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## A COMPARATIVE STUDY ON EXPERIMENTAL AND THEORETICAL ESR SPECTRA OF LACTIC ACID POLYMERS IRRADIATED BY GAMMA RAYS

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Homo polymers of L-Lactic acid (LLA) and D,L-Lactic acid (DLLA), being biocompatible and absorbable in body fluids have recently found wide applications in the preparation of surgical sutures, controlled drug delivery systems, burn wound coverings etc. For sometime these polymers have also been prepared in the form of plates and screws for mandibular fracture fixation, tissue implants. Their chemical sensitivities against relatively high temperatures and hydrolysis with water make them unsuitable for conventional sterilization techniques like hot water vapor and ethylene oxide. Sterilization of the devices made of these polymers is therefore possible by gamma ray irradiation. This has initiated a number of research works in order to better understand the effects of ionizing radiation on this polymer. The aim of this study is to determine the possible radical types, their location on macromolecular structure and the reasons for peak shifts in the experimental and theoretical ESR spectra.

Polymer samples were irradiated in air and in vacuum ( $10^{-4}$  torr) to 25 kGy sterilization dose at the dose rate 0.59 kGy/h and at room temperature by  $^{60}\text{Co}$   $\gamma$ -irradiator. Despite being chemically the same radical type, some differences were observed in the splitting of peaks of PLLA and PDLLA samples. These differences were determined and compared by means of fitting studies.

Firstly, PLLA was characterized and its  $g$  and hyperfine splitting values were found as  $2.0032 \pm 0.0002$  and  $20.37 \pm 0.2$ . In the characterization study of PDLLA, it was found that one of the nearest two radicals was on the upper and the other one was on the lower plane of PDLLA chain. This difference in radical location was assumed to be the reason for the splitting and hyperfine splitting value difference between PLLA and PDLLA. The  $g$  and hyperfine splitting values of first and second radical were found to be  $g=2.0032 \pm 0.0002$ ,  $a_{\text{H3}}=20.37 \pm 0.2$  and  $g=2.0037 \pm 0.0002$ ,  $a_{\text{H3}}=15.8 \pm 0.2$  respectively for PDLLA. And Also the intensity ratio of first and second radical ( $I_1/I_2$ ) was found to be 1.6.