Improving drug treatments with natural products

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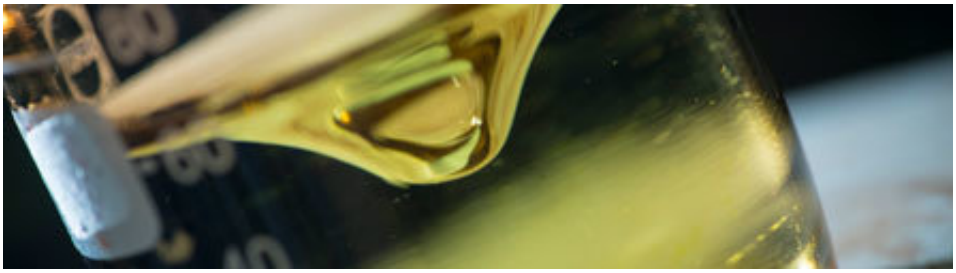

Credit: University of Nottingham

Turmeric, shrimp shells, beeswax and cocoa butter are being used to improve the effectiveness of drugs and reduce side effects when treating a range of diseases including cancer and diabetes.

Research is being carried out at the University of Nottingham Malaysia to discover how these 'natural products' can improve the ways drugs are delivered and their efficiency, whilst also minimising any side effects.

The team led by Professor Nashiru Billa in the School of Pharmacy has been studying curcumin from turmeric and are looking into developing ways to deliver this effectively in dosage forms to treat colon cancer, specifically targeting tumour cells with minimal side effects unlike with conventional chemotherapy.

Turmeric to improve treatment for Colon Cancer

Professor Billa explains: "We are mainly using natural molecules such as turmeric, chitosan from crab or shrimp shell, and pectin from the rind of orange in the construction of the delivery system. This 'natural product' is ideal as it is biocompatible, biodegradable and muco-adhesive, which means it sticks to the surfaces of the colon intestine. We then package these components in nanoparticles and deliver it to the colon where it will act locally.

"One of the issues with the treatment of cancer currently is that there is a very negative impact in the treatment due to the intense side effects of the chemotherapeutic agents. The fact that we are using curcumin means that the side effects are reduced significantly as it can be packaged in a way that specifically targets just the cancer cells in the colon and not healthy tissue. This is achieved by attaching antibodies on the surfaces of the nanoparticles that recognise and are attracted to colon cancer tissue. Furthermore, pectin also has anticancer properties when modified, as we have done here so that the effects of curcumin are reinforced."

Nanoparticles are of the order of one billionth of a meter and are the tiniest of all delivery systems. They are constructed in our labs by admixture of chitosan, pectin, curcumin and a cross-linker which knits the components into nanoparticles. The nanoparticles have the ability to penetrate the cancer tissue after recognition and carry the curcumin cargo along.

Reducing toxic side effects

The research team is also investigating reducing the toxic side effects that occur with an antifungal medication called Amphotericin B that is given to treat serious diseases caused by fungus such as Sepsis,

Pneumonia and Meningitis. This medication is currently given intravenously but can cause kidney and heart problems.

Using cocoa butter and beeswax the scientists are developing a pill that can effectively deliver anti-fungal medication into the bloodstream via the GI tract with less toxic side effects. Professor Billa said: "We have used components such as beeswax and cocoa butter to act as a vehicle to produce nanoparticles that improves the bioavailbilty of Amphotericin B. We are also trying to improve the uptake of the drug by slowing its transit in the gastrointestinal tract. To do this we apply a coating of chitosan on the surface of the nanoparticles. The idea is to try and increase its transit time and by doing so we can ensure that there is maximum uptake of the drug into the blood."

Better release of medicine

Another project that incorporates the use of chitosan is aiming to create a diabetic drug delivery system that responds to the glucose level in the blood. This system will use microparticles that expand when they come into contact with glucose and then respond by releasing insulin. The research team are aiming to develop a system that can be embedded under the skin, that releases the insulin gradually over time reducing the need for daily injections.

Professor Billa concludes: "All of the work we are doing is finding new frontiers in drug delivery and is completely new. Most drug delivery solutions being developed are based on nanoparticular systems because these have capabilities that cannot be found in the current conventional systems. The natural approach we are taking in this research is unique and the benefits will not only be for the patient, but also provides a cost effective solution for the pharmaceutical industry."

Provided by University of Nottingham