Supplementary Information
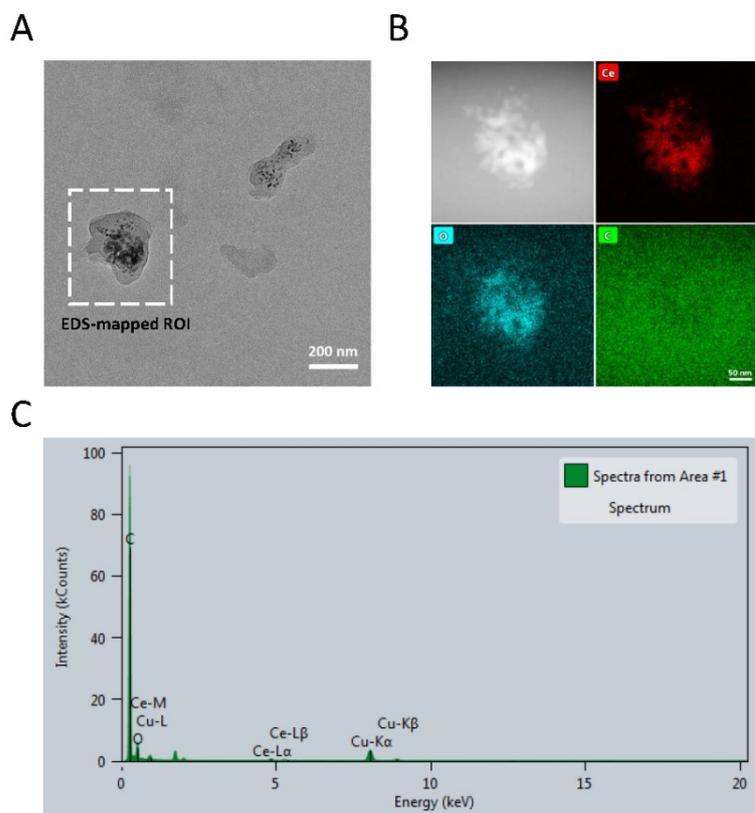

Figure S1. TEM/HAADF‑STEM characterization and STEM‑EDS analysis of CeLA. (A) Low‑magnification TEM image of CeLA in a single field of view, the boxed region indicates the ROI used for subsequent analysis. (B) HAADF‑STEM image acquired from the boxed ROI in (A) and STEM‑EDS elemental maps. (C) The corresponding EDS spectrum collected from the same ROI, confirming the presence and spatial co‑localization of Ce and O with the nanoparticle region (Cu peaks originate from the TEM grid). Minor intensity variations in the elemental maps may arise from local thickness variations/particle overlap and counting statistics，semi‑quantitative EDS analysis gives a Ce atomic fraction of ~0.22 at% (≈2.44 wt%) for this ROI.
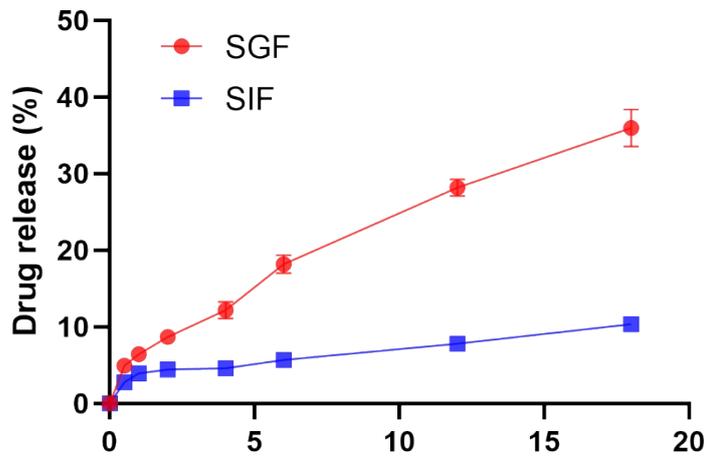
Figure S2. In vitro release profiles of 5-ASA from CeLA over 6 hours under simulated gastrointestinal conditions, including SGF and SIF. Data are presented as cumulative 5-ASA release (%) versus time.
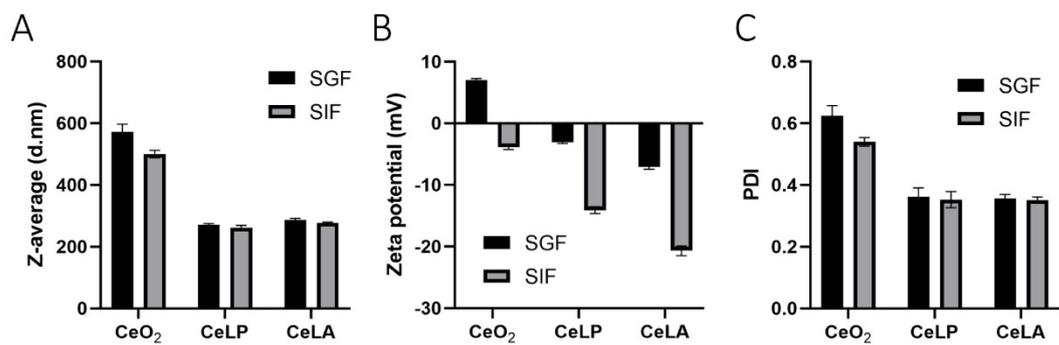
Figure S3. (A) Z-average, (B) Zeta potential and (C) PDI of CeO2, CeLP and CeLA in SGF and SIF after 6 hours.
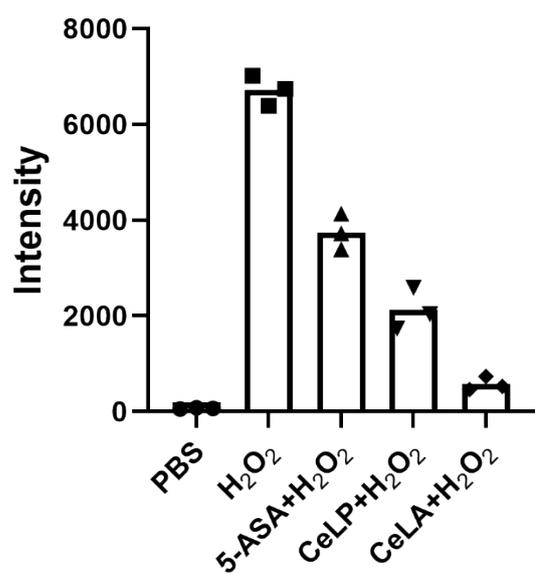
Figure S4. Quantification of intracellular ROS by flow cytometry using DCFH‑DA after H_2O_2 stimulation. ROS levels are presented as the mean fluorescence intensity.
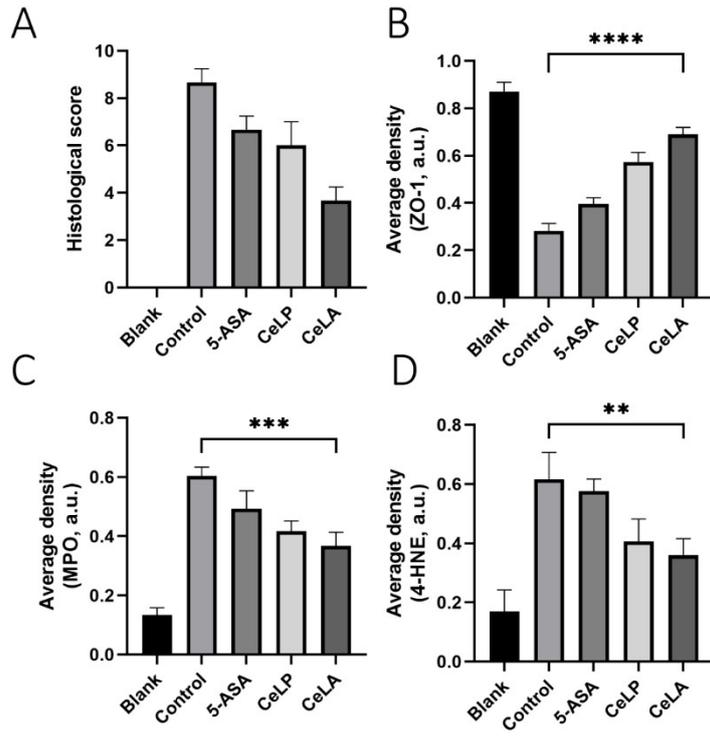
Figure S5. Quantitative analysis of histology and immunostaining across groups. (A) H&E histopathological score. (B) Average density of ZO-1, (C) MPO and (D) 4-HNE staining.
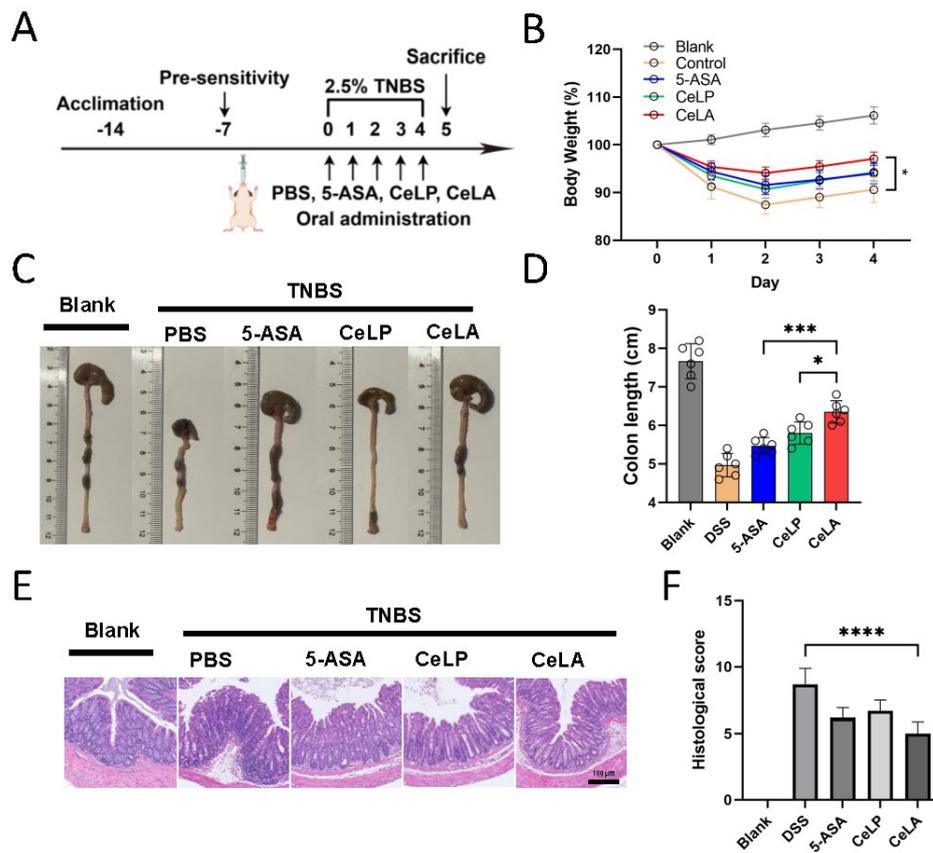
Figure S6. Therapeutic efficacy of nanoparticles in TNBS-induced colitis in mice. (A) Schematic diagram of the TNBS-induced colitis model. (B) Body weight changes of mice in each group during the modeling period. (C) Representative macroscopic appearance of the colon from each group after euthanasia. (D) Statistical analysis of colon length in mice. (E) Representative H&E staining images of mouse colon tissues. (F) Histological scoring of H&E-stained colon sections.
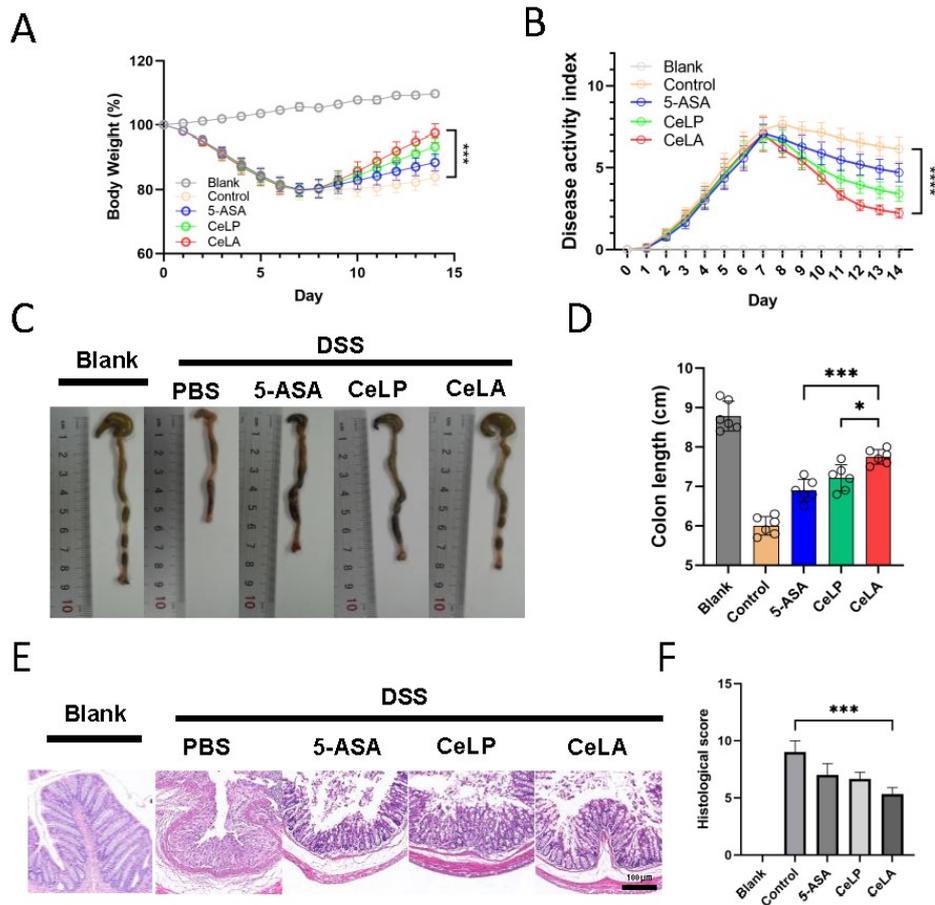
Figure S7. Therapeutic efficacy of nanoparticles in a rescue experiment following DSS-induced colitis in mice. (A) Schematic diagram of the rescue model after DSS induction. (B) Body weight changes of mice in each group during the modeling period. (C) Representative macroscopic appearance of the colon from each group after euthanasia. (D) Statistical analysis of colon length in mice. (E) Representative H&E staining images of mouse colon tissues. (F) Histological scoring of H&E-stained colon sections.

Figure S8. Histograms of all groups showing relative abundance differences.