**Materials and Methods**

Implantable 3D polymer scaffolds have drawn enormous attention from various disciplines because of their unique properties. Poly(propylene fumarate) (PPF) scaffolds have several advantages (e.g., biocompatibility, sufficient mechanical strength, large porous surface area, and long decomposition time with biodegradability) that make them favorable for developing bone substitute materials with a capacity for in vivo controlled release of cancer drugs. However, several hurdles must be overcome in the development of drug-dispensing PPF scaffolds. Since PPF is extremely hydrophobic, it might be difficult to load most water-soluble drug molecules. In addition, loaded drugs might often be degraded during the scaffold fabrication, a procedure that involves heating and desalinization. In this study, we used super paramagnetic iron oxide (SPIO) and manganese oxide (MnO) nanoparticles (nps) as carriers for the anti-cancer drug, doxorubicin, and measured the kinetics of the release from the PPF scaffold surface using MRI. Because of the persistent release of drugs in the vicinity of a malignancy, these macroporous PPF scaffolds could be used for many biomedical applications, including MR-guided implantation, as drug-carrying vehicles, and as a tumor treatment.

**Results and Discussions**

SPIO (30nm) and MnO (60nm) nanoparticles with amine groups on their surfaces were prepared using silane chemistry and a surface exchange method. A JEM 2100 transmission electron microscope (JEOL, Tokyo, Japan) was used to characterize the nanoparticles. One mg/ml of each nanoparticle batch was dispersed in PBS, then 10ul of an anti-cancer drug molecule, doxorubicin (1mmol), was mixed into the nanoparticles to coat the surface through electrostatic adsorption. Ten pieces of PPF scaffolds, 6.3 mm in diameter and 5 mm thick, were prepared. One hundred ul of drug-coated nps were either sprayed on or mixed in the scaffolds, and the scaffolds were kept in 3ml tubes containing PBS or cell culture media. MRI images were obtained at different time points using an 11.7T Bruker Avance system equipped with a 15 mm birdcage RF coil. T1 and T2 relaxation were measured using a modified MSME protocol. All data processing was performed using custom-made codes in Matlab (ver. R2009a, Mathworks, Natick, MA).

**Conclusion**

PPF scaffolds were imaged with MRI. Doxorubicin-coated magnetic nanoparticles were successfully attached to the scaffolds and released into solution in a timely manner. We monitored the releasing profile and quantified the amount of released particles by measuring MRI contrast changes. Released drug-coated nanoparticles retained their cancer cell-treating efficacy.

**References**