# OPTIMIZATION of ELECTROPOLYMERIZATION CONDITIONS for ENHANCED ANTICORROSIVE RESISTANCE OF 2,6-BENZOPHENONE ON AISI316L: A RESPONSE SURFACE METHODOLOGY APPROACH

**Ibrahim FILAZI**[[1]](#footnote-1)\*

**Cankiri Karatekin University, Central Research Laboratory, Cankiri, TÜRKİYE**

**Mustafa Kemal University, Institute of Graduate Studies In Sciences, Chemistry Department, Antakya, TÜRKİYE**

**ORCID:0000-0002-8194-1421**

**Ali Tuncay OZYILMAZ**

**Mustafa Kemal University, Science & Art Faculty, Chemistry Department, Antakya, TÜRKİYE**

**ORCID: 0000-0002-3657-8117**

**Gul OZYILMAZ**

**Mustafa Kemal University, Science & Art Faculty, Chemistry Department, Antakya, TÜRKİYE**

**ORCID:0000-0002-2373-6219**

**Cumali CELIK**

**Yalova University, Yalova Vocational School, Property Protection and Security Department, Yalova, TÜRKİYE**

**ORCID: 0000-0002-7788-5703**

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| **ABSTRACT**  Corrosion is a pervasive and natural process that occurs when metals react with their environment, undergoing a gradual deterioration that can have detrimental effects on structures, equipment, and infrastructure. [1]. In the pursuit of effective corrosion prevention strategies, many studies are researching the utilization of a conductive polymer coatings [2]. This study researched the effect of electropolymerization conditions (effect of monomer concentration, scan rate and electropolymerization time) of 5-hydroxy-2,2-diphenyl-4h-benzo[d][1,3]dioxin-4-one [3] on the anti-corrosive performance of the resulting coating via using response surface methodology (RSM). RSM offering distinct advantages over classic methods by efficiently resolving interactions among variables on complex data sets and identifying optimal conditions for enhanced outcomes. [4].  The coatings were carried out on the surfaces of AISI 316L working electrodes in the acetonitrile medium presence of 0.15 M LiClO4 electrolyte with Ag/AgCl (3M KCl) reference electrode and Pt counter electrode by cycling voltammetry (CV) technique on CHI660B electrochemical-workstation. The electrodes obtained according to the designed operating parameters were immersed in 3.5% NaCl solution for 240 hours, and at the end of the period, its corrosion performance were monitored with the AC impedance (EIS) technique between 100 kHz - 1 mHz. The obtained impedance data were converted into equivalent circuits with ZView2 software and the response surface modeling was made by entering the resistance values obtained as response into the design.  It was determined that the model obtained as a result of the study could explain the corrosion resistance, which is affected by 97.0% of the independent parameters studied, with 91.6% accuracy and high sensitivity. According to the obtained models, it was seen that the monomer concentration had the biggest effect on corrosion resistance and the electropolymerization time had the least effect. In addition, it was determined that the individual effects of monomer concentration and scan rate on the response were close to each other, but their combined changes were high. However, it was observed that this effect was less than the effect of the joint change of electropolymerization time and scan rate. The results were converted into response surface graphs and formulations that allowed parameters to be optimized to achieve the desired corrosion resistance.  **References:**  [1] M. G. FONTANA, “Corrosion Engineering And Corrosion Science,” *Corrosion*, vol. 19, no. 6, pp. 199t-204t, Jun. 1963, doi: 10.5006/0010-9312-19.6.199.  [2] A. T. Ozyilmaz, İ. Filazi, C. Surmelioglu, and G. Ozyilmaz, “Optimization of Anticorrosive PANi and PPy Synthesis Conditions on ZnNiMo Coated Copper Electrode Surface with Box Behnken Design,” *Prot. Met. Phys. Chem. Surfaces*, vol. 58, no. 4, pp. 883–897, Aug. 2022, doi: 10.1134/S2070205122040177.  [3] V. Kumbaraci, N. Talinli, and Y. Yagci, “Photoinduced Synthesis of Oligoesters,” Macromolecules, vol. 39, no. 18, pp. 6031–6035, Sep. 2006, doi: 10.1021/ma0607721.  [4] R. H. Myers, D. C. Montgomery, and C. M. Anderson-Cook, *Response surface methodology: Process and product optimization using designed experiments*, 3rd ed. New Jersey, USA: John Wiley & Sons, Inc., 2009. |

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1. \* Corresponding author. *e-mail address: mail@ifilazi.com* [↑](#footnote-ref-1)