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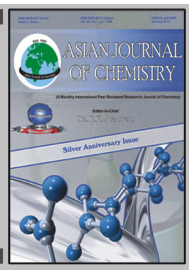

NOTE

Spectroscopic Analysis of Sparfloxacin Release Pattern from the Cellulose Derivative Bases

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Ultraviolet/visible and infrared studies were carried out with the mixture of sparfloxacin and various polymer bases namely, ethyl cellulose: polyethylene glycol (EC:PEG), ethyl cellulose:hydroxy propylmethyl cellulose (EC:HPMC) and ethyl cellulose:eudrajit (EC:EUD). The amount of drug release for every 24 h was estimated through UV/visible spectroscopy. The study showed that the drug release rate is related to the binding of the drug to the base. The IR spectrum of the samples provides the information about the strength of bonding between the drug and bases.

Key Words: Sparfloxacin, Cellulose, Analysis.

Periodontitis is a common dental disease, which is an inflammatory response to bacteriological infection[1] and can be arrested through systemic administration of antibiotics/antibacterial agents. It has been found that the discontinuation of therapy results in the recolonization of potential pathogen in the periodontal pocket[2]. Hence long term antibacterial/antibiotic therapy is required for the complete eradication of the disease.

The local delivery of an antibiotic/antibacterial agent into periodontal pocket is considered to have an excellent potential as an alternative to traditional therapy, since low dosage of drug required and no/less side effects[3,4]. In recent years considerable attention has been focused to develop sustained release dosage form of drugs for periodontal diseases. The present study was carried out with a view to develop a sustained release dosage form of sparfloxacin as a dental chip and to assess the release pattern of drug based on the interacting molecules. The literature[5,6] shows that sparfloxacin is a superior antibacterial agent among the quinolone [$C_{19}H_{22}N_4O_3F_2$] group with lesser adverse effects, hence sparfloxacin was selected as a drug candidate for the present study.

The pure sample of sparfloxacin was obtained from Torrent Pharmaceuticals Ltd., India. The absorbance of different concentrations of sparfloxacin in phosphate buffer at pH 7.8 was measured at 289.5 mm using Shimadzu 1610UV PC spectrophotometer. In order to simulate the physiological condition of the periodontal pocket, the chips of sparfloxacin was made in to 10 mm length, 2 mm width and 0.5 mm thickness. In the present study 100 times reduced oral dose of sparfloxacin *i.e.* 2 mg, was targeted in the periodontal pocket in the form of dental chip, which is expected to release the drug well above the minimum inhibitory concentration required by oral pathogens.

The chip of drug was prepared by dispersing the drug in polymer solutions namely, ethyl cellulose:polyethylene glycol (9:1) (EC:PEG), ethyl cellulose:hydroxy propyl methyl cellulose (9:1) (EC:HPMC) and ethyl cellulose:eudrgit (9:1) (EC:EUD) in isopropyl alcohol and dichloromethane (1:1). Then it was casted on a glass plate and a thin film was cut into dental chip after complete removal of solvent.

The *in vitro* release of the chip was carried out at pH 7.8 since the pH of gingival crevicular fluid is between 7.5 to 8.0. The chip was placed in 5 mL of phosphate buffer at pH 7.8 and maintained at a temperature of 37 ºC. Every 24 h once the dissolution medium was replaced with fresh medium. The drug concentration of the medium was determined by measuring the absorbance at 289.5 nm.

The infrared spectrum of the films with various combinations of polymer bases and drug recorded using JASCO IR-700 Infrared spectrophotometer.

The standard graph of sparfloxacin in phosphate buffer pH 7.8 was prepared and presented in Fig. 1. The results of *in vitro* release of sparfloxacin from the three bases are given in Fig. 2. From the results, it was observed that EC:PEG based formulation releases the drug very slowly than other two formulations such as EC:HPMC and EC:EUD based

formulations. The results showed that cumulative drug release of EC:PEG and EC:HPMC were 42.2 and 83.84 % respectively in 21 days, but the percentage was 99.99% in EC:EUD base in 21 days (Data not shown).

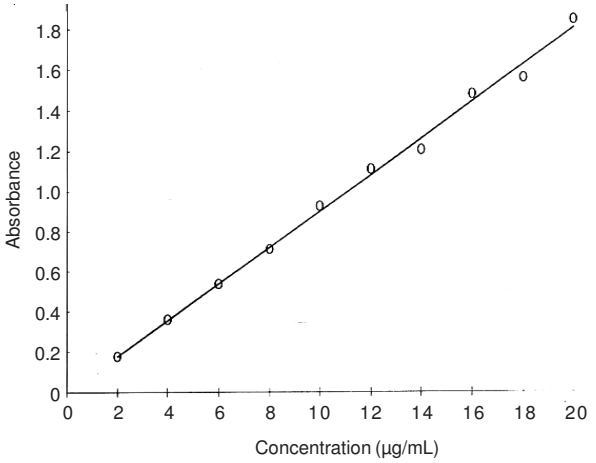

Fig. 1. Standard graph of sparfloxacin in phosphate buffer pH 7.8

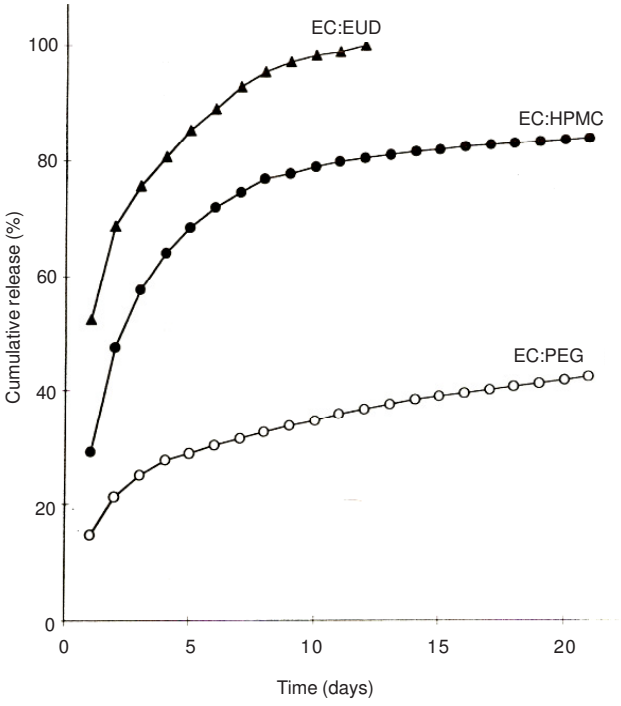

Fig. 2. *In vitro* release of sparfloxacin from different cellulose bases

IR spectrum of the samples in the present study showed bands in the region between 3700-2500 cm^{-1}. The absorption bands of EC:PEG base are observed at 3504 and 2936 cm^{-1} which correspond to O-H groups. These bands are broadened and shifted to lower frequency side on addition of drug to the base. The absorption band of EC:HPMC base is observed at 3510 cm^{-1} and it also broadened on addition of the drug to the base. There is no much shift in the spectral region from 3700 to 2500 cm^{-1} on addition of the drug to the EC:EUD base.

From the structure of the bases and the drug, the interaction is mainly between the O-H group of base and carbonyl and amino group of drug. Among the three bases, the O-H group is not available in eudragit, hence the interaction is very less in the mixture of EC:EUD and sparfloxacin. In the other two cases the polyethylene glycol has more number of hydroxyl group compared with hydroxy propylmethyl cellulose. Apart from the available OH group, the configuration and confirmation of hydroxy propylmethyl cellulose reduces the interaction between the carbonyl and amino group of drug and the hydroxyl group of hydroxy propylmethyl cellulose. The broadening of spectra in the region 3500 to 2000 cm^{-1} clearly indicates that the strong interaction seen between drug and polyethylene glycol. The broadening and shift is well pronounced for EC:PEG with drug than the broadening occurred in the drug incorporated hydroxy propylmethyl cellulose formulation.

The IR spectra of the bases with and without drug confirms that the binding of drug to EC:EUD base is very little, but EC:PEG have more binding to the drug than the EC:HPMC base. Thus the drug binding to the polymers are as follows: EC:PEG > EC:HPMC > EC:EUD.

The above result confirms the % cumulative drug release profile of sparfloxacin with the three bases. Hence, it may be concluded that the EC:EUD base releases the sparfloxacin at a faster rate with a reasonable concentration than other two bases.

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