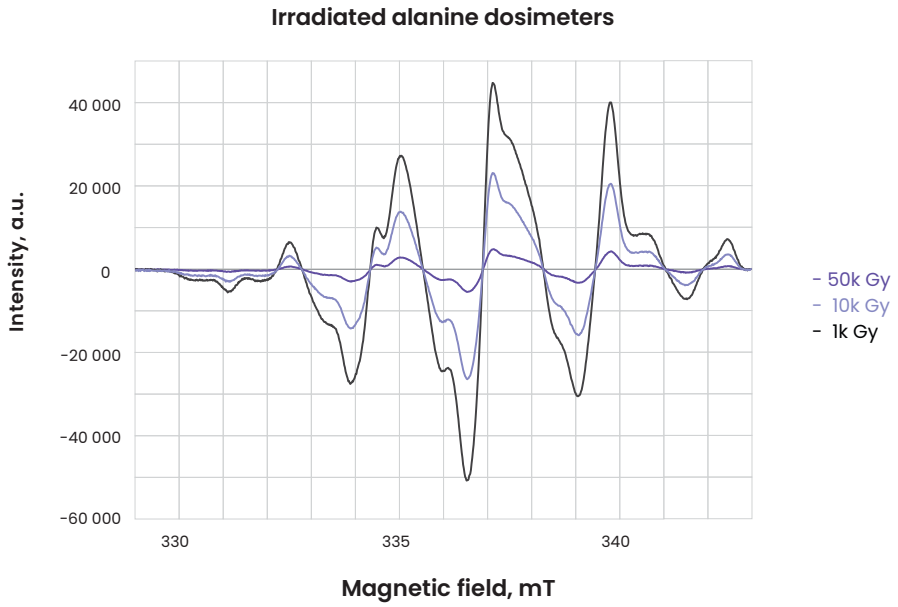
LINEV SYSTEMS®

Application Note

EPR-SPECTROSCOPY IN ALANINE DOSIMETRY

The most important method of measuring the absorbed dose is the alanine-based dosimetry. Alanine (α-aminopropanoic acid, α-alanine: CH3-CH(NH2)-COOH) exposed to ionizing radiation forms a very stable free radical [2, 3]. Alanine free radical provides a characteristic EPRsignal, whose intensity is proportional to the absorbed dose and is independent on the radiation energy and power, and also weakly dependent on temperature and humidity of the medium. For this reason the alanine dosimetry equally fits the devices, which use the electron beams, X-rays or gamma-rays [4].

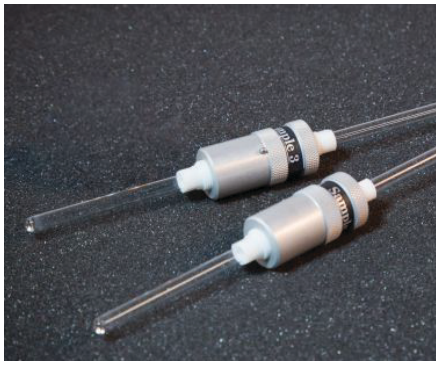
The irradiated alpha-alanine spectrum has 5 equidistant peaks having the amplitudes ratio of 1:4:6:4:1 [2]. Alanine dosimeters are produced as pellets or films depending on the application. Due to its high linearity of dose response (up to 104 Gy) and its high stability, alanine proved to be convenient for radiation technologies and is recommended as the basic method. Alanine dosimetry has long been accepted as an International Standard ISO/ASTM 51607:2013



In order to detect the ionizing radiation treatment several methods are used based on the physicochemical effects occurring upon the action of radiation on the substance. In the past few years solid-phase dosimetry methods have become the most widely spread, using the solid objects as a sensitive organ to detect the radiation.

> These objects keep the "memory" about the radiation treatment for a long time. Paramagnetic centers (free radicals) are formed in these solid phase bodies, the concentration of these paramagnetic centers can be easily measured by using the Electron Paramagnetic Resonance (EPR) spectroscopy.

One of the advantages of EPR/ESR dosimetry is that the read out does not affect the spin concentration; the sample can be evaluated many times. Therefore, the signal to noise ratio (S/N) can be improved by repeated reading of the sample [1].



EPR DOSIMETRY SYSTEM COMPONENTS

1. Benchtop EPR spectrometer Spinscan X;
2. Precise positioning dosimeter holders;
3. Calibration set;
4. Alanine dosimeters (pellets, films…);
5. Software dosimetry package;
6. Analytical balance;
7. Barcode reader;
8. Autosampler for 50/100 pellets.

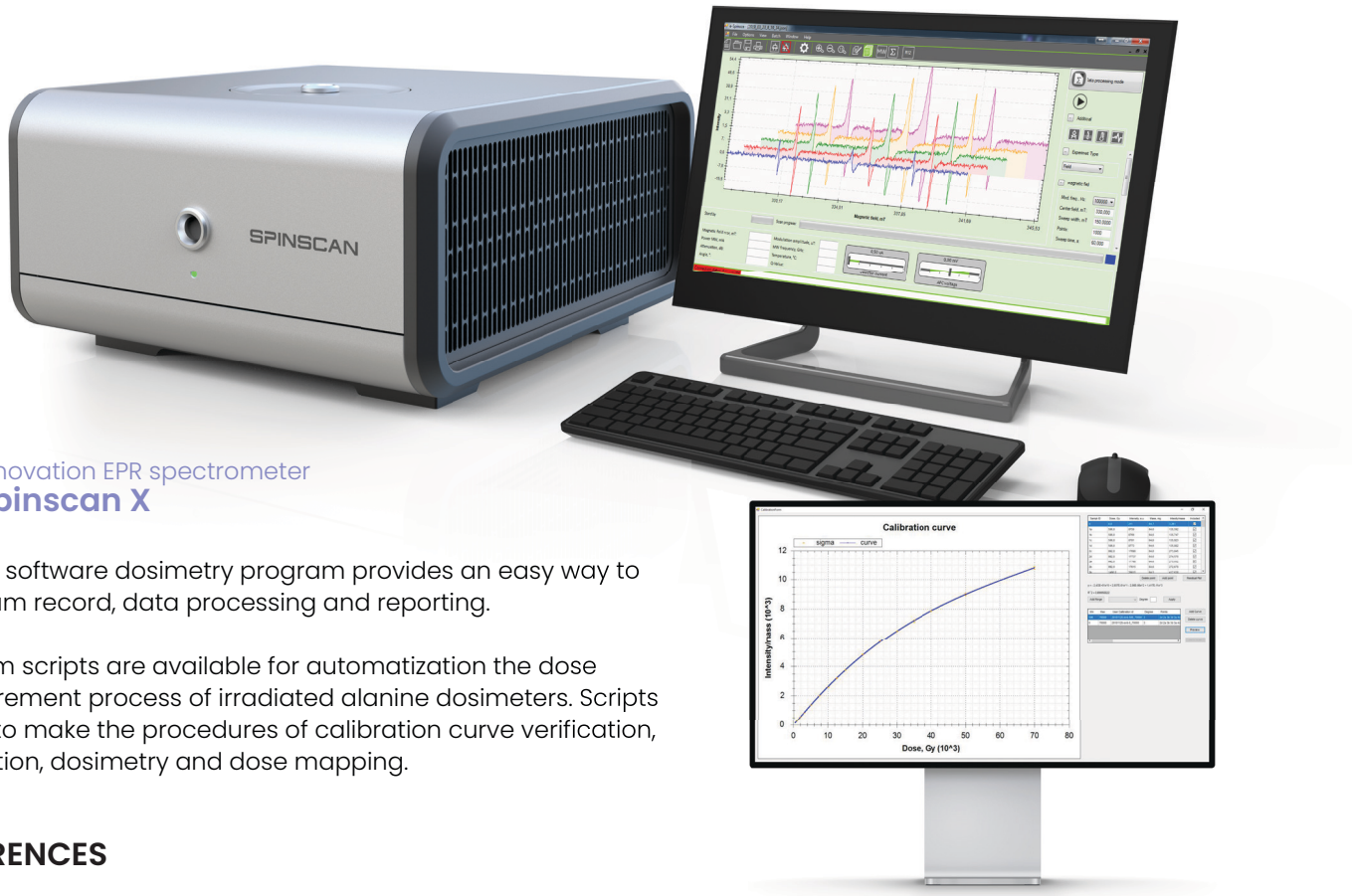
APPLICATIONS

Medical products and pharmaceuticals sterilization

Food irradiation

Polymer modifications

Medical therapy and radiation damage studies in materials



Innovation EPR spectrometer
Spinscan X

Special software dosimetry program provides an easy way to spectrum record, data processing and reporting.

Program scripts are available for automatization the dose measurement process of irradiated alanine dosimeters. Scripts allows to make the procedures of calibration curve verification, calibration, dosimetry and dose mapping.

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