Metronidazole/montmorillonite nanodevices for controlled drug delivery

I. Calabrese[1], L. Sciascia[1], G. Cavallaro[1], C. Scialabba[1], M. Licciardi[1], M. Merli[1], M. L. Turco Liveri[1]
[1]*University of Palermo, Dipartimento di Scienze della Terra e del Mare, Palermo, Italy*

In the present work the potential of a new-tailored made drug delivery system, obtained by the intercalation of the antibiotic metronidazole (MNE) into the K10-montmorillonite clay (MMT) has been evaluated.
The interest in this field comes from the consideration that the pharmacokinetic profile of the conventional tablet metronidazole indicates that the dosage form not only provides minimal amount of metronidazole for local action but it also holds unwanted systemic effects. This way, the design of more effective strategies for the administration of metronidazole, aiming at minimizing secondary effects, increasing drug bioavailability and stability or even exhibiting high accuracy in reaching the target has become significant.
In this perspective a series of MNE/MMT hybrids have been prepared by varying the pH and the amount of loaded drug. Complementary kinetic and equilibrium studies have been carried out in order to elucidate the adsorption mechanism of the MNE into the MMT and to establish the nature of the interactions involved in the hybrid MNE/MMT formation. Moreover, the interactions sites of the clay surface have been proposed on the bases of the XRD results.
The gathered results allowed us to establish that the adsorption process strongly depends on the pH conditions and to propose a multistep adsorption mechanism involving the neutral and the cationic form of the drug, which interact with different sites of the clay surfaces, i.e. the interlayer region and the faces of the lamella.
The drug release kinetics has been then studied under physiological pH mimicking conditions simulating the oral drug administration and delivery. The investigation of the release profiles and the comparison with the commercial formulation of the drug reveal not only that the new-tailor made formulation could be fruitful exploited for successfully prolonged the action of drug in the target site but the use of these nanodevices reduce both time and costs for the drug delivery.