۰۰

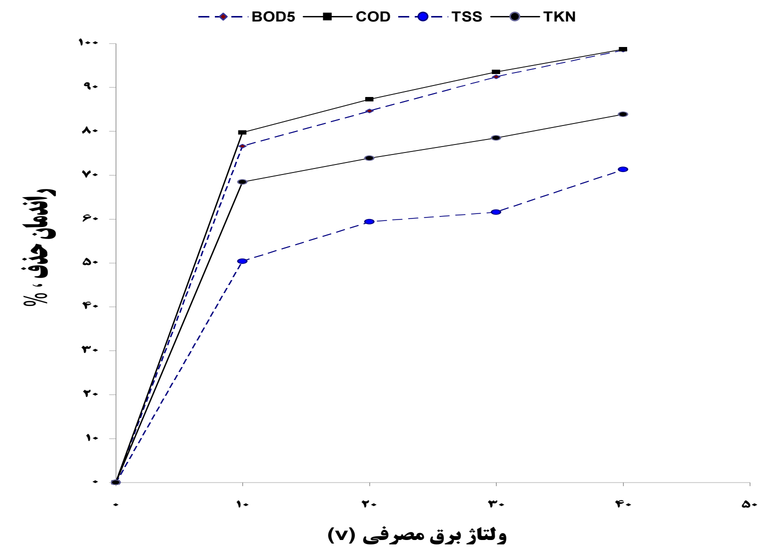
[illegible]

مقدار PAC (mg/L)	درصد حذف آلاینده ها توسط فرایند انعقاد شیمیایی: BOD_5	COD	TSS	TKN	کلیفرم مدفوعی
۲۵	۲۹/۸۱	۳۶/۸۴	۴۵/۴۷	۲۶/۴۰	۹۹/۸۲
۵۰	۳۵/۵۷	۴۶/۷۵	۵۱/۷۸	۳۱/۳۰	۹۹/۸۴
۷۵	۴۰/۵۱	۵۱/۱۴	۵۶/۵۴	۳۵/۱۳	۹۹/۸۷
۱۰۰	۴۵/۸۶	۵۸/۶۶	۶۲/۸۰	۴۱/۲۶	۹۹/۸۷

[illegible]

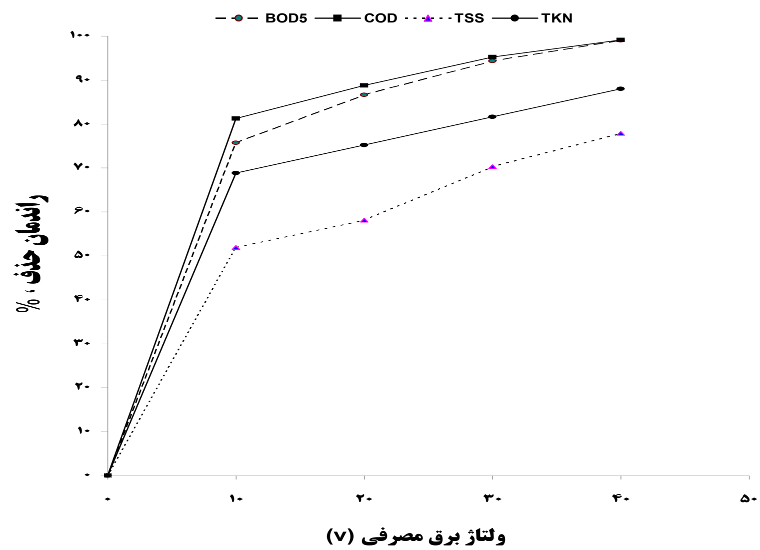


[illegible] mg/L [illegible] min [illegible] (pH= [illegible])

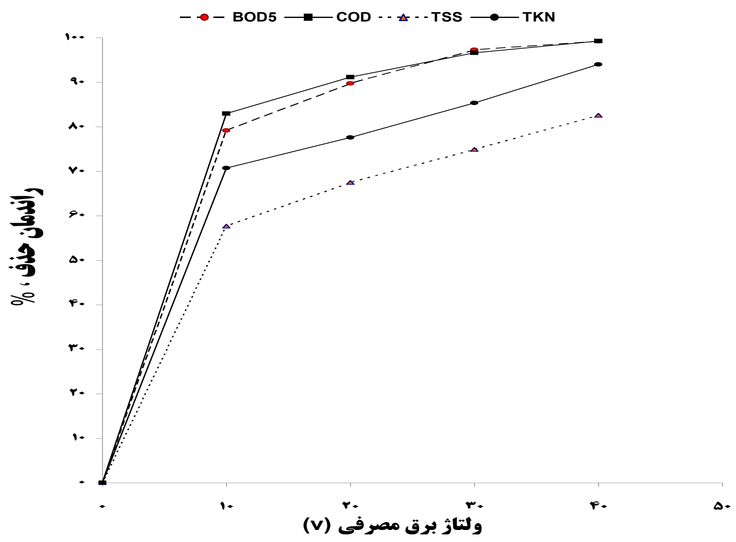


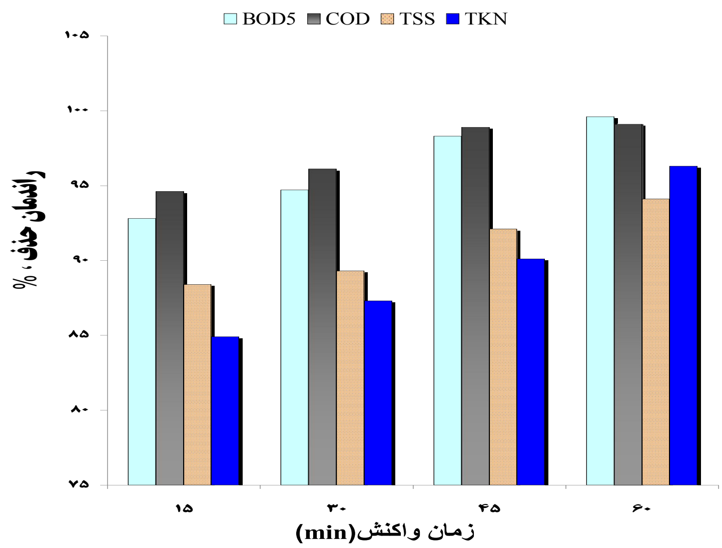
(pH= [illegible] min [illegible] mg/L [illegible]) [illegible]

[illegible]



(pH= [illegible] min [illegible] mg/L [illegible]) [illegible]


BOD5
COD
TSS
TKN
راندمان حذف، %
ولتاژ برق مصرفی (V)


BOD5
COD
TSS
TKN
راندمان حذف، %
زمان واکنش(min)

[illegible]

[illegible]

ولتاژ (v)	غلظت پلی آلومینیوم کلراید (mg/L)			
	۲۵	۵۰	۷۵	۱۰۰
۱۰	۰/۸	۰/۹	۰/۸	۱/۰
۲۰	۱/۴	۱/۳	۱/۴	۱/۶
۳۰	۲/۰	۲/۱	۲/۱	۲/۲
۴۰	۲/۵	۲/۵	۲/۶	۲/۶

ولتاژ (v)	غلظت پلی آلومینیوم کلراید (mg/L)			
	۲۵	۵۰	۷۵	۱۰۰
۱۰	۰/۰۰۹۷	۰/۰۱۰۳	۰/۰۱۰۸	۰/۰۱۱۲
۲۰	۰/۰۲۵۳	۰/۰۲۷۰	۰/۰۲۸۱	۰/۰۲۹۷
۳۰	۰/۰۴۹۵	۰/۰۵۲۴	۰/۰۵۵۰	۰/۰۵۷۰
۴۰	۰/۰۷۹۷	۰/۰۸۴۹	۰/۰۸۸۰	۰/۰۹۱۸

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1. Asselin M, Drogui P, Benmoussa H, Blais JF. Effectiveness of electrocoagulation process in removing organic compounds from slaughterhouse wastewater using monopolar and bipolar electrolytic cells. Chemosphere. 2008;72:1727-33.
2. Tezcan UU, Altay U, Koparal AS, Ogutveren BU. Complete treatment of olive mill wastewaters by electrooxidation. Chemical Engineering Journal. 2008;139:445-52.
3. Alvarez R, Liden G. Semi-continuous co-digestion of solid slaughterhouse waste, manure, and fruit and vegetable waste. Renewable Energy. 2008;33:726-34.
4. Masse L, Masse DI. Effect of soluble organic, particulate organic and hydraulic shock loads on anaerobic sequencing batch reactors treating slaughterhouse wastewater at 20°C. Process Biochemistry. 2005;40(3-4):1225-32.
5. Torkian A, Eqbali A, Hashemian SJ. The effect of organic loading rate on the performance of UASB reactor treating slaughterhouse effluent. Resources, Conservation and Recycling. 2003;40(1):1–11.
6. Manjunath NT, Mehrotra I, Mathur RP. Treatment of wastewater from slaughterhouse by DAF-UASB system. Water Research. 2000;34(6):1930-36.
7. Palatsi J, Vinas M, Guivernau M, Fernandez B, Flotats X. Anaerobic digestion of slaughterhouse waste: Main process limitations and microbial community interactions. Bioresource Technology. 2011;102:2219-27.
8. Tezcan UU, Koparal AS, Ogutveren BU. Hybrid processes for the treatment of cattle-slaughterhouse wastewater using aluminum and iron electrodes. Journal of Hazardous Materials. 2009;164:580-86.
9. Cuetos MJ, Gomez X, Otero M, Moran A. Anaerobic digestion of solid slaughterhouse waste (SHW) at laboratory scale: Influence of co-digestion with the organic fraction of municipal solid waste (OFMSW). Biochemical Engineering Journal. 2008;40:99–106.
10. Al-Mutairi NZ, Hamoda MF, Al-Ghusain I. Coagulant selection and sludge conditioning in a slaughterhouse wastewater treatment plant. Bioresource Technology. 2004;95:115-19.

11. Amuda OS, Alade A. Coagulation/flocculation process in the treatment of abattoir wastewater. Desalination. 2006;196:22-31.
12. Hua Ch, Liu H, Qua J. Preparation and characterization of poly aluminum chloride containing high content of Al13 and active chlorine. Colloids and Surfaces A: Physicochemical and Engineering Aspects. 2005;260:109-17.
13. Yan M, Wang D, Yu J, Ni J, Edwards M, Qu J. Enhanced coagulation with poly aluminum chlorides: Role of pH/Alkalinity and speciation. Chemosphere. 2008;71:1665-73.
14. Bayramoglu M, Kobya M, Eyvaz M, Senturk E. Technical and economic analysis of electrocoagulation for the treatment of poultry slaughterhouse wastewater. Separation and Purification Technology. 2006;51:404-408.
15. Bazrafshan E, Mahvi AH, Naseri S, Mesdaghinia AR. Performance evaluation of electrocoagulation process for removal of chromium (VI) from synthetic chromium solutions using iron and aluminum electrodes. Turkish Journal Engineering Environmental Science. 2008;32(2):59-66.
16. Bazrafshan E, Mahvi AH, Naseri S, Shaighi M. Performance evaluation of electrocoagulation process for Diazinon removal from aqueous environment by using iron electrodes. Iranian Journal of Environmental Health Science & Engineering. 2007;2(4):127-32.
17. Nouri J, Mahvi AH, Bazrafshan E. Application of Electrocoagulation Process in Removal of Zinc and Copper from Aqueous Solutions by Aluminum Electrodes. International Journal of Environmental Research. 2010;4(2):201-208.
18. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 19th ed. Washington DC: APHA; 1995.
19. Yilmaz AE, Boncukcuoglu R, Kocakerim MM. A quantitative comparison between electrocoagulation and chemical coagulation for boron removal from boron-containing solution. Journal of Hazardous Materials. 2007;149(2):475-81.
20. Bagga A, Chellam Sh, Clifford DA. Evaluation of iron chemical coagulation and electrocoagulation pretreatment for surface water microfiltration. Journal of Membrane Science. 2008;309(1-2):82–93.
21. Chaudhary A, Goswami N, Grimes S. Electrolytic removal of hexavalent chromium from aqueous solutions. Journal Chemical Technology and Biotechnology. 2003;78:877-83.
22. Wang CT, Chou WL, Kuo YM. Removal of COD from laundry wastewater by electrocoagulation/electroflotation. Journal of Hazardous Materials. 2009;164(1):81–86.
23. Letterman R, Amirtharajah A, O'Melia C. Water Quality and Treatment: A Handbook of Community Water Supplies. 5th ed. New York: McGraw-Hill; 1999.
24. Holt PK, Barton GW, Wark M, Mitchell CA. A quantitative comparison between chemical dosing and electrocoagulation. Colloids and Surfaces A: Physicochemical and Engineering Aspects. 2002;211(2-3):233-48.
25. Khosla NK, Venkatachalam S, Somasundaram P. Pulsed electrogeneration of bubbles for electroflotation. Journal of Applied Electrochemistry. 1991;21(11):986-90.
26. Akbal F, Camci S. Copper, chromium and nickel removal from metal plating wastewater by electrocoagulation. Desalination. 2011;269(1-3):214-22.

Application of Combined Chemical Coagulation-Electro Coagulation Process for Treatment of the Zahedan Cattle Slaughterhouse Wastewater

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ABSTRACT

Background and Objectives: Slaughterhouse wastewater contains various and high amounts of organic matter (e.g., proteins, blood, fat, and lard). In order to produce an effluent suitable for stream discharge, chemical coagulation and electrocoagulation techniques have been particularly explored at the laboratory pilot scale for organic compounds removal from slaughterhouse effluent. The purpose of this work was to investigate the feasibility of treating cattle-slaughterhouse wastewater by combined chemical coagulation and electrocoagulation process to achieve the required standards.
Materials and Methods: At present study, slaughterhouse wastewater after initial analysis was tested for survey of coagulation process using Poly aluminum chloride (PAC) at various doses (25-100 mg/L). Then we measured the concentrations of wastewater pollutants (BOD_5, COD, TKN, TSS and fecal Coliforms). Later, we transferred the effluent to the electrocoagulation unit and we evaluated the removal efficiency of pollutants in the range 10 to 40 volts of electric potential during 60 min.
Results: It was found that the efficiency of chemical coagulation process using poly-aluminum chloride (PAC) as coagulant increases with increasing doses (from 25 to 100 mg/L); we achieved maximum removal efficiency during the chemical coagulation for parameters of BOD5, COD, TSS, and TKN at 100 mg/L of PAC equivalent to 44.78%, 58.52%, 59.9%, and 39.58% respectively. Moreover, the results showed that with increasing the electric potential and reaction time, the yield increases linearly so that maximum removal efficiency at a dose of 100 mg/L PAC, an electrical potential of 40 volts and a reaction time of 60 minutes for the parameters BOD_5, COD, TSS, and TKN was 99.18% 99.25%, 82.55%, and 93.97% respectively.
Conclusion: The experiments demonstrated the effectiveness of combined chemical coagulation and electrocoagulation processes for pollutants removal from the slaughterhouse wastewaters. Consequently, this combined process can produce effluent compliance with the effluent discharge standards.

Keywords: Chemical coagulation, Electro coagulation, Slaughterhouse wastewater treatment

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