Medicine released from pill filmed

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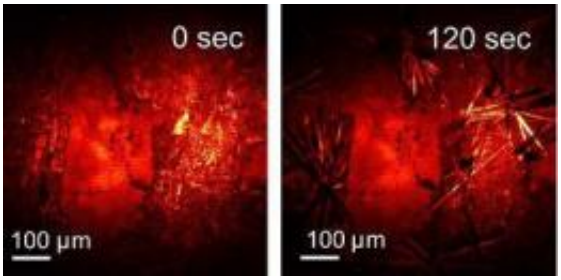

In the case of a smooth pill surface (the even surface to the left of the image) no crystals have formed even after 120 seconds, whereas in the case of the rough pill surface (to the right and far left of the image) crystals have formed. Images by Maike Windbergs and Martin Jurna

(PhysOrg.com) -- In an international alliance with funding from NanoNed, the Dutch national research programme, researchers at the University of Twente, the Netherlands, have succeeded in filming the spread of medicine from a pill in real time.

The results show that there are big differences in the spread of medicine from different pills. These data are relevant because the speed with which the medicine is released determines how much of it should be given and how frequently. By incorporating medicine in pills in the correct manner, pills can be tailor-made to deliver specific amounts of medicine. The researchers are publishing their results in the March number of the professional journal, Analytical Chemistry.

Medicines we take in the form of a pill are packaged in material (the pill as a whole) that gradually releases the medicine into the body by diffusion. Precisely how this takes place in the body determines the efficiency of the pill. Under the leadership of Herman Offerhaus, researchers Maike Windbergs (of the Universität Düsseldorf, Germany) and Martin Jurna (NanoNed/University of Twente) filmed the spread of theophylline (a medicament for asthma) from various types of tripalmitin pills using a technique known as CARS microsopy. CARS (the abbreviation stands for Coherent Anti-Stokes Raman Scattering) makes it possible to distinguish between, and image, specific molecules.

The results of the study show that there are large differences in the spread of the medicine from different pills. Pills made by pressing tripalmitin have rougher surfaces than those made by extrusion when the surface melts slightly and becomes relatively smooth. The smoother surface does not allow the medicine released from the pill to adhere to it. This is, however, possible with the rougher pills; long, needle-shaped crystals of the medicine even grow on the surface. In the case of a smooth surface, the medicine therefore passes into the environment (and thus into the bloodstream) faster and more easily than in the case of a rough surface.

These data are relevant because the speed with which medicine is released determines how much medicine must be administered and how often. By incorporating medicine in pills in the correct manner, pills can be made that are tailored to delivering specific doses of medicine in a controlled manner, as is the case with drips.

The speed with which the medicine is released from the pill is not the only factor that determines the dosage. In a follow-up to this project, the research groups of Clare Strachan (University of Otago, New Zealand), Peter Kleinebudde (Dusseldorf, Germany) and Jennifer Herek (head of the research group at the University of Twente) will also try to measure

subtle changes in the state of the medicine (by adherence of water molecules) during spread.

The research group at the University of Twente is measuring pills because it was looking for an industrial application in which label-free measuring (that is, without added markers) is very important; the addition of markers to the medicine alters its diffusion behaviour, making efficacy measurements inaccurate. This is, furthermore, a good example of chemical-specific detection in which the medicine and the pill can be measured separately. It demonstrates that the CARS technique is applicable in a realistic medical/biological environment and not only in gas bundles or solid crystals. The basis created here will enable the imaging of increasingly specific things in cells and increasingly specific molecules (such as for the detection of Alzheimer's disease in blood).

More information: The article 'Chemical Imaging of Oral Solid Dosage Forms and Changes upon Dissolution Using Anti-Stokes Raman Scattering Microscopy' by Maike Windbergs, Martin Jurna, Herman Offerhaus, Jennifer Herek, Peter Kleinebudde and Clare Strachan will appear in the March number of *Analytical Chemistry*. pubs.acs.org/doi/full/10.1021/ac8020856

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