

Property relationship of Alginate and Alginate-carbon dot nanocomposite with bivalent and trivalent cross-linker ions.

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Electronic Supplementary Information

Experimental Sections

Synthesis of metal ion cross-linked alginate films

3 weight percent alginate solution was first prepared and casted on glass plates with constant volumes and allowed to dry at room temperature. Different ion cross-linked alginate films were obtained by dipping these films into 0.5 M solution of different ions, viz; Ca²⁺, Ba²⁺, Cu²⁺, Fe³⁺ and Al³⁺ for 5 minutes. The films were washed with milliQ water and again allowed to dry at room temperature. Dried films were peeled out carefully and stored in vacuum chamber.

Synthesis of Alginate-carbon-dots nanocomposite films

Carbon-dots alginate nanocomposite films were prepared following the similar procedure with the metal ion cross-linked alginate films. First alginate solution was prepared by dissolving 3 weight percent of alginate in CDs solution with various concentrations. The solution was then subjected to vigorous mechanical stirring for two hours. This solution was casted on Petridis and dried films were cross-linked with various metal ions. Films were dried at room temperature and peeled out carefully.

Characterization

To analyse the UV–visible absorption of the different metal ion cross-linked alginate and the Alginate-Carbon dots nanocomposite films, the films were studied through UV–visible spectroscopy (Shimadzu UV 2600). The films were cut off into equal sizes (~1 × 1 cm²) and scanned through a range of 190–550 nm wavelength in reflectance mode. DLS measurements were carried out using Malvern Zeta sizer Nano ZS90. Thermogravimetric analysis (TGA) were carried out in Perkin Elmer 4000, Each film samples were cut into small pieces and kept in vacuum chamber overnight before the test. Heating rate was maintained at 10⁰ C rise per minute with nitrogen flow rate at 20 ml/min. Tensile strengths (T.S.) of the films were determined by a Linkam Stage T-95 micro tensile testing machine with a load cell of 20N. The films were cut in to (7 x 30) mm² size and speed during the test was maintained at 2mm/min. SEM images were collected on a Carl Zeiss Sigma VP instrument. As the carbon dots are not apparently present on the surface of the film, so to observe the interior of the films we used crushed portions of all the films. The static contact angles of the hydrogel films were measured using Contact Angle Analyzer (KRÜSS DSA 30, Germany). Fluorescence Microscopy was done using Leica DMI 3000 B. Millipore water of approximately 10μL was dropped on to the surface of each hydrogel films to measure the contact angle.

FT-IR analysis of carbon dots (CDs)

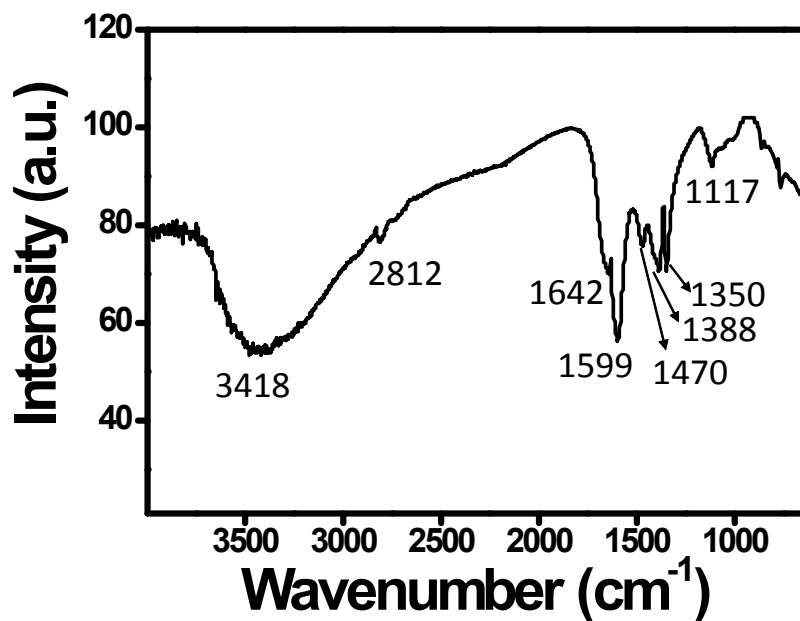


Figure 1S: FT-IT spectra of carbon dots.

In the FT-IR spectra of CDs the broad peak at 3418 cm⁻¹ indicates presence of -OH groups on the CDs. Peak for C=C stretching frequency appears at 1599 cm⁻¹ and peaks in the region 1350 to 1388 cm⁻¹ is because of the of -C-H bending. The -C-O stretching frequency contributes to the peak at 1117 cm⁻¹.

SEM analysis of carbon dots

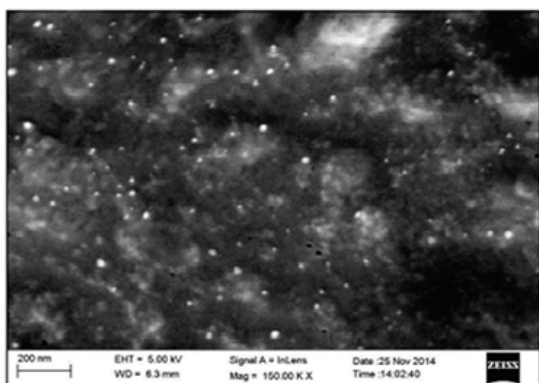


Figure 2S: SEM image of the Tea carbon dots.

SEM analysis of the Alginate films

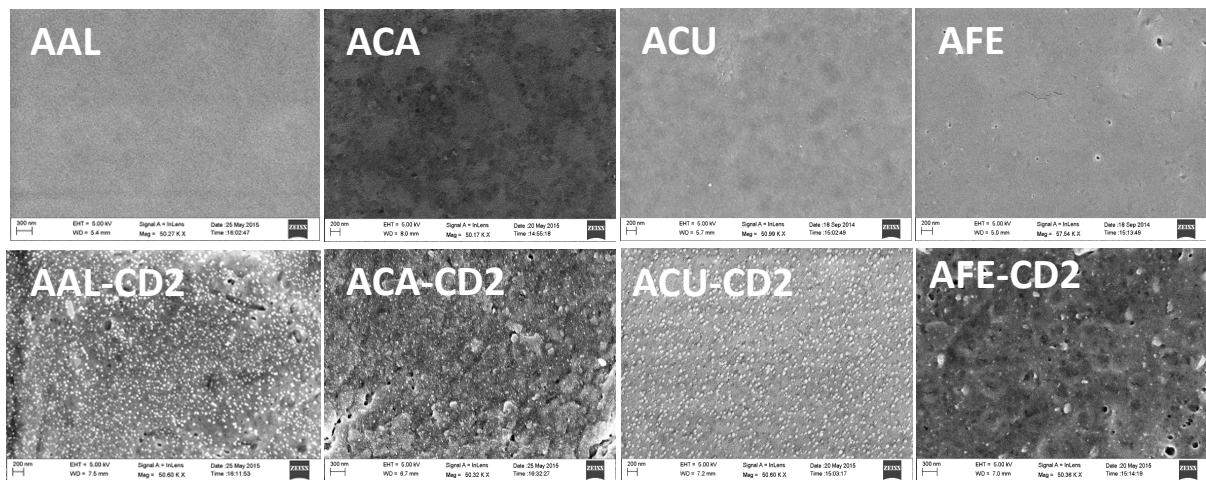


Figure 3S: SEM images of Al^{3+} , Ca^{2+} , Cu^{2+} and Fe^{3+} cross-linked Alginate and their corresponding nanocomposite films with 2% CDs

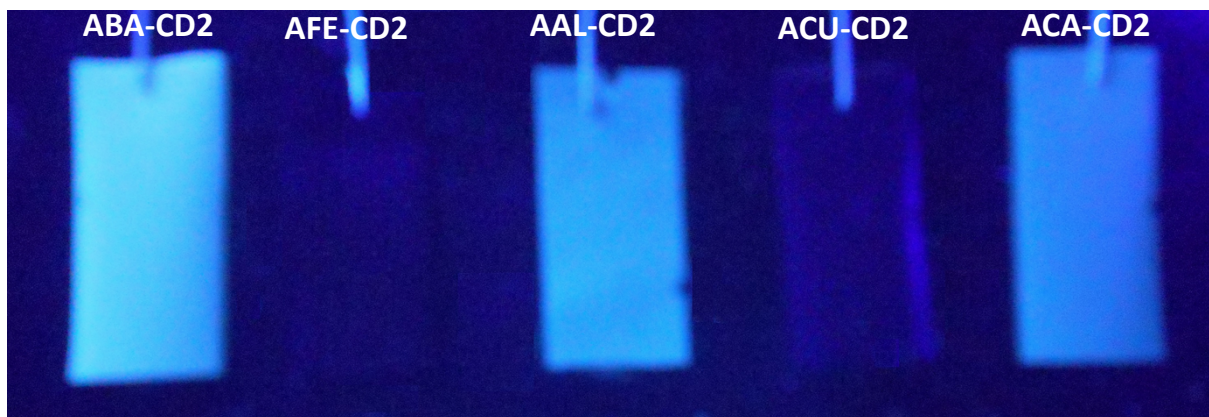


Figure 4S: Photographic images of different ion cross-linked Alginate nanocomposite films with 2% CDs under UV-light.