Why crystals could be the shape of future pharmaceuticals

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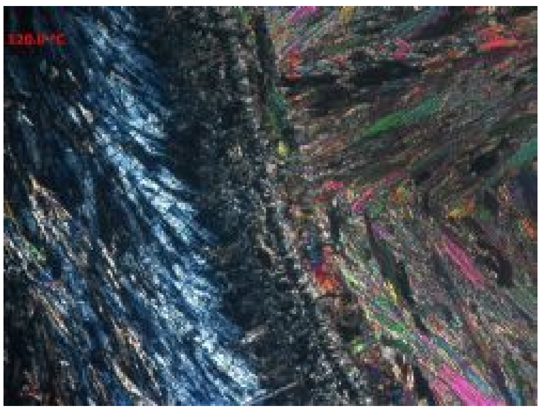

Scientists from across the UK and Europe are working together to build a better understanding of the chemical processes behind the creation of crystals with the aim of developing new ways to produce pharmaceuticals.

Crystallisation - the process of crystal formation via crystal growth - is typically employed in chemical manufacturing as a purification step or to isolate a final product and determine its quality.

Despite its widespread uses, understanding the precise molecular mechanisms which occur during crystallisation remains a scientific challenge, particularly for organic compounds.

The Crystallize research network, funded by COST (European Cooperation in Science and Technology), brings together recognised scientific leaders in the field to develop new ideas, research and share knowledge in the science of crystallisation. The inaugural meeting 'Crystallize - From molecules to crystals - how do organic molecules form crystals?' will take place from June 22-25, 2015 in Marseille, France.

The objective is to increase academic and industrial understanding of the structure and function of crystals in order to custom-design new materials for specific applications, such as pharmaceuticals.

Led by Dr Simon Lawrence at University College Cork, the group involves Professor Nicholas Blagden from the School of Pharmacy at the University of Lincoln, UK, who is involved in the management committee to represent the UK and support the working group in crystal growth.

Professor Blagden explained: "Crystal growth is the science behind creating a crystal - about how and why crystals form. Particularly over recent years the pharmaceutical industry has shown more of an interest in organic crystals and their use in creating new drugs.

"The big problem is that we have still got a lot to learn about how crystals actually grow as it's not clear how they change from a liquid to a solid state. This is called 'nucleation' and is the first step in crystallisation, determining if a crystal can form from a liquid state. A bigger effort has now begun to understand crystallisation and how it impacts on everything from chemicals to pharmaceuticals. We need to understand this process so we can deal with the bigger problems. It's about sharing advice and experience."

Professor Blagden is known for his work in crystal growth, crystal engineering and polymorphism (the ability of a solid material to exist in more than one crystal structure).

He is part of a team of researchers at the University of Lincoln focussed on crystal growth, specifically around the pre-formulation of drugs. In Lincoln's Crystallisation Lab researchers are growing nanocrystals on tiny plastic chips, meaning they can produce larger volumes and have much more control over the growth process.

Professor Blagden said: "If you look at modern society many everyday items evolve from a crystal at some point. There are crystals in the filaments in lights, in bricks and mortar and even in the metal of a chair frame. Crystals are everywhere. Developments in advanced analytical techniques and computational methodologies are beginning to provide insight into how molecules interact in solution and ultimately form crystals. Together with studies into different phases, in confined systems, on surfaces and with impurities, this will improve our understanding of crystallization processes."

Professor Blagden is also involved in research exploring the formation of co-crystals with small drug molecules or biologics such as peptides - a new crystalline structure produced from the two forming materials - and their potential use in drug delivery.

Many new drug discoveries are difficult to develop into viable dosage forms because of their inherently poor structural properties. For example, they are often poorly soluble, or problematic to crystallise and therefore the active ingredient is difficult to dissolve.

One potential method of improving the solubility of certain drugs is to form a co-crystal of the drug with another pharmaceutically accepted material, such as a sugar or vitamin.

Provided by University of Lincoln