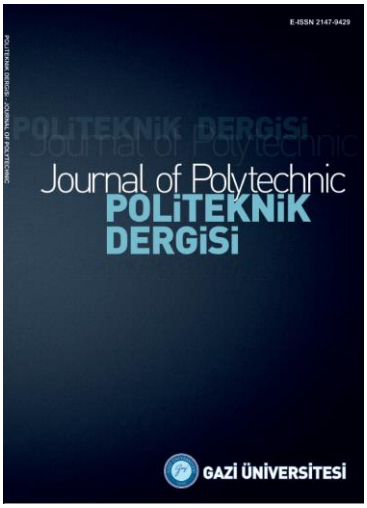

POLİTEKNİK DERGİSİ

JOURNAL of POLYTECHNIC

ISSN: 1302-0900 (PRINT), ISSN: 2147-9429 (ONLINE)
URL: http://dergipark.org.tr/politeknik

EPR investigation of gamma- irradiated L-proline and L-serine

L-Prolin ve L-Serin'de oluşan serbest radikallerin EPR çalışması

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Bu makaleye şu şekilde atıfta bulunabilirsiniz(To cite to this article): Başkan M.H., "EPR investigation of gamma- irradiated L-proline and L-serine", ***Politeknik Dergisi***, 25(2): 593-595, (2022).

Erişim linki (To link to this article): http://dergipark.org.tr/politeknik/archive

DOI: **10.2339/politeknik.806499**

EPR Investigation of Gamma- Irradiated L-Proline and L-Serine

Highlights

- *L-proline and L-serine powders were exposed to gamma radiation. /L-prolin ve L-serin tozları gama radyasyonuna maruz bırakıldı.*
- *Radiation damage centers in L-proline and L-serine powders were determined by EPR spectroscopy method./L-prolin ve L-serin tozlarındakki radyasyon hasar merkezleri EPR spektroskopisi metoduyla belirlendi.*

Graphical Abstract

The experimental and simulated EPR specta of L-proline/L-Prolinin deneysel ve simüle EPR spektrumları

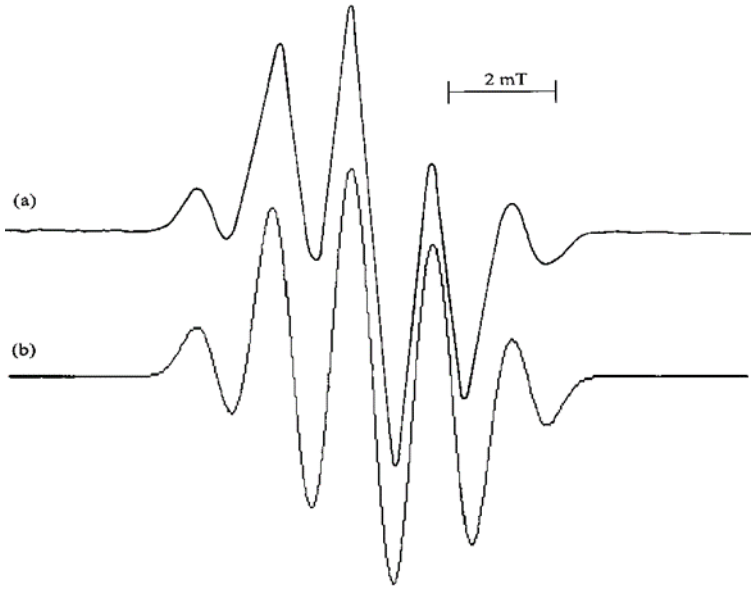

Figure. EPR spectrum of L-proline

Aim

In this work, electron paramagnetic resonance (EPR) spectra of gamma irradited L-proline and L-serine powders have been examinated at 300 K.

Design & Methodology

EPR spectroscopy method was used in this study.

Originality

EPR spectroscopy method is important in radical determination

Findings

The spectrum of L-proline at 300 K includes five lines. The EPR spectrum of the γ- irradiated L-serine at 300 K is exhibits of 7 lines.

Conclusion

In this work, the free radicals observed in the samples attributed to $CH_3\dot{C}H$ and $CH_2\dot{C}NH_2$, radicals, respectively.

Declaration of Ethical Standards

The author of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission.

EPR Investigation of Gamma- Irradiated L-Proline and L-Serine

Araştırma Makalesi / Research Article

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(Geliş/Received : 06.10.2020 ; Kabul/Accepted : 05.11.2020 ; Erken Görünüm/Early View : 23.11.2020)

ABSTRACT

In this work, electron paramagnetic resonance (EPR) spectra of gamma irradited L-proline and L-serine powders have been examinated at 300 K, as well as to determine their stability and radical structures. The EPR of samples were attributed to the $CH_3\dot{C}H$ and $CH_2\dot{C}NH_2$ radicals. The EPR spectra were seen to be stable for more than five months. The results obtained from the radicals discussed here were observed to be in good agreement with the literature data.

Keywords: Electron paramagnetic resonance, free radical, amino acid.

L-Prolin ve L-Serin'de Oluşan Serbest Radikallerin EPR Çalışması

ÖZ

Bu çalışmada 300 K sıcaklıkta L-prolin ve L-serin tozlarında Gama ışınlaması sonucu oluşan elektron paramanyetik rezonans (EPR) spektrumlarının belirlenmiş, aynı zamanda radikallerin kararlılıkları ve yapıları incelenmiştir. Örneklerin deneysel EPR spektrumları $CH_3\dot{C}H$ ve $CH_2\dot{C}NH_2$ radikallerine atfedilmiştir. EPR spektrumları beş aydan fazla değişmeden kalmıştır. Burada tartışılan radikallerden elde edilen sonuçların literatür verileri ile uyumlu olduğu görülmüştür.

Anahtar Kelimeler: Elektron paramanyetik rezonans, serbest radikal, amino asit.

1. INTRODUCTION

Electron paramagnetic resonance method has been used for the detection of the free radicals produced by gamma irradiation in amino acid and derivatives [1-8]. Besides, gamma-irradiated food and drugs were studied at room temperature by EPR [9-12]. EPR study of gamma-irradiated L-serine derivatives was carried out at room temperature by Osmanoğlu et.al. [13]. L-proline and L-serine are biologically important amino acids. EPR measurements were performed 3 and 6 weeks following irradiation. The detected free radicals were stable for more than five months. The main purpose of this work is in L-proline and L-serine as well as to determine their spectroscopic parameters and radical structures at 300 K.

2. MATERIAL and METHOD

L-proline and L-serine used in this work were provided by commercial sources, and these samples were irradiated with a dose of 20 kGy. The stable free radicals produced in irradiated samples were obtained with a Varian model X-band EPR spectrometer. The *g* values were calculated by comparing with a dipenhylpicrylhydrazyl (DPPH) sample of g = 2.0036. The spectra in Figs. 1b and 2b were simulated using the powder simulation program.

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3. RESULTS AND DISCUSSION

The spectrum of L-proline at 300 K includes five lines of intensity ration of 1:4:6:4:1, as shown in Fig.1a. According to these results, the free radical structure formed in L-proline of γ-irradiated was determined to be $CH_3\dot{C}H$. It can be concluted from five lines EPR spectrum that the free electron interacts with one αproton and three β-protons, which are magnetically equivalent.The hyperfine splittings of methylene protons and one $a_{\dot{C}H}$ proton are determined to be a_α = 2.23 mT, a_β = 1.74 mT and linewidth ΔH = 0.56 mT, respectively**.** The g value from the EPR experimental spectrum was calculated g = 2.0035. At the end, the simulated of the spectrum obtained using the above values is shown in Fig.1b. The well agreement is found between the experimental EPR spectrum and the simulated spectrum.

The EPR spectrum of the γ- irradiated L-serine at 300 K is presented in Fig.2a that exhibits of 7 lines. The experimental EPR spectrum of the L-serine can be attributed to $CH_2\dot{C}NH_2$ radical. This radical is similar to the aminoalkyl radical and is stable for more than three months. The hyperfine interaction of the free electron with two equivalent methylene protons and two protons near the adjacent ^{14}N nucleus, which are magnetically nearly equal, and the values for ^{14}N atom can be suggested as a_{CH2} = 1.46 mT, a_{NH2} =0.74 mT, a_N = 1.06 mT, and the linewidth 0.46 mT.The hyperfine splitting constants are determined using the simulation program. The g factor measured in the spectrum is g = 2.0029. The

coupling constants and g values seem to agree with the literature values [13-18]. The hyperfine splitting constants are determined by the simulation method. In Fig. 2b spectrum is observed an agreement well between the EPR experimental and the simulated spectrum.

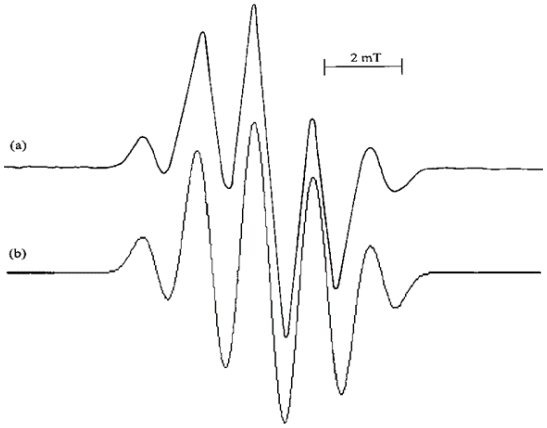

Fig. 1. a) The experimental EPR spectrum **L-proline**.
b) Simulated form of the spectrum

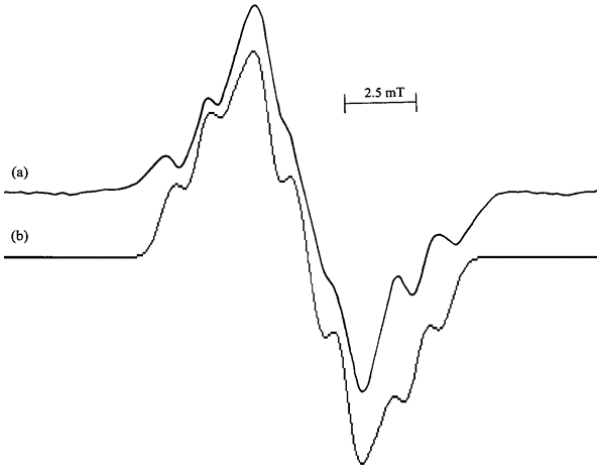

Fig. 2. a) The experimental EPR spectrum **L-serine**.
b) Simulated form of the spectrum.

4. CONCLUSION

In this work, the free radicals observed in the samples attributed to $CH_3\dot{C}H$ and $CH_2\dot{C}NH_2$, radicals, respectively. The identification of L-proline and L-serine is reported with a comparison of the experimental and simulated spectra. The spectra of these samples can also provide useful information about alkyl and amine radicals.

DECLARATION OF ETHICAL STANDARDS

The author of this article declare that the materials and methods used in this study do not require ethical committee permission and/or legal-special permission**.**

AUTHORS' CONTRIBUTIONS

M. Halim BAŞKAN: Perofrmed the experiments and analyse the results, wrote the manuscript.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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