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Resonance Raman spectroscopy of bioadhesive transdermal patches for percutaneous local anaesthesia

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Raman spectroscopy is a technique of increasing interest due mainly to its non-invasive nature. It has been widely employed in the characterisation of drug penetration across the skin barrier (Anibogu et al 1995) and in determining the structural similarities between skin from different species (Williams et al 1994). In addition, water exhibits negligible Raman scattering, making the technique suitable for the analysis of pharmaceutical and biological systems. For example, as Raman spectroscopy is insensitive to skin hydration, it has been employed in monitoring drug release from aqueous systems into the *stratum corneum* (Williams et al 1993).

The local anaesthetic amethocaine has been formulated successfully as a gel (McCafferty and Woolfson 1988) and more recently as a bioadhesive transdermal patch, offering enhanced drug stability and patient convenience (Woolfson et al 1998).

In order to check whether drug release is retarded by interaction of amethocaine with the polymeric components of the patch system, resonance Raman spectroscopy has been employed as a non-invasive characterisation technique. In addition, several recent technical advances in this area, particularly concerning diode laser excitation sources and holographic notch filters, have been employed (Angel et al 1996).

Bioadhesive films were formulated as described previously (Woolfson et al 1998). Raman spectra were recorded on an Andor RAMANSPEC dispersive instrument employing a diode laser source operating at 785nm (20mW), a wavelength at which background fluorescence from samples is significantly reduced (Wang and McCreery 1989).

Figure 1 shows spectra of loaded and unloaded gels. The scattering due to the patch backing film and gel (Fig.1(b)) was sufficiently weak not to cause significant spectral interference. In conjunction with automatic background subtraction, this allowed the direct, non-destructive acquisition of spectra of amethocaine in the gels. Figure 1 indicates that the anaesthetic is apparently unaffected by, and exhibits no physicochemical interactions with, the gel into which it is loaded. This is significant in terms of drug release, showing that the drug is unbound within the polymer matrix. Thus, the materials chosen for the local anaesthetic patch are compatible with the system. This is consistent with previous thermal analysis and drug stability studies (Woolfson and McCafferty 1993).

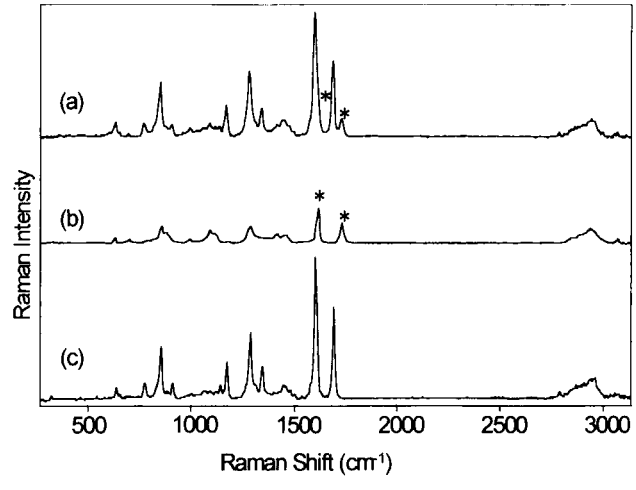

Figure 1. Raman spectra at 785 nm for (a) patch loaded with drug (b) unloaded patch and (c) amethocaine free base.
* represents peaks from the polymeric excipients.

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