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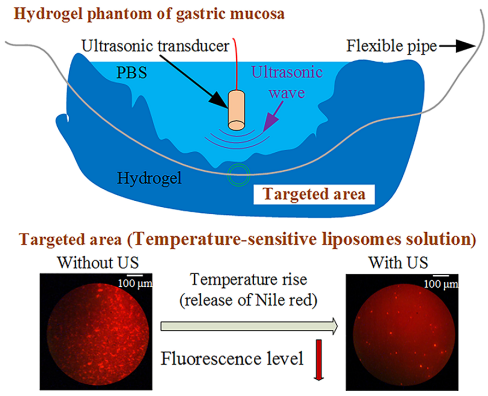
An ultrasonic transducer can initiate and control a temperature increase in a liposome drug-delivery system.



Liposomes have proven useful for drug-delivery applications during chemotherapy by targeting the tumor area and reducing the amount of potentially toxic drugs delivered to normal tissue. The method is difficult to apply in the gastrointestinal tract, since the tract consists of narrow, hollow regions restricting the amount of drug delivered.

Zhu and Peng report a technique using temperature sensitive liposomes, TSLs, that undergo a hydrogel-to-liquid crystal phase transition at a certain temperature, releasing the liposome's contents in a controlled manner. The investigators used a piezoelectric single-crystal ultrasonic transducer only 2.2 millimeters in size to initiate and control the localized temperature increase.

Nile Red, a lipid-soluble fluorescent dye, was used as the drug stand-in, since its release from the liposome could be monitored with a spectrometer. The system was tested using a manufactured model of the gastric mucosa, created from a 3D printed form that was overlaid with the gastric mucosa from a pig stomach. This provided a mold for the hydrogel solution, producing a phantom gastric mucosa with the same surface structure as found in a biological system.

The duty ratios and amplitudes of the driving voltage for the ultrasound transducer could be adjusted to change the temperature of the TSLs.

"The proposed method for temperature control has the potential to improve local drug concentration in the gastrointestinal tract and reduce the amount of anticancer drugs in the body," said author Hanmin Peng.

Spectroscopic data showed the encapsulated Nile Red concentration decreased when the lipid bilayer underwent a phase transition from gel to liquid crystal. Future research will test this method in *in vivo* stomach tissues using real drugs.

Source: "Theory and method of temperature control for drug release in hydrogel phantom of gastric mucosa *in vitro*," by Pancheng Zhu and Hanmin Peng, *Journal of Applied Physics* (2021) The article can be accessed at https://doi.org/10.1063/5.0054733.