

Abstract

This Bachelor thesis deals with the characterization of curcumin nanocrystals using capillary electrophoresis with UV-VIS and laser-induced fluorescence (LIF) detection.

Curcumin is a natural polyphenolic substance with many biological effects. Its low solubility is one of the main reasons for its low bioavailability, however, it can be increased by preparing curcumin nanocrystals.

In the experimental part, the effects of the composition of the background electrolyte (BGE) and the applied voltage on the curcumin nanocrystals were investigated. Background electrolytes were prepared using phosphoric acid, or HEPES and their pH was adjusted to 7.0 by NaOH, or TRIS, to test whether the shape of the peak is influenced by the ionic strength of BGE and not by the increasing concentration of a particular BGE component. Initial experiments did not involve voltage application, but only a pressure of 50 mbar. In following experiments both positive and negative voltages were applied, using a 10mM phosphate buffer, the pH of which was adjusted using TRIS. Most of the experiments were conducted using a 100nm curcumin nanocrystals sample.

Curcumin nanocrystals provided an abnormally wide peak in both UV-VIS and LIF detection. It was found that the dispersion of the nanocrystal zone was not caused by diffusion, and that the blurring of zones occurs due to parabolic flow profile when pressure is applied. Furthermore, peak height was found to decrease with increasing ionic strength, which is likely due to the aggregation of nanocrystals into larger units, which are shown as extremely narrow and high peaks in experimental record. This phenomenon occurred for all buffers tested at roughly the same ionic strength values. Subsequently, the negative surface charge of nanocrystals and their migration towards the anode were confirmed by an experiment in which the zone of nanocrystals moved towards the neutral marker at different times of positive and negative voltage application. The impact of nanocrystal size has also been studied, where increase in particle size resulted in greater blurring of zones due to parabolic flow profile, as well as decreasing signal intensity of nanocrystals.

Keywords

Curcumin, capillary electrophoresis, UV-VIS detection, LIF detection, curcumin nanocrystals