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The use of encapsulation of cross-linked polysaccharide salts and micelles as a carrier for hydrophobic medicinal substances

Drug absorption is a significant problem, especially if the active ingredient is fat-soluble and intestinal absorption is desired. There are many strategies to build drugs with microbubbles and micelles. Micelles are spherical forms of detergent molecules (surfactants), formed in an aqueous environment, the interior of the micelles being hydrophobic and the outer layer hydrophilic.

The aim of the present experiment (pilot study) was to create a vehicle for a model hydrophobic drug that will be released in the intestines (alkaline pH) and not in the stomach (acidic pH).

In the study, micelles were created into which a hydrophobic dye (simulating a hydrophobic drug) was incorporated. Subsequently, microparticles (microbubbles) were produced from sodium alginate (a sticky substance obtained from seaweed) in which the previously produced dye micelles were encapsulated. Two cross-linking solutions (causing alginate coagulation) were used. The resulting microparticles were observed with a confocal fluorescence microscope to confirm the presence of the dye inside the vesicles. Then, one day later, the follicles were soaked for 45 minutes in solutions imitating gastric and intestinal juices. The vesicles were then analyzed under a confocal microscope.

As a result of the experiment, it was possible to effectively enclose a hydrophobic model drug (dye) in alginate vesicles, thanks to its earlier encapsulation in micelles. The microparticles cross-linked in one of the salt solutions were broken down in the intestinal juice, and not in the gastric juice. However, in the case of vesicles cross-linked in the second salt, the release of the dye from the inside of the microparticles took place in both solutions simulating gastric and intestinal juices.

Encapsulated in vesicles (e.g. sodium alginate), micelles can serve as a stable carrier of hydrophobic drugs, e.g. anti-cancer drugs. Depending on the cross-linking salt, it is possible to obtain a potential carrier for drugs which are more advantageously released in the intestines.