Novel Carbon dot coated Alginate beads with superior stability, swelling and pH responsive drug delivery

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Electronic Supplementary Information (ESI)

Preparation of Carbon dots (CD)

Chitosan based carbon dots were synthesized using chitosan hydrogel. To prepare chitosan (CH) hydrogels 1% glacial acetic acid solution and glycerol were mixed in the ratio of 1 part acetic acid solution to 3 parts glycerol and used as the solvent. 0.1 g chitosan was dissolved in 10 ml of the aforementioned solvent by stirring with a magnetic stirrer at room temperature for 1– 2 h to form a clear pale yellow solution. The solution was neutralized by adding 5 N NaOH. Immediately a clear, slightly tacky gel was formed. The gel, which apparently results from the interaction of chitosan, glycerol and water, has a three dimensional structure, and no free water or glycerol is apparent.

The prepared CH hydrogel was then dissolved in 30 ml of 0.1 M acetic acid and heated in a microwave for 5-10 mins until a transparent thick liquid is observed. When viewed under UV lamp this transparent thick liquid showed excellent blue coloured fluorescence confirming the formation of carbon dots from chitosan hydrogel.

Photoluminescence properties of Carbon dot coated alginate beads(CA-CD) and carbon dot coated alginate bead after drug loading

We studied the fluorescence properties of Carbon dot coated alginate beads(CA-CD) and carbon dot coated alginate bead after drug loading (CA-CD/TC). In this regard solid fluorescence was taken for Ca beads, CA-CD and CA-CD/TC as shown in figure S1 (A). As evident from the figure PL emission is very weak. The weak PL emission is due to quenching of carbon dot emission on coating on alginate bead.

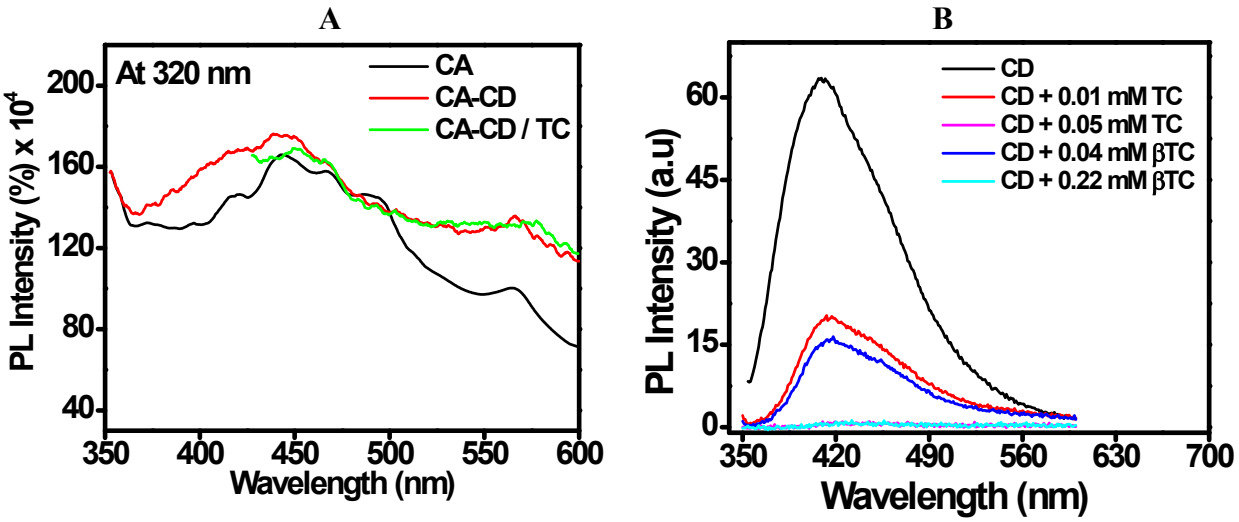

Figure S1. (A) Comparative solid photoluminescence emission spectrum of CA bead, CA-CD (alginate bead coated with carbon dots) and CA-CD/TC (alginate bead coated with carbon dots after drug loading).(B) Photoluminescence of carbon dots and its PL properties upon addition of TC and β-TC.

PL properties of carbon dot in presence of TC and ß-TC was studied and shown in figure S1 (B). PL emission shows that there is quenching of PL intensity on addition of TC drug. Same trend is also observed with ß-TC. It is observed that quenching of PL intensity is more pronounced with ß-TC than TC.

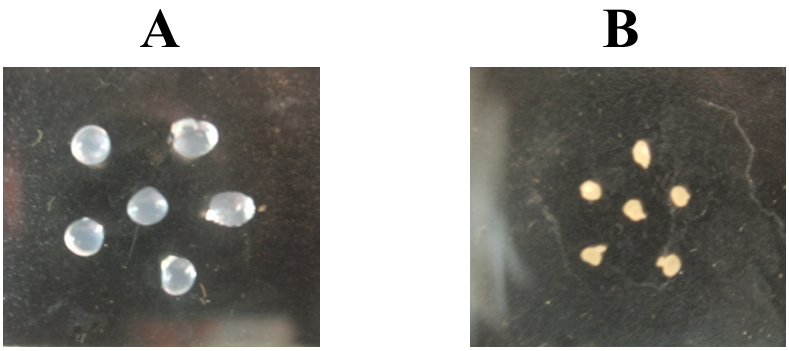

Figure S2. Photograph of (A) CA bead, and (B) Chitosan coated calcium alginate bead.

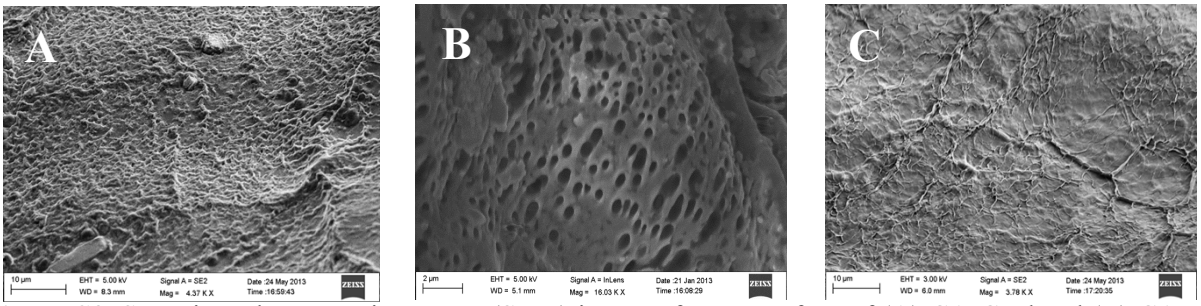

Figure S3. Scanning Electron Microscope (SEM) image of outer surface of (A) CA-CD bead (B) CA-CD bead at higher magnification and (C) CA bead.

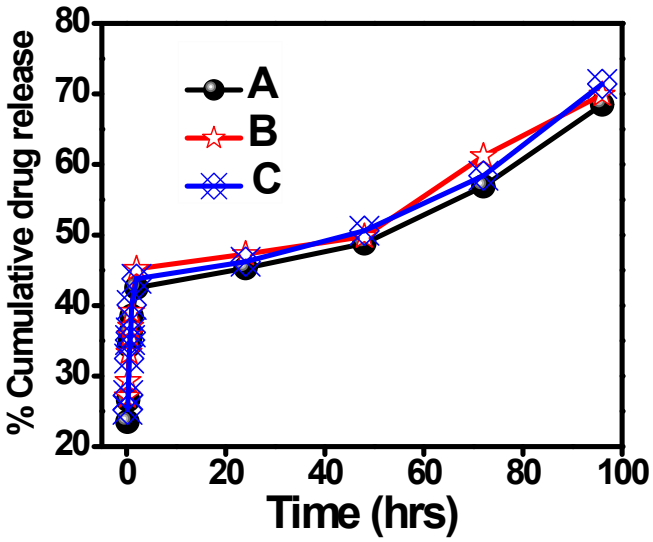

Figure S4. % Cumulative Tetracycline drug release study at pH 1 of three sets of CA-CD (A, B and C). [Preparation of these three sets of CA-CD → **A:** 10 CA beads coated in 10 ml CD solution, **B:** 20 CA beads coated in 10 ml CD solution, and **C:** 30 CA beads coated in 10 ml CD solution]

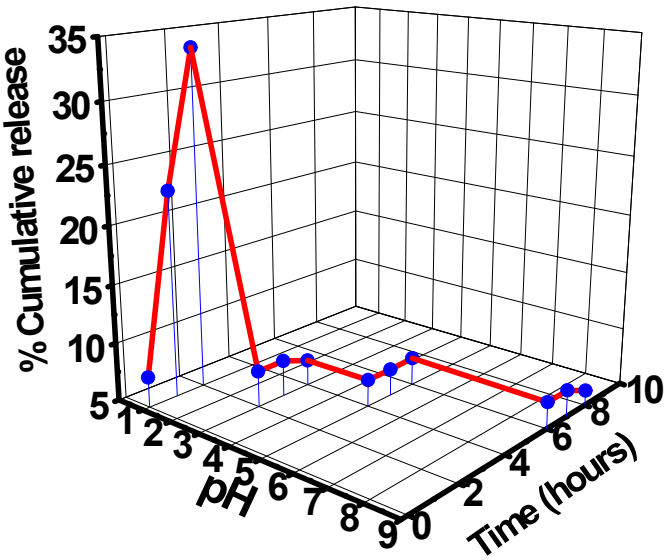

Figure S5. 3-Dimensional plot of release of TC at different time interval at different pH condition from acidic as in stomach to basic as in intestine

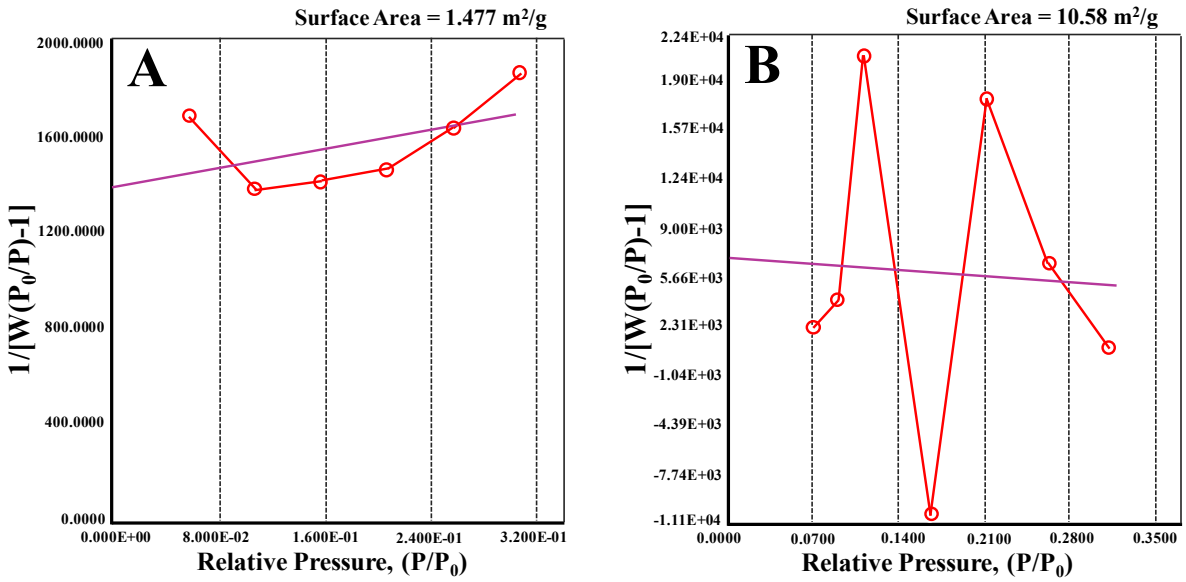

Figure S6. BET plot (Surface area analysis) of (A) CA, and (B) CA-CD beads.

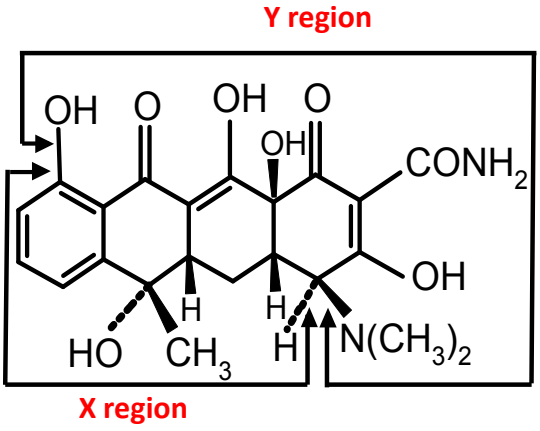

Figure S7. Molecular structure of Tetracycline hydrochloride (TC) showing X and Y reactivity regions.

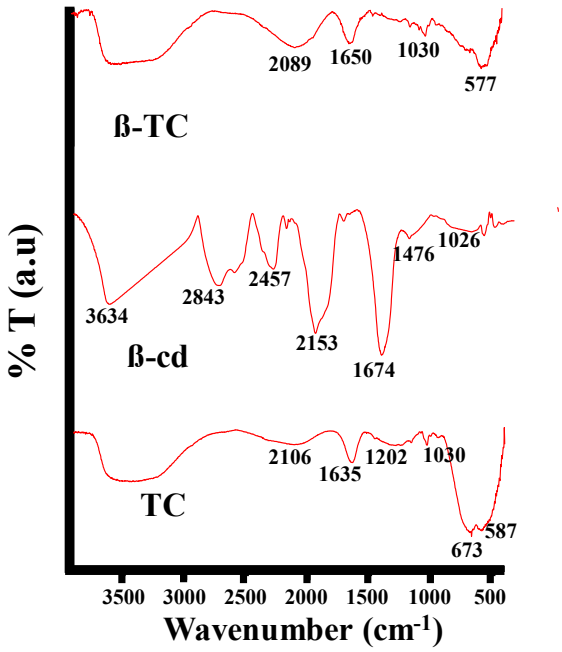

Figure S8. FTIR spectra of tetracycline (TC), ß-cyclodextrin (ß-cd) and ß-cyclodextrin-tetracyline inclusion complex (ß-TC).