催化学报 » 2011, Vol. 32 » Issue (11) :1685-1692 DOI: 10.1016/S1872-2067(10)60268-9

研究论文

Sensitive Voltammetric Determination of Captopril Using a Carbon Paste Electrode Modified with Nano-TiO2/Ferrocene Carboxylic Acid

Jahan Bakhsh RAOOF*, Reza OJANI, Mehdi BAGHAYERI

Electroanalytical Chemistry Research Laboratory, Department of Analytical Chemistry, Faculty of Chemistry, Mazandaran University, Babolsar 47416-95447, Iran

Jahan Bakhsh RAOOF*, Reza OJANI, Mehdi BAGHAYERI

Electroanalytical Chemistry Research Laboratory, Department of Analytical Chemistry, Faculty of Chemistry, Mazandaran University, Babolsar 47416-95447, Iran

摘要 A carbon paste electrode (CPE) modified with ferrocene carboxylic acid (FcCA) and TiO_2 nanoparticles was constructed by incorporating TiO_2 nanoparticles and ferrocene carboxylic acid into the carbon paste matrix. The electrochemical behavior of captopril (CAP) at the surface of the modified electrode was investigated using electroanalytical methods. The modified electrode showed excellent electrocatalytic activity for the oxidation of CAP in aqueous solutions at physiological pH values. Cyclic voltammetric curves showed that the oxidation of CAP at the surface of the modified electrode reduced its overpotential by more than 290 mV. The modified electrode was used for detecting captopril using cyclic voltammetry and square wave voltammetry techniques. A calibration curve in the range of 0.03 to 2400 μmol/L was obtained that had a detection limit of 0.0096 μmol/L (3s) under the optimized conditions. The modified electrode was successfully used for the determination of captopril in pharmaceutical and biological samples.

关键词： electrocatalysis modified electrode nano-TiO2 ferrocene carboxylic acid captopril cyclic voltammetry

Abstract: A carbon paste electrode (CPE) modified with ferrocene carboxylic acid (FcCA) and TiO_2 nanoparticles was constructed by incorporating TiO_2 nanoparticles and ferrocene carboxylic acid into the carbon paste matrix. The electrochemical behavior of captopril (CAP) at the surface of the modified electrode was investigated using electroanalytical methods. The modified electrode showed excellent electrocatalytic activity for the oxidation of CAP in aqueous solutions at physiological pH values. Cyclic voltammetric curves showed that the oxidation of CAP at the surface of the modified electrode reduced its overpotential by more than 290 mV. The modified electrode was used for detecting captopril using cyclic voltammetry and square wave voltammetry techniques. A calibration curve in the range of 0.03 to 2400 μmol/L was obtained that had a detection limit of 0.0096 μmol/L (3s) under the optimized conditions. The modified electrode was successfully used for the determination of captopril in pharmaceutical and biological samples.

Keywords: electrocatalysis, modified electrode, nano-TiO2, ferrocene carboxylic acid captopril, cyclic voltammetry

收稿日期: 2011-06-07; 出版日期: 2011-10-08

引用本文:

Jahan Bakhsh RAOOF, Reza OJANI, Mehdi BAGHAYERI .Sensitive Voltammetric Determination of Captopril Using a Carbon Paste Electrode Modified with Nano-TiO2/Ferrocene Carboxylic Acid[J] 催化学报, 2011,V32(11): 1685-1692

Jahan Bakhsh RAOOF, Reza OJANI, Mehdi BAGHAYERI .Sensitive Voltammetric Determination of Captopril Using a Carbon Paste Electrode Modified with Nano-TiO2/Ferrocene Carboxylic Acid[J] Chinese Journal of Catalysis, 2011,V32(11): 1685-1692

链接本文:

http://www.chxb.cn/CN/10.1016/S1872-2067(10)60268-9 或 http://www.chxb.cn/CN/Y2011/V32/I11/1685

[1] ushman D W, Cheung H S, Sabo E F, Ondetti M A. Bio-chemistry, 1978, 16: 5484

[2] lein J, Colin P, Scherer E, Levy M, Koren G. Ther Drug Monit, 1990, 12: 105

[3] uchin K L, McKinstry D N, Cohen A L, Migdalof B H. Clin Pharmacokinet, 1988, 14: 241

[4] oyer J, Liu R H. Nutrition, 2004, 3: 1

[5] emirkol O, Adams C, Ercal N. J Agr Food Chem, 2004, 52: 8151

[6] rakawa M, Ushimaru N, Osada N, Oda T, Ishige K, Ito Y. Neurosci Res, 2006, 55: 255
[7] ang Y Z, Yang S, Wu G. Nutrition, 2002, 18: 872
[8] hang X R, Baeyens W R G, Van der Weken G, Calokerinos A C, Nakashima K. Anal Chim Acta, 1995, 303: 121
[9] inrong Z, Baeyens W R G, Van der Weken G, Calokerinos A C, Nakashima K. J Pharm Biomed Anal, 1995, 13: 425
[10] Sastry C S P, Srinivas K R, Prasad K M M K. Anal Lett, 1996, 29: 1329
[11] Askal H F. Talanta, 1991, 38: 1155
[12] El-ashry S M, Ibrahim F A. Anal Lett, 1992, 25: 1657
[13] Panderi I, Parissi-poulou M. Int J Pharm, 1992, 86: 99
[14] Emara K M, Mohamed A M I, Askal H F, Darwish I A. Anal Lett, 1993, 26: 2385
[15] Sastry C S P, Rao S G, Naidu P Y, Srinivas K R. Anal Lett, 1998, 31: 263
[16] Squella J A, Lemus I, Borges Y, Nevgara-Vergara I J. Bol Soc Chilena Quim, 1992, 37: 259
[17] de Oliveira I R W Z, Vieira I C. Enzyme Microbiol Technol, 2006, 38: 449
[18] de Oliveira I R W Z, Fernandes S C, Vieira I C. J Pharm Biomed Anal, 2007, 40: 661
[19] de Oliveira I R W Z, Os´orio R E-H M B, Neves A, Vieira I C. Sensor Actuat B, 2007, 122: 89
[20] Stefan R I, van Staden J F, Aboul-Enein H Y. Talanta, 2000, 51: 969
[21] Wakabayashi H, Yamato S, Nakajima M, Shimada K. J Pharm Biomed Anal, 1994, 12: 1147
[22] Siangproh W, Ngamukot P, Chailapakul O. Sensor Actuat B, 2003, 91: 60
[23] Ghicov A, Macak J M, Tsuchiya H, Kunze J, Haeublein V, Frey L, Schmuki P. Nano Lett, 2006, 6: 1080
[24] Wang L, Bai J, Huang P, Wang H, Zhang L, Zhao Y. Electro-chem Commun, 2006, 8: 1035
[25] Navio J A, Cerrillos C, Pradera M A, Morales E, Gomez-Ariza J L. Langmuir, 1998, 14: 388
[26] Ranjit K T, Willner I. J Phys Chem B, 1998, 102: 9397
[27] Chang C P, Chen J N, Lu M C, Yang H Y. Chemosphere, 2005, 58: 1071
[28] Kim S B, Hong S C. Appl Catal B, 2002, 35: 305
[29] O’ Regan B, Gratzel M. Nature, 1991, 353: 737
[30] Macak J M, Barczuk P J, Tsuchiya H, Nowakowska M Z, Ghicov A, Chojak M, Bauer S, Virtanen S, Kulesza P J, Schmuki P. Electrochem Commun, 2005, 7: 1417
[31] Raoof J B, Ojani R, Baghayeri M. Sensor Actuat B, 2009, 143: 261
[32] Bard A J, Faulkner L R. Electrochemical Methods, Funda-mentals and Applications. New York: Wiley, 2001
[33] Dong S J, Che LG, Xie Y W. Chemical Modified Electrode. Beijing: Science Press, 2003
[34] Raoof J B, Ojani R, Chekin F. Electroanalysis, 2007, 19: 1883
[35] Raoof J B, Ojani R, Kolbadinezhad M. J Solid State Electro-chem, 2009, 13: 1411
[36] Raoof J B, Ojani R, Chekin F. J Chem Sci, 2009, 121: 1083
[37] Raoof J B, Ojani R, Kiani A. J Electroanal Chem, 2001, 515: 45
[38] Zhou M, Ding J, Guo L, Shang Q. Anal Chem, 2007, 79: 5328
[39] Beitollahi H, Raoof J B, Hosseinzadeh R. Electroanalysis, 2011, 23: 1934
[40] Pournaghi-Azar M H, Razmi-Nerbin H. J Electroanal Chem, 2000, 488: 17
[41] Kuo K N, Murray R W. J Electroanal Chem, 1982, 131: 37
[42] Galus Z. Fundamentals of Electrochemical Analysis. New York: Ellis Horwood, 1976
[43] Wang J. Analytical Electrochemistry. 2nd Ed. New York: Wiley, 2000
[44] Vaughan N P, Milligan B D, Ogden T L. Analyst, 1987, 112: 199
[45] Shahrokhian S, Karimi M, Khajehsharifi H. Sensor Actuat B, 2005, 109: 278
[46] Rezaei B, Damiri S. Sensor Actuat B, 2008, 134: 324
[47] Karimi-Maleh H, Ensafi A A, Allafchian A R. J Solid State Chem, 2010, 14: 9

[1] M. JAFARIAN;*;F. GOBAL;M. G. MAHJANI;M. HOSSEINI ALIABADI.碱性溶液中分子氧在多晶银上的多步还原[J]. 催化学报, 2010,31(5): 541-546