CDKZM
CRNOGORSKO DRUŠTVO ZA KOROZIJU, ZAŠTITU MATERIJALA I ZAŠTITU ŽIVOTNE SREDINE

INŽENJERSKA KOMORA CRNE GORE
ENGINEERS CHAMBER OF MONTENEGRO

ČETVRTI MEĐUNARODNI SIMPOZIJUM O KOROZIJI I ZAŠTITI MATERIJALA, ŽIVOTNOJ SREDINI I ZAŠTITI OD POŽARA

FOURTH INTERNATIONAL SYMPOSIUM ON CORROSION AND MATERIALS PROTECTION, ENVIRONMENTAL PROTECTION AND PROTECTION AGAINST FIRE

KNJIGA RADOVA
PROCEEDINGS

BAR, 18-21. septembar 2018. godine


CDKZM
CRNOGORSKO DRUŠTVO ZA KOROZIJU, ZAŠTITU MATERIJALA I ZAŠTITU ŽIVOTNE SREDINE


ECE

ČETVRTI MEĐUNARODNI SIMPOZIJUM
O KOROZIJI I ZAŠTITI MATERIJALA,
ŽIVOTNOJ SREDINI I ZAŠTITI OD POŽARA

KNJIGA RADOVA

Izdavač:
CRNOGORSKO DRUŠTVO ZA KOROZIJU,
ZAŠTITU MATERIJALA I ZAŠTITU ŽIVOTNE SREDINE

Štampa:
Grafički studio Krug, Bar

Bar, septembar 2018.

Каталогизација у публикацији
Национална библиотека Црне Горе, Цетиње

ISBN 978-9940-9334-3-2
COBISS.CG-ID 36491280

ISBN 978-9940-9334-3-2
9 789940 933432 >

Elektrohemijska degradacija esomeprazola na različitim elektrodama u cilju zaštite životne sredine

Electrochemical degradation of esomeprasole on different electrodes in a sense of environment protection

M. Avramov Ivić[1], J. Lović[1], J. Ladjarević[2], D. Mijin[2], S. Stevanović[1], N.Nikolić[1], D. Vuković[3], S.Petrović[2]

[1]ICTM, Department of Electrochemistry,University of Belgrade, Njegoševa 12, Belgrade, [2]Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia, [3]Faculty of Medicine, Dr. Subotica 8 University of Belgrade, Belgrade, Serbia.

Abstract

Esomeprazole has been shown to be the most effective oral PPI for controlling intragastric pH. The persistence of esomeprasole in environmental systems could be solved by different types of its degradation. In this work electrocatalytic degradation of esomeprasole has been investigated in the presence of sodium sulfate and sodium chloride using IrOx electrode and was monitored using UV-Vis spectrophotometer at 303 nm. Also the electro degradation process was examined and on Au electrode. NanoScope III A (Veeco, USA) microscope was used to study the morphology of Esomeprazole on the gold surface by atomic force microscopy. By optical microscopy the morphology of Esomeprazole dissolved in human serum on the gold surface was studied as well.

Keywords: esomeprasole degradation , IrOx electrode ,AFM , OM

Izvod

Ezomeprazol je poznat kao najefikasniji lek , tj. inhibitor protonske pumpe u kontroli intragastricne vrednosti pH. Njegovo prisustvo u vodenim tokovima i zemljištu se resava osmišljavanjem novih postupaka degradacije. U ovom radu elektrokatalitička degradacija ezomeprazola je proučavana u natrijum sulfatu i natrijum hloridu na IrOx elektrodi. Reakcija je praćena korišćenjem UV-Vis spektrofotometra na 303 nm. Takođe je proučavana degradacija ezomeprazola na elektrodi od zlata. NanoScope III A (Veeco, USA) mikroskop je korišćen u proučavanju morfologije ezomeprazola na površini eelektrode od zlata mikroskopijom međuatomskih sila. Optičkom mikroskopijom je ispitivana morfologija ezomeprazola na površini eelektrode od zlata u prisustvu humanog seruma.

Ključne reči: esomeprasole degradacija,, IrOx electrode, AFM , OM

Introduction

The most effective treatment for gastro-oesophageal reflux disease is acid suppressive therapy with proton pump inhibitors The degree of erosive oesophagitis and symptom severity are both related to the amount of time that the intraoesophageal pH is below 4. Esomeprazole has been shown to be the most effective oral PPI for controlling intragastric pH. Less is known, however, about the effectiveness of esomeprazole administered intravenously [1,2].
The subject of this study is esomeprazole administered intravenously and its electrochemical degradation in order of environment protection.

Experimental

Esomeprasole infusion standard, was kindly provided from Hemofarm Stada A.D. (Vršac, Serbia). All chemicals used were of p.a. grade. The degradation was performed under galvanostatic conditions in a cylindrical glass electrochemical cell. The dimensionally stable anode (DSA), IrOx (5 cm^2) was used as anode. A cathode was 10 cm^2 plate made from austenite 18Cr/8Ni stainless steel series 304.The electrodegradation measurements were performed also by CV method using gold electrode in 0.05M$NaHCO_3$..
NanoScope III A (Veeco, USA) microscope was used to study the morphology of Esomeprazole on the gold surface by atomic force microscopy, which operated in contact mode under ambient conditions. Silicon nitride probes were used. The surface characterization was also performed using optical microscope (Olympus CX41) connected to the computer.

Results

Electrocatalytic degradation of esomeprasole has been investigated in the presence of sodium sulfate and sodium chloride using IrOx electrode. The reaction was monitored using UV-Vis spectrophotometer at 303 nm. The conditions (electrolyte concentration, esomeprazole concentration, agitation speed and current) were optimized and the degradation of the molecule under the optimal conditions is presented on the Figs. 1 and 2.

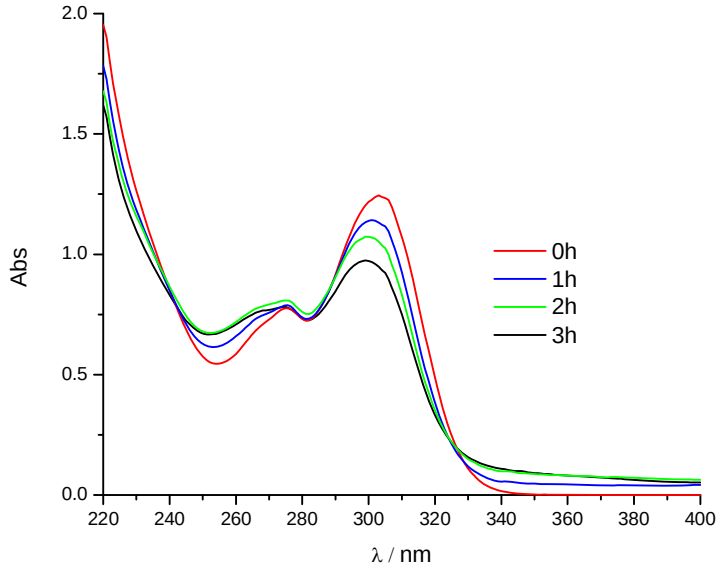


Figure1. Degradation of esomperasole using sodium sulfate. Conditions: c (esomeprasole) = 40 mg dm^{-3}, c(Na_2SO_4) = 2 g dm^{-3}, ω = 500 rpm, I = 250 mA.

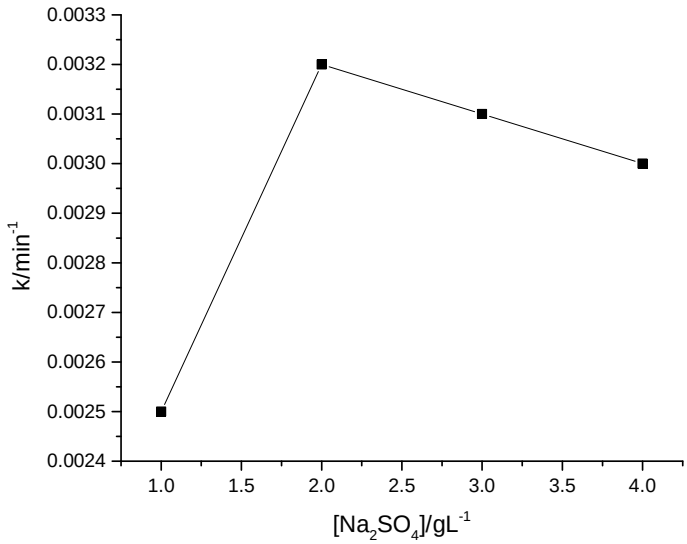


Fig. 2. The influence of sodium sulphate initial concentration on the degradation rate of esomeprazole [c(esomeprazole) = 40 mg dm^{-3}, I = 250 mA, ω = 500 rpm].

In Fig 3 it is presented electrochemical activity of esomeprasol on gold electrode, during three hours this activity is twenty times lower according to its degradation.

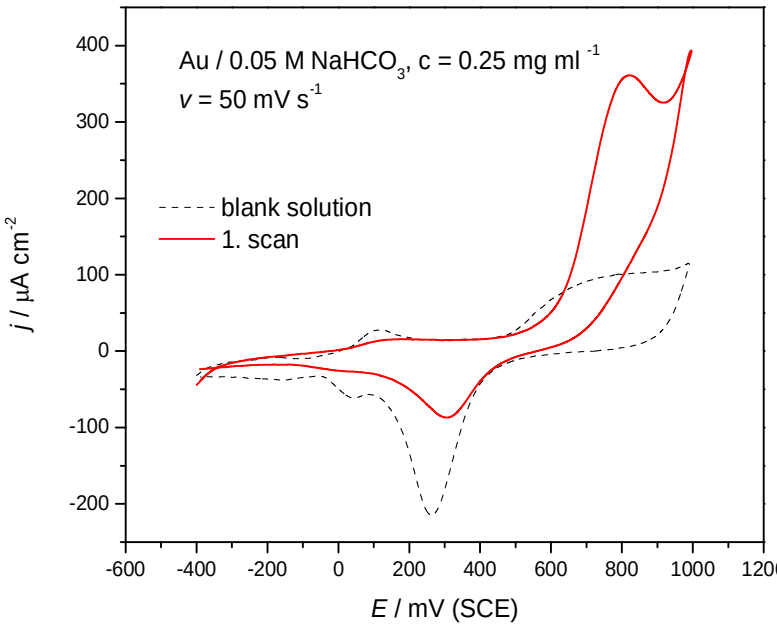
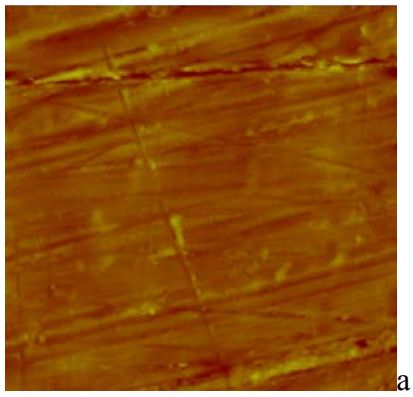


Fig. 3. CV of the Au electrode (dot line) and in the solution of esomeprasol standard c = 0.25 mg ml^{-1} (solid line) in 0.05 M $NaHCO_3$, v = 50 mV s^{-1}.


a

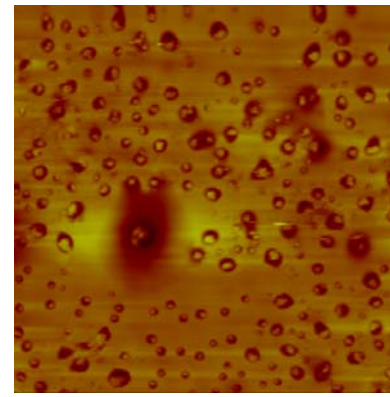

b

Fig 4. AFM images of a)polished Au surface (20 x 20 x 0.8 μm) and b)deposited esomeprasole on the polished Au surface(20 x 20 x 0.8 μm)

After esomeprasol deposition on gold electrode surface, AFM image (Fig 4b) shows that all the surface of gold electrode is completely covered by esomeprasol. Its morphology is uniform.
By optical microscopy the morphology of Esomeprazole dissolved in human serum on the gold surface was studied as well confirming AFM measurements.

Conclusion

The presented results show by different techniques that esomeprasol degradation is successfully performed.

References

[1]DiPalma JA. Management of severe gastroesophageal reflux disease. J Clin Gastroenterol 2001, 32, 19–26.
[2] Miner PB, Katz PO, Chen Y, et al. Gastric acid control with esomeprazole, lansoprazole, omeprazole, pantoprazole and rabeprazole: a five-way, crossover study. Am J Gastroenterol 2003, 98, 2616–20.

Acknowledgement

The work was supported by the Ministry of Education, Science and and Technological Development of the Republic of Serbia under the research projects: ON172013 and ON172060.