

Aqueous sample considerations in uniform field resonators for electron paramagnetic resonance spectroscopy

James S. Hyde, Richard R. Mett

A new class of cavity resonators for use in EPR spectroscopy has recently been introduced by Mett, Froncisz and Hyde (Rev. Sci. Instrum. 72, 4188, 2001) that oscillate in what were termed “uniform field” modes. In these cavities, the RF magnetic field is uniform along an axial sample tube. The present paper is a theoretical analysis of flat aqueous sample cells in the uniform field resonator designated TEU02, which is an analogue of the widely used rectangular TE102 cavity. A full wave solution in the presence of sample loss was found. Samples that saturate with the available RF magnetic field and those that do not are considered. A geometry is described that requires four times more sample than in a conventional cavity, and yields three times higher EPR signal intensities for saturable samples such as spin labels. It was concluded that not only is the quality of the EPR data improved in these resonators because the RF field is uniform over the sample, but also the signal-to-noise ratio can be better