Microencapsulation Using Microfluidic Processes

Dr Tim Ryan

Epigem Limited, Malmo Court, Kirkleatham Business Park, Redcar, TS10 5SQ, UK

tim.ryan@epigem.co.uk

Abstract:

Any discussion on applications of microfluidics inevitably begins with the lessons learnt from nature, where microfluidics is ubiquitous. This talk will be no different and will address the benefits of microfluidics for product formulation, particularly microencapsulation of gases and liquids using phospholipids and high throughput, microfluidic droplet generation components. Formulation of microdrops, at the point of need, at an estimated rate of10^6 /sec is as relevant to a snake spitting to defend its space, as it is to microbubble formulation of contrast agents for ultrasound image enhancement and drug contrast delivery for cancer theranostics.

Living systems maximise throughput and reaction rate using manifolded together (bloodstream vasculature), microcellular arrays (microreactors) combined within a fast (ns), molecularly self-assembled, single pump operated, infrastructure. Whilst we cannot yet achieve the same 3D elegance, throughput in industrial terms is achieved using the combination of high spray rates and by manifolding multiple spray head devices (in multilayered or stacked arrays). Sequenced input from multiple inlets of gas and liquids provides specific encapsulation by self-ordering phospholipids – which themselves can be chemically modified or tailored to create various droplet or bubble surface functions.

Within an EPSRC Healthcare Partnership Project, “Engineering Therapeutic Microbubbles” (EP/I000623), Leeds University and Epigem have successfully developed on-chip microfluidic formulation of microbubbles (MBs). We have demonstrated that these MBs efficiently deliver drugs to treat colorectal cancer *in vivo*, in animal models of the disease. The main achievements of this project will be summarised.