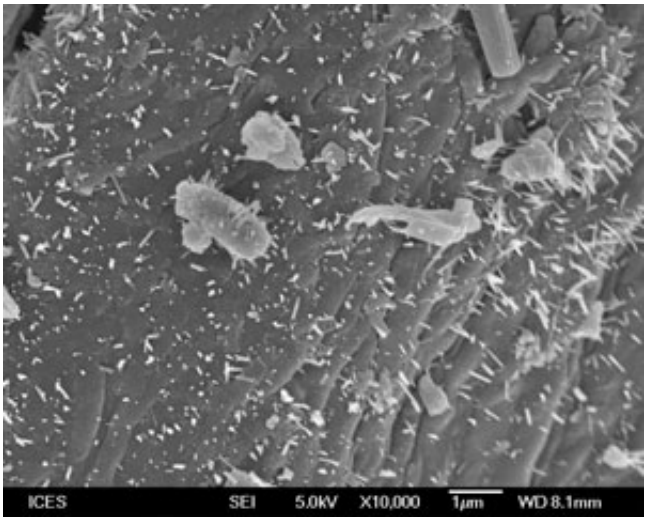
Insoluble dietary fiber could help make antioxidant quercetin more soluble

September 8 2017



A scanning electron microscope image showing the quercetin nanoparticles bonded to the surface of the cellulose fiber. Credit: A*STAR Institute of Chemical and Engineering Sciences

A common plant pigment that is also a potent antioxidant could soon be a mainstream health supplement, as A*STAR researchers get closer to making it soluble.

Laboratory and animal studies of quercetin – one of the most abundant dietary plant-based antioxidants – suggest it could offer antioxidant, anti-cancer, anti-obesity, anti-inflammatory and anti-microbial benefits if incorporated in food supplements. However its use has been limited by

the fact that it does not dissolve in water, which reduces its absorbability.

The research team, led by Yuancai Dong from the A*STAR Institute of Chemical and Engineering Sciences faced two key challenges; the first was to find a way to break the quercetin down into nano-sized particles that would enable it to be better absorbed in the gastrointestinal tract, and the second was to stabilize the nanoparticles so they did not clump together into a less soluble form.

"There are some publications in the literature about the preparation of quercetin nanoparticles, but these nanoparticles become highly agglomerated immediately after formation and/or during the drying process, so their benefits are severely diminished," says Dong

To solve these problems, the team first formed nanoparticles from quercetin in an ethanolic solution by adding water, to which they added insoluble dietary fibers in the form of cellulose or resistant starch. "We used dietary fiber as the matrix former, so the quercetin nanoparticles can be individually deposited on to the fibers' surface, which guarantees the full benefits of a faster dissolution rate," says Dong.

Normally when quercetin nanoparticles are formed, they agglomerate and grow into large particles within minutes. But with the addition of the insoluble dietary fiber, the quercetin nanoparticles bind to the surfaces of the fiber particles instead. The solution was then spray-dried to a powdered form, yielding nanoparticles that were stable and non-clumping.

This technique avoided the clumping problems that had previously thwarted efforts to create quercetin nanoparticles, and the resulting nanoformulation was found to be significantly more soluble than raw quercetin.

As an added benefit, the cellulose and resistant starch brought their own health benefits that further boosted the antioxidant effects of the quercetin.

"We think the quercetin nanoparticle/dietary fiber formulation could be used as a novel food ingredient or as a supplement," Dong says. However given quercetin has a less-than-pleasant taste, further processing is necessary to make it a feasible food additive.

More information: Chia Miang Khor et al. Preparation and characterization of quercetin/dietary fiber nanoformulations, *Carbohydrate Polymers* (2016). DOI: 10.1016/j.carbpol.2016.12.059

Provided by Agency for Science, Technology and Research (A*STAR), Singapore