Hydrogel loaded with nanostructures based on superparamagnetic particles and hydroxyapatites for local delivery of anti-fungal and anti-inflammable drugs

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Hydrogels are widely used in medicine due to their facile loading with many different biologically active molecules and easy synthesis. They offer prolonged and spatial control for releasing different therapeutic agents in different various tissues. In our study, we focused on the preparation of hydrogels as drug carriers for the treatment of wounds, including gum disease lesions. The proposed hydrogel loaded with hydroxyapatite and superparamagnetic iron oxide nanoparticles (SPIONs) was proposed to be a novel way to deliver anti-inflammatory and antifungal drugs. The nanoparticles were synthesized using a co-precipitation technique and incorporated into the hydrogel before being cross-linked together with anti-inflammatory and antifungal drugs. The hydrogel can be designed in a specific shape and size and can be 3D printed, making it a promising material for dental applications, offering prolonged drug release, biocompatibility and the ability to carry different therapeutic agents. Drug release was studied by UV-vis spectrometry. The effectiveness of heating the hydrogel with SPION was investigated using magnetic hyperthermia. It was found that by loading SPIONs into the polymeric network of hydrogel, it was possible to increase the gel temperature up to 42 °C by means of an alternating magnetic field while improving drug release, while the loading of hydroxyapatites enables prolonged drug release.

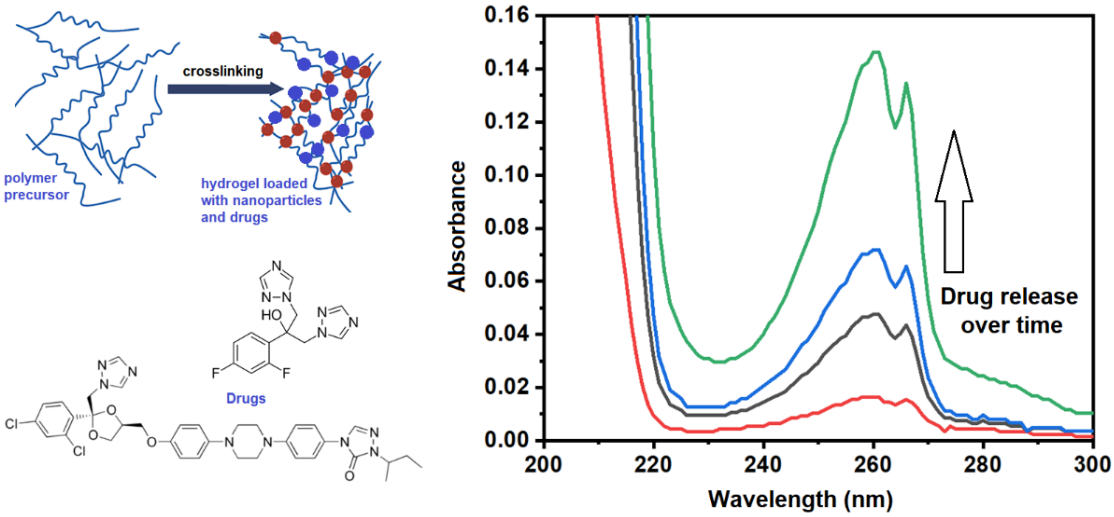

Figure 1. Schematic diagram of hydrogel and the results on the drug releas using UV-vis spectrometry.