

## Applications of EPR Spectroscopy in Pharmaceutical Analysis

Helen Gray, AstraZeneca, Silk Road Business Park, Macclesfield, Cheshire, SK10 2NA, UK

EPR spectroscopy has a wide variety of applications within the analysis of pharmaceutical compounds but is currently very under utilised in this area by pharmaceutical companies. The potential of EPR as a tool for use in pharmaceutical analysis will be discussed and current applications within AstraZeneca will be presented. These include photodegradation and oxidation of active pharmaceutical ingredients (APIs) and formulations<sup>1</sup>, the effects of sterilization techniques such as autoclaving,  $\gamma$ -<sup>2</sup> and  $\beta$ -irradiation, interactions between APIs and excipients, investigating the mode of action of spin trap compounds used in the treatment of strokes<sup>3</sup> and as a technique for more general problem solving and probing material characteristics.



The relevant regulatory authorities require photostability testing for all new pharmaceutical compounds of APIs and formulations. EPR spectroscopy has been shown to be a powerful tool in this area and results from studies of the photodegradation of Nifedipine, a drug used in the treatment of hypertension, will be discussed. Initial results have shown that the photostability characteristics of a new API may be predicted by EPR, by measuring the extent of radical formation on exposure to light.

The potential for interactions between an API and the excipients used in pharmaceutical formulations must be considered during the development of a new drug. Many examples are known where an interaction can result in degradation of an API<sup>4-6</sup>. An example will be discussed where the presence of organic radical species in a commonly used excipient has been shown to accelerate the photodegradation of an API.

<sup>1</sup> M.T. Baker, M.S. Gregerson, S.M. Martin, G.R. Buettner, *Crit. Care Med.* 31, 3 (2003) 787-792

<sup>2</sup> M. Claybourn, H. Gray, D.M. Murphy, I.J. Purnell, C.C Rowlands, *J. Controlled Release* 91 (2003) 341-438

<sup>3</sup> K.R. Maples, F. Ma, Y-K Zhang, *Free Rad. Res.* 34 (2001) 417-426

<sup>4</sup> R.A. Castello, A.M. Mattocks, *J Pharm Sci*, 51 (1962) 106-108

<sup>5</sup> P. Crowley, L. Martini, *Pharm Tech Europe*, 13, 3 (2001) 26-34

<sup>6</sup> M.J. Akers, *J Pharm Sci*, 91, 11 (2002) 2283-2300