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**Development of micron and submicron scale carriers for drugs and nutrients delivery**

**Abstract**

Formulating multiple nutrient supplements and better dosage forms for paediatric patients are still current needs and challenges. This study aims to develop a cost-effective novel delivery system capable of delivering water-soluble and oil-soluble nutrients or drugs to address paediatric compliance. Two ranges of micron and submicron scale carriers for nutrients and drugs were developed and characterized thoroughly. First, fast-dissolving orodispersible film was produced using an emerging electrospinning technique to deliver iodine, an essential micronutrient. PEO and  $KIO_3$  were used in a formulation that ensures the safety and cost-effectiveness of the final product. Second, a novel structured oil system (SOS), capable of holding a large amount of oil, was designed as a carrier for fat-soluble vitamins and drugs. This SOS was produced using a freeze dryer that is suitable for heat sensitive vitamins and drugs. Gelatine/Xanthangum were used as emulsifiers due to the affinity of protein-polysaccharide complexes to form emulsions stable to environmental stresses such as freezing. In addition, a range of SOSs were formulated using Hypromellose/Xanthangum, Methylcellulose/Xanthangum, Tween 20/Xanthangum, and Gelatine/Carboxymethylcellulose in order to understand the formation of SOS, to prove the concept that any surface active and non-surface active polymers that can form electrostatic complexes can form SOS, and to find an alternative to Gelatine/Xanthangum emulsifiers. A thorough physicochemical characterisation of both the fast-dissolving orodispersible film and structured oil systems was conducted using a range of analytical techniques including imaging techniques (various optical and electron microscopes, and  $X\mu$ CT), ATR-FTIR, PXRD, DSC, TGA, a texture analyser, LD, and *in vitro* dissolution testing.

This study demonstrated that electrospinning technology has great potential to be used in formulating a dosage form for children, that liquid vegetable oil and fish oil can be encapsulated within fibres using emulsion electrospinning and introduced a novel solid structured oil system capable of holding large amounts of oil.

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