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Supplementary Information

Down- and Up-Conversion Photoluminescence of Carbon-Dots from Brewing Industry Waste: Application in Live Cell-Imaging Experiments

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Experimental Details

For the synthesis of C-dots **1**, 5 g of beer's waste were washed with distilled water and calcined at 300 °C for 3 h and then cooled to r.t. The resulting black powder was further refluxed in nitric acid solution (5.0 mol L^{-1}, 100 mL), for 24 h. The suspension was then cooled and the pH was controlled between 5-7. Filtration to remove undissolved particles was followed by sonication for 90 min. The resulting solution was filtered through a 0.22 μm membrane to remove the larger particles. Water was then evaporated in an open beaker and the carbon nanoparticles **1** were obtained.

Similarly, nanoparticles **2** were prepared from 5 g of beer's waste that was washed with distilled water and then calcinated at 300 °C for 3 h. The black powder was dissolved in distilled water, had its pH controlled between 5-7 and was filtered to remove undissolved particles. The solution was then sonicated for 90 min, filtered through a 0.22 μm membrane and the water was evaporated in an open beaker to obtain the C-dots **2**.

Live cell-imaging experiments were performed as follows: MCF-7 cells were plated on 13 mm round glass coverslips on the bottom of 24 wells plate and let on to adhere at 37 ºC in 5% CO_2 atmosphere for 30 min. Then, the plate was washed with serum free medium, in order to remove the non-adherent cells. MCF-7 cells were cultivated in Dulbecco's Modified Eagle's medium (DMEM) plus 10% fetal bovine serum at 37 ºC in 5% CO_2 atmosphere. After confluence being reached, the culture were washed three times in phosphate buffered saline (PBS) pH 7.4 and fixed for 15 min in 3.7% formaldehyde solution in PBS at r.t., only for the adhered cells experiments. The cells were washed three times with PBS and then incubated with C-dots **1** (aqueous solutions of 2.5 mg mL^{-1}) for 30 min, at r.t. The cells were incubated in PBS at the same conditions, to obtain the negative control. Afterwards the incubation time, the cells were washed three times with PBS and incubated with 4'6-diamidino-2-phenylindole, dihydrochloride (DAPI; Invitrogen, Oregon, USA) according to manufacture recommendations. ProLong Gold Antifade (Invitrogen, Oregon, USA) was used according to manufacture recommendations to mount the coverslips. The samples were analyzed in a Leica Confocal Microscopy TCS SP (Mannheim, Germany). All assays were performed in three independents series.

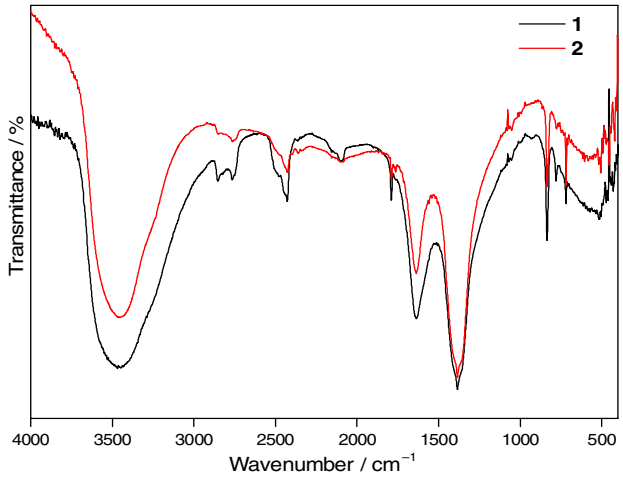

Figure S1. Infrared spectra of the materials. The black and red curves refer to samples **1** and **2**, respectively.

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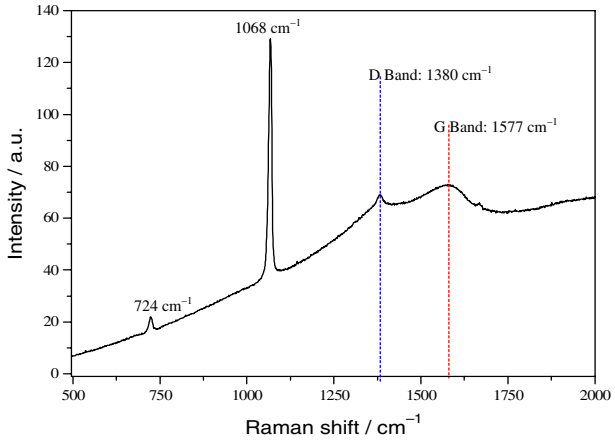

Figure S2. Raman spectrum of the C-dots **1**. Sample **2** presented an identical spectral profile.

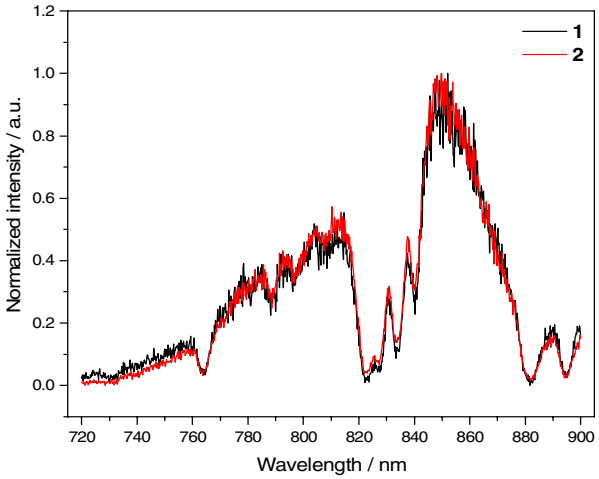

Figure S3. Excitation spectra of the C-dots measured at r.t. by monitoring their emissions at 460 nm. The black and red curves refer to samples **1** and **2**, respectively.