Scientists make droplets move on their own

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Droplets are simple spheres of fluid, not normally considered capable of doing anything on their own. But now researchers have made droplets of alcohol move through water. In the future, such moving droplets may deliver medicines, etc. To be able to move on your own – to be self-moving – is a feature normally seen in living organisms. But also non-living entities can be self-moving, report researchers from University of Southern Denmark and Institute of Chemical Technology in Prague, Czech Republic.

The researchers have made alcohol droplets move in a life-like way, and this could lead to interesting new technology, they say.

"The system itself is very simple but yet it displays sophisticated behavior", explains principal investigator Martin Hanczyc, who was at Center for Fundamental Living Technology (FLINT), University of Southern Denmark, when the research was done.

Martin Hanczyc is now at Centre for Integrative Biology, University of Trento in Italy. The study's first author is Jitka Cejkova, also formerly with University of Southern Denmark, now assistant professor at the Chemical Robotics Laboratory of Professor Frantisek Stepanek at the Institute of Chemical Technology in Prague.

Hanczyc and his colleagues from Prague have shown that small droplets of alcohol in water can move through complex mazes. The droplets can be led to certain targets, and therefore they may be used as a technology to physically move chemistry to a place where it is desired.

"For example, the droplet can act either as a lubricant, targeting an area that needs lubrication. Or the droplet can act as a carrier for chemistry that can find a target destination and release its content, such as flavoring, medicine etc.", Martin Hanczyc explains.

The droplets start to move when they sense salt in their environment.

"Salt is the stimulus that makes them move. They move because the salt gradient provides a different energy landscape. It is like taking a ball that is laying still on a flat surface and then suddenly make the surface hilly. The ball will roll to the lowest accessible point. That is what the droplet is doing. Without a salt gradient every direction in which a droplet might move looks the same (flat). But with a salt gradient coming from one direction the droplet can move energetically downhill into the salt gradient. And stronger salt concentrations will attract the droplet more", says Martin Hanczyc.

The system is sustainable in that the same droplet can migrate towards salts at different positions added sequentially. In addition the droplet can distinguish between salt sources of different concentration. The process can also be controlled by external temperature stimulus, and when the droplet arrives at the source it can physically fuse with it and react with it.

Martin Hanczyc has previously reported that oil droplets display a life-like moving behavior and may be a simple chemical predecessor to biological life.

More information: Dynamics of chemotactic droplets in salt concentration gradients, Jitka Cejkova, Matej Novak, Frantisek Stepanek, and Martin Hanczyc. *Langmuir*, Sept 12 2014. pubs.acs.org/doi/pdf/10.1021/la502624f

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