ESR Study on Irradiated Ascorbic Acid Single Crystal

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Abstract. Food irradiation is a "cold" process for preserving food and has been established as a safe and effective method of food processing and preservation after more than five decades of research and development. The small temperature increase, absence of residue and effectiveness of treatment of pre-packed food are the main advantages. In food industry, ascorbic acid and its derivatives are frequently used as antioxidant agents. However, irradiation is expected to produces changes in the molecules of food components and of course in the molecules of the agents added as preservation agents such as ascorbic acid. These changes in the molecular structures could cause decreases in the antioxidant actions of these agents. Therefore, the radiation resistance of these agents must be known to determine the amount of radiation dose to be delivered. Electron spin resonance (ESR) is one of the leading methods for identification of intermediates produced after irradiation. ESR spectrum of irradiated solid powder of ascorbic acid is fairly complex and determinations of involved radical species are difficult. In the present work, single crystals of ascorbic acid irradiated by gamma radiation are used to determine molecular structures of radiation induced radicalic species and four radicalic species related in pair with $P2_1$ crystal symmetry are found to be responsible from experimental ESR spectrum of gamma irradiated single crystal of ascorbic acid.

Keywords: Electron Spin Resonance (ESR); γ-irradiation, ascorbic acid (AA); single crystal.
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INTRODUCTION

In the present work, γ-irradiated single crystals of AA revealed that ESR spectra of crystalline. Hence, it was concluded that such a spectrum can not be explain along with radical species with unpaired electrons localized on carbon and oxygen atoms of five member. Therefore, we decided that species produced after the damage of the $-CHOHCH_2OH$ molecular part of AA should also take part in the formation of experimental ESR spectra of irradiated solid AA.

RESULT AND DISCSSION

Single crystals of AA were grown from solution by slow evaporation. It crystallizes in the monoclinic space group $P2_1$ with 4 molecules in the unit cell. The ESR spectra of γ irradiated powder and single crystal in special directions were shown in Figure 1. The angle dependent of the AA spectra, and the microwave saturation behaviors of observed resonance lines, and the three different microwave saturation power value (Figure 2.) imply that 3 different radicalic species were produced after irradiation of single crystal of AA. Other studies are not presented to save space.

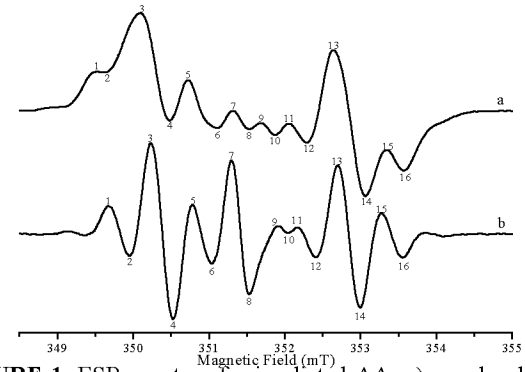

FIGURE 1. ESR spectra of γ irradiated AA, a) powder, b) single crystal in 0^o direction.

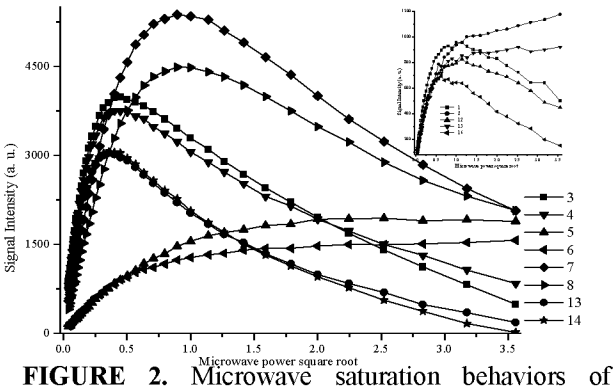

FIGURE 2. Microwave saturation behaviors of observed resonance lines.

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