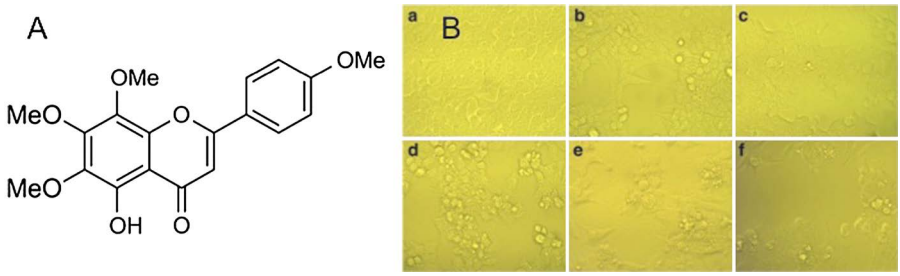

Figure 6.3 (A) Chemical structure of 5-demethyltangeretin. (B) Effect of nanoemulsion containing 5-demethyltangeretin on HCT116 cancer cells after 24 h of treatment. (a) Control cells; (b)-(f) morphological changes induced by 1.6 μM 5DT delivered in bulk water, bulk oil and emulsions with different mean droplet radii (203, 125 and 67 nm), respectively. Reprinted with permission from ref. 89, *Food Research International*, 62, Jinkai Zheng, Yan Li, Mingyue Song, Xiang Fang, Yong Cao, David Julian McClements, Hang Xiao, Improving intracellular uptake of 5-demethyltangeretin by food grade nanoemulsions, 98–103, Copyright 2014 with permission from Elsevier.

were lecithin, pea proteins, sugar ester and a combination of Tween 20 and glycerol monooleate. The anti-microbial activity was found to be dependent on the formulation method of nanoemulsions—the sugar ester-based and Tween 20 and glycerol monooleate mixture-based nanoemulsions showed antimicrobial activity for a short period of time, while the nanoemulsions based on lecithin and pea proteins showed antimicrobial activity for an extended period of time. The authors suggest that these observations can be used in a rational way to design nanoemulsion-based delivery systems for food-related applications.[90] A novel study where protein hydrogels were used as the matrix for microencapsulation of bilberry anthocyanins was reported, where whey protein was used as the matrix material. Phosphatidylcholine-depleted lecithin was used as the emulsifier. The results of this study prove that protein-based encapsulation is comparable to the well-studied polysaccharide-based systems for encapsulating active compounds.[91]

6.3.2 Nanoencapsulation/Nanoparticles

Encapsulation is the process of entrapping active agents within another carrier substance to improve the activity of the encapsulated active compound. Encapsulation can be used to create a protective covering around the active compound to stabilize it, prevent unwanted reactions and improve the delivery of the bioactive compounds. Different encapsulation technologies are available for the protection of bioactives in food.[92,93] Nedovic and coworkers explained the concept of encapsulation and described the materials used for encapsulation, techniques used in encapsulation and various examples of encapsulated food products.[92] Each bioactive food component has its own characteristic properties and the encapsulation technology used will depend