

Vibrating Nanodroplets May Invade A Tumor

2021-02-10

Sending tiny droplets to a tumor and having them vaporized using focused ultrasound: it could be a new way of tracing a tumor or deliver drugs locally. Researchers of the University of Twente now demonstrate a new phenomenon triggering droplet vaporization: it happens at the exact acoustic resonance frequency and causes fast and efficient lowering of the pressure inside the droplet, until below the threshold value for vaporization. The research results are in Physical Review Letters.

Micro droplets, stabilized using a thin shell, can be visualized in the blood stream using ultrasound. There is a growing number of medical applications, in imaging and therapy. The droplets, however, are too large to invade a tumor. Smaller, nano size droplets, can do this.

By guiding them to the tumor and having them vaporize 'on the spot', the bubbles that are formed can have a therapeutic effect inside the tumor. Vaporization may typically seem a physical phenomenon of which everything is known already, but the [UT](#) researchers demonstrate a new mechanism.

It is based on resonance, just like in the case a crystal glass breaks caused by the sound of that specific singing note. It is at the resonance frequency that vaporization can be guided and amplified. The research was done using droplets of hydrofluorocarbons (HFCs), with a low boiling point.

The paper 'High-frequency acoustic droplet vaporization is initiated by resonance', was published in [Physical Review Letters](#).

Pressure six times lower

In practice, vaporization is hard to control, as nucleation points are needed: these are the triggers for vaporization. The drastic lowering of pressure taking place at resonance – six times lower than in the surrounding fluid – causes a dramatically higher vaporization

probability.

The resonance effect is caused by the difference in the speed of sound: inside the fluorocarbon, it is much lower than in the water or tissue surrounding it.

The right moment

By sending an acoustic wave to the droplets, the researchers demonstrate how vaporization is triggered. This highly controlled vaporization may introduce new ways of treating tumors.

Imagine switching the vaporization 'on', the moment the droplet has invaded the tumor: this can damage the tumor caused by the violent way vaporization takes place. It can also be used for delivering drugs in the tumor locally and exclusively, without side effects in the rest of the body.

The new insights into resonance-guided vaporization can, except for medical applications, be important in energy storage or combustion processes.

Read the [original article](#) on University of Twente.