CYCLODEXTRIN-MEDIATED INTERCALATION OF LYCOPENE INTO CATION-EXCHANGED MONTMORILLONITE

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Lycopene present in tomato (*Solanum lycopersicum* L), has wide-ranging pharmacological characteristics including antioxidant, hypocholesterolemic and anticancer. However, lycopene has poor water solubility and is oxidised rapidly, resulting in poor systemic bioavailability. In the present study, new composites of layered H^+- and Al^{3+}-exchanged montmorillonite (MMT) clays, β-cyclodextrin and lycopene were prepared, and releasing of lycopene from the composites at pH values of gastric and intestinal fluids was investigated. These clay composites are unique because they are expected to contain lycopene molecules in a torus-shaped channel (i.e. β-cyclodextrin) encased in a layered matrix of clay.

H^+- and Al^{3+}-exchanged MMT clays were prepared by treating MMT with aqueous HCl and $AlCl_3$, respectively, employing standard procedures. Lycopene, isolated from tomato by solvent extraction (hexane:acetone:ethanol, 2:1:1), was mixed with aqueous solutions of β-cyclodextrin (β-CD) and cation-exchanged clay to obtain various clay composites, which were characterized by FT-IR spectroscopy. The amount of lycopene trapped in each clay composite was determined by UV-Vis spectroscopic analysis of lycopene remaining in the supernatant, at 471 nm. With Al^{3+}-MMT and H^+-MMT, the composites contained 97% and 92% of lycopene, respectively, when all three components-LYC, β-CD and the clay-were mixed together. The H^+-MMT and Al^{3+}-MMT clays, when treated with β-CD initially, trapped 93% and 84% of lycopene, respectively. According to FT-IR spectra, appearance of new peaks which are characteristic of lycopene indicated the formation of a new composites containing lycopene. According to TGA, appearance of new decomposition step at 250-350 ^{0}C indicated the formation of new composites. In the absence of β-CD, the characteristic FT-IR peaks were not observed for the clays. It was found that optimum stirring time for intercalation was 2 h.

The amount of lycopene released when composites were stirred in buffer solutions was determined. Minute releasing of lycopene was observed in simulated gastric fluid (pH 1.2) and significant releasing of lycopene in simulated intestinal fluid (pH 7.4) after 6 h. It can be concluded that lycopene can be successfully trapped in cation-exchanged montmorillonite clays with the mediation of β-cyclodextrin and that the intercalated composites may pass through the acidic stomach and reach the intestine where lycopene is released.