GLOBAL RESEARCH TRANSLATION AWARD

University of East Anglia

We support the Sustainable Development Goals

Developing innovative supplements for child malnutrition at UEA

The Global Research Translation Award (GRTA) project is funded from the UK government's Global Challenges Research Fund (GCRF) Innovation and Commercialisation Programme, developed to fast-track promising research findings into real-world solutions. UEA is leading a £1.36 million project to help tackle health, nutrition, education and environment issues in developing countries.

One of the sub-projects is coordinated by Dr Sheng Qi at the School of Pharmacy, University of East Anglia (UEA), developing low-cost and child-friendly micronutrient supplements with regional partners in Brazil, Jordan, Malaysia and Thailand. In this blog, Research Associate Thomas McDonagh describes some of the innovative methods the team at UEA are using to create customized supplements which are easy for children to consume.

Oral dispersible films (ODFs)

The research team at UEA are developing novel fabrication methods for manufacturing oral dispersible films (ODFs) to combat child malnutrition in developing countries. ODFs are thin flexible films which can be administered orally, efficiently delivering desired nutrients to the recipient. The small, readily dissolvable films are ideal for small children that struggle to swallow pills and tablets. They are also effective for nutrient delivery because the active ingredient diffuses directly into the bloodstream in the mouth, bypassing the gastrointestinal tract. Crucially for this project, the vitamins and minerals in the ODF can be tailored to the specific dietary deficiencies of each country to combat child malnutrition effectively and efficiently.

Example of an oral dispersible film (ODF)

In this project we are particularly interested in electrospinning and 3D printing for creating the ODFs. These two fabrication methods give us a large degree of control over the inner geometry of the film, which enables disintegration times and drug release profiles to be fine-tuned. By characterising and controlling these parameters we hope to create a drug delivery platform that can be tailored to specific populations and applications.

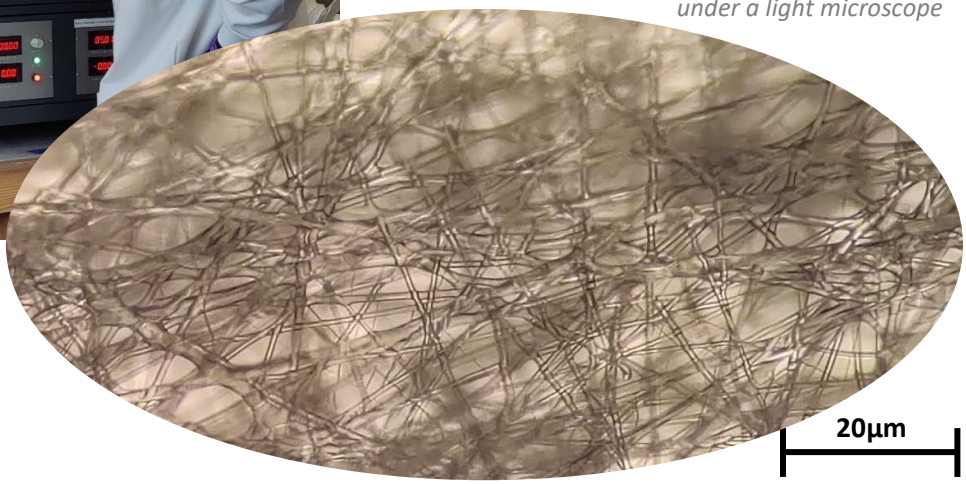
Electrospinning

One of the methods we are exploring is a relatively recent electrospinning technique, called emulsion electrospinning, which creates very thin, highly porous ODFs with both an aqueous and lipid phase. Different types of micronutrients usually have good solubility in only one of the two phases which limits application. By including both phases in the same ODF, we can incorporate water soluble compounds such as iodine, and lipid soluble compounds such as vitamin D, thereby reducing the amount of supplements a child needs to take.

Research Associate Thomas McDonagh tuning the nanofibre electrospinner

Electrospun fibres (see picture below) are incredibly thin, up to 1000 times thinner than a strand of hair, giving them a huge surface area to volume ratio. This means the film will disintegrate rapidly in the mouth.

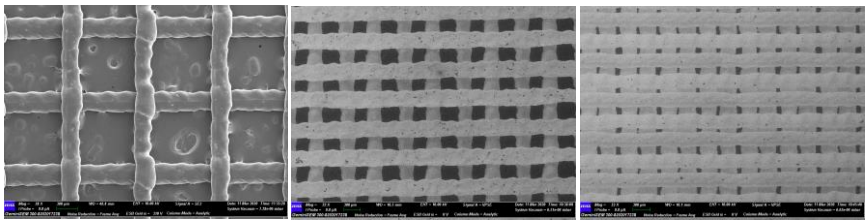
Electrospun fibres as seen under a light microscope



3D printing

Through a partnership with PCE automation, a regional engineering company, we have gained use of an exciting high-end 3D printer, called the Arburg FreeFormer. The Freeformer can print intricate structures with a high degree of accuracy and more importantly has the flexibility to allow us to print with our own custom materials. Before the Covid-19 lockdown, we experimented with the geometric capabilities of the machine using a standard 3D printing material.

A few of the lattice structures printed during this experimentation are shown to the right. By controlling the surface area to volume ratio and pore geometry it is possible to alter the degradation and release profiles of the micronutrients, creating dosage forms that can release immediately or over a prolonged period of time.



25% in-fill **50% in-fill** **75% in-fill**

Scanning electron micrograph (SEM) of lattice structures printed by the Freeformer (all images have the same scale)

Future Work

Following on from the promising fabrication of electrospun and 3D printed ODFs we will perform micronutrient release studies and conduct taste testing trials to assess patient compliance. We hope to welcome our GRTA partners from Jordan, Thailand, Malaysia and Brazil to UEA to share knowledge. Each partner will adjust supplement composition and flavour based on profiles of local populations. The partners are working with industrial partners in their own countries to maximise local capabilities for the long-term and low-cost production of supplements to ensure sustainability.

Blog written by Thomas McDonagh, Research Associate at the School of Pharmacy at UEA and Hannah Gray, GRTA Project Officer at UEA on 24 June 2020.

[Click here to go to the GRTA Child Malnutrition webpage]