A Study on Sustained Drug Releasing Properties of Acarbose Intercalated Na-montmorillonite for Potential Pharmaceutical Applications

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Acarbose is a well-known synthetic drug, which commonly treats type II diabetes. For diabetic patients, acarbose must be administered multiple doses a day to keep a stable glucose level in the body due to short biological half-life. Therefore, drug formulations with sustained releasing properties are developed using stable carriers like, Montmorillonite (MMT) due to its unique structure and properties. In this study, acarbose intercalated clay formulations were synthesized and their sustained releasing properties tested. Acarbose solution (100 ppm) was stirred with MMT (1 g) for 24 h at 4–8 pH. The highest intercalation of acarbose was observed at acidic pH due to electrostatic interactions between negatively charges clay layers and protonated acarbose molecules. The concentration of acarbose in aqueous solution was determined using the UV-Vis spectroscopy method. The calibration curve (2–40 ppm) of standard acarbose (r^2 =0.9826) at 426 nm, was used for calculating the acarbose intercalation percentages. 2.18 mg g^{-1} (43.77%) and 5.1 mg g^{-1} (52.27%) of acarbose intercalated into MMT at pH 6 and the interlayer space of unmodified montmorillonite has been increased from 1.185 to 1.310 nm and 1.403 nm upon acarbose intercalation at 50 ppm and 100 ppm initial acarbose concentrations, respectively. This concludes that acarbose has been successfully intercalated into the interlayers of montmorillonite and the intercalated amount increased with increasing the initial acarbose concentration. Increased intensity and broadening of the peak corresponding to vibrations of OH groups (3687–3125 cm^{-1}) was observed in FTIR spectra of acarbose intercalated montmorillonite, which may due to the presence of acarbose on or between the layers of montmorillonite. The *in-vitro* drug releasing properties of acarbose from acarbose intercalated montmorillonite was tested in artificial intestinal condition (pH 7.4 PBS solution) using dialysis tube method. Acarbose releasing from the montmorillonite matrix was gradually increased in the first 8 h and slow release was observed after that. Pseudo-second order kinetics model showed a good fit (r^2= 0.9767) for the acarbose releasing data suggesting the release of acarbose from MMT matrix involves chemical desorption. Overall, this study demonstrates the potential applications of montmorillonite as matrix material for sustained release drug formulations for future pharmaceutical studies.

***Keywords*:** Acarbose; Montmorillonite; Sustained drug releasing; XRD; FTIR