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Supporting Information

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Impact of Mucin Protein Corona on the Gastrointestinal Behavior and

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Antioxidant Activity of Food Carbon Dots Extracted from Bread Crust

4 **Methods:**

5 **Quantum Yield.** The quantum yield of BDCDs was detected using a FLS1000
6 photoluminescence spectrometer ([Edinburgh Instruments, Scotland, UK](#)). The
7 excitation and emission wavelengths were set to 344 nm and 437 nm, respectively.

8 **Fluorescence lifetime.** The fluorescence lifetime of BDCDs was measured by an
9 FLS1000 photoluminescence spectrometer ([Edinburgh Instruments, Scotland, UK](#)).
10 The excitation and emission wavelengths were set to 344 nm and 437 nm, respectively.

11 **Particle Size Measurement.** The particle size distributions of BDCDs, mucin, and
12 the BDCDs-mucin protein corona at varying pH values (2, 3, 6, 7, and 8) were
13 determined using a Malvern Zetasizer Nano dynamic light scattering ([Malvern](#)
14 [Instruments Ltd., Malvern, UK](#)).

15 **Stern-Volmer Equation.** The fluorescence quenching mechanism of pepsin and
16 trypsin by BDCDs, mucin, or the BDCDs-mucin corona was analyzed using the Stern-
17 Volmer equation:

$$18 \quad \frac{F_0}{F} = 1 + K_{SV}[Q]$$

19 where F_0 and F represent the fluorescence intensities of pepsin and trypsin in the
20 absence and presence of BDCDs, mucin, or the BDCDs-mucin corona, respectively.
21 $[Q]$ denotes the quencher concentration in mg/mL, and K_{SV} is the Stern-Volmer
22 quenching constant.

23 **Optical Properties Measurement.** The fluorescence spectra of BDCDs, mucin, and
24 the BDCDs-mucin protein corona at varying pH values (2, 3, 6, 7, and 8) were measured
25 using a F-7000 spectrofluorometer ([Hitachi, Tokyo, Japan](#)). The measurements were

26 performed at excitation wavelengths of 344 nm (the maximum excitation wavelength
27 of BDCDs) and 280 nm (the maximum excitation wavelength of mucin). Additionally,
28 the ultraviolet-visible spectra of BDCDs, mucin, and the BDCDs-mucin corona at the
29 same pH values were recorded using a Multiskan GO UV-visible spectrophotometer
30 ([Thermo Fisher Scientific, Waltham, USA](#)).

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32 **Supplementary Figures**

33 **Supplementary Figure 1. The quantum yield and decay curve for BDCDs.** (A)

34 Quantum yield of BDCDs measured at 344 nm. (B) Fluorescence lifetime decay curve
35 of BDCDs.

36 **Supplementary Figure 2. The size distribution diagram.** The size distributions of

37 BDCDs (A), mucin (B), and the BDCDs-mucin corona (C) under various pH conditions
38 simulating the gastrointestinal tract.

39 **Supplementary Figure 3. Stern-Volmer model for the fluorescence quenching of**

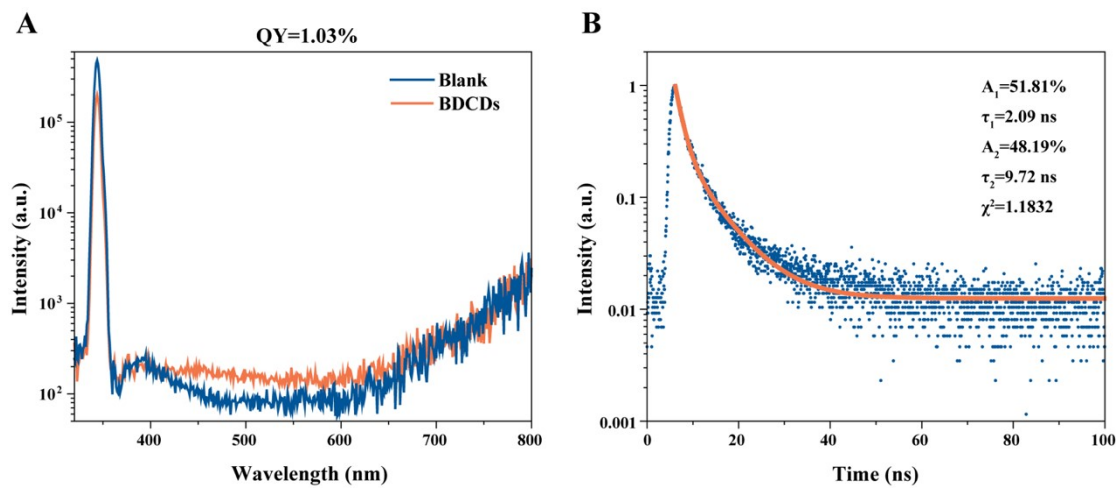
40 **pepsin and trypsin.** (A-C) The fluorescence quenching of pepsin by BDCDs (A),
41 mucin (B), and the BDCDs-mucin corona (C). (D-F) The fluorescence quenching of
42 trypsin by BDCDs (D), mucin (E), and the BDCDs-mucin corona(F).

43 **Supplementary Figure 4. Optical properties of BDCDs, mucin, and the BDCDs-**

44 **mucin corona under different pH conditions.** (A-C) Fluorescence emission under an
45 excitation wavelength of 344 nm (the maximum excitation wavelength of BDCDs); (D-
46 F) Fluorescence emission under an excitation wavelength of 280 nm (the maximum
47 excitation wavelength of mucin); (G-H) UV-vis absorption spectra.

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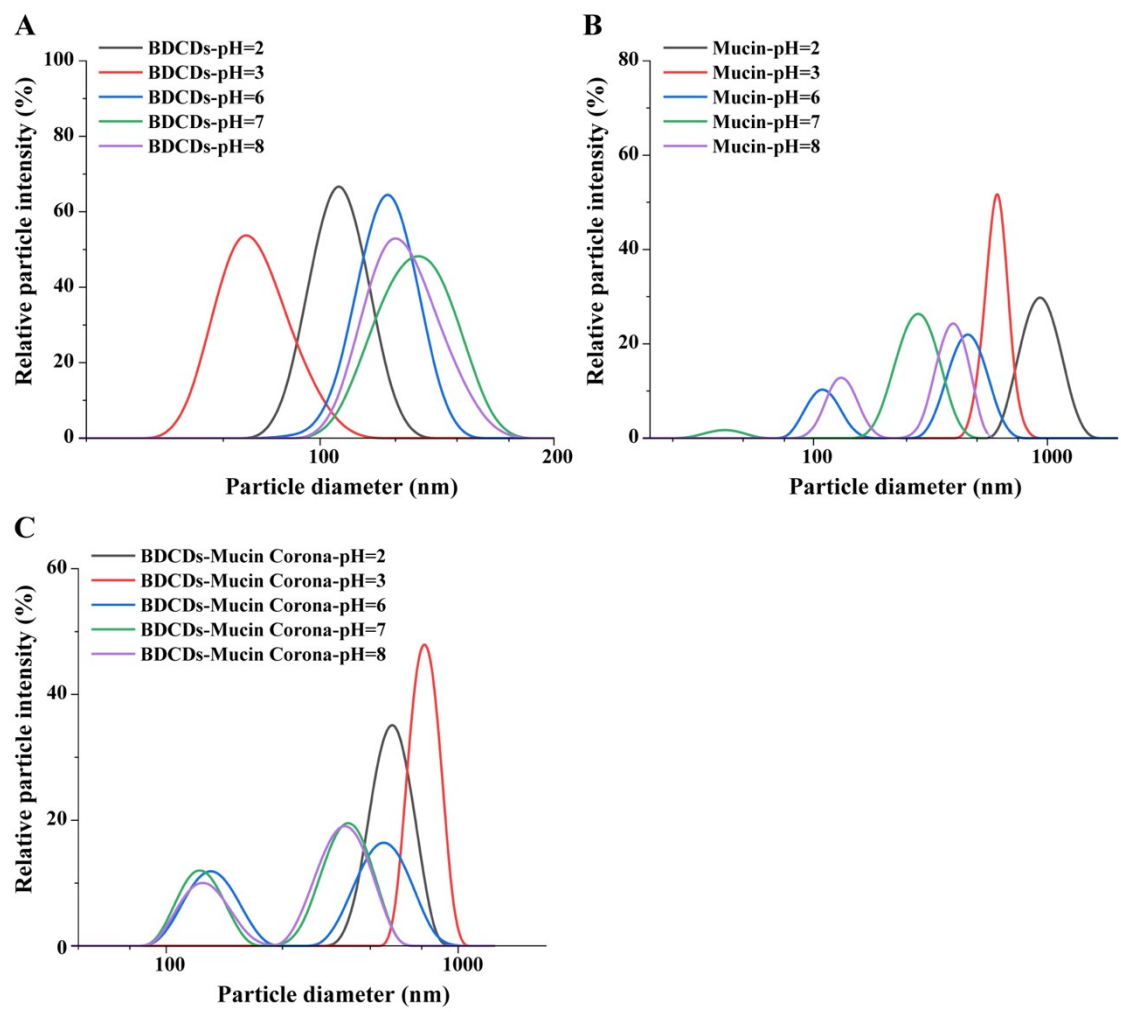
49 **Supplementary Figure 1.**



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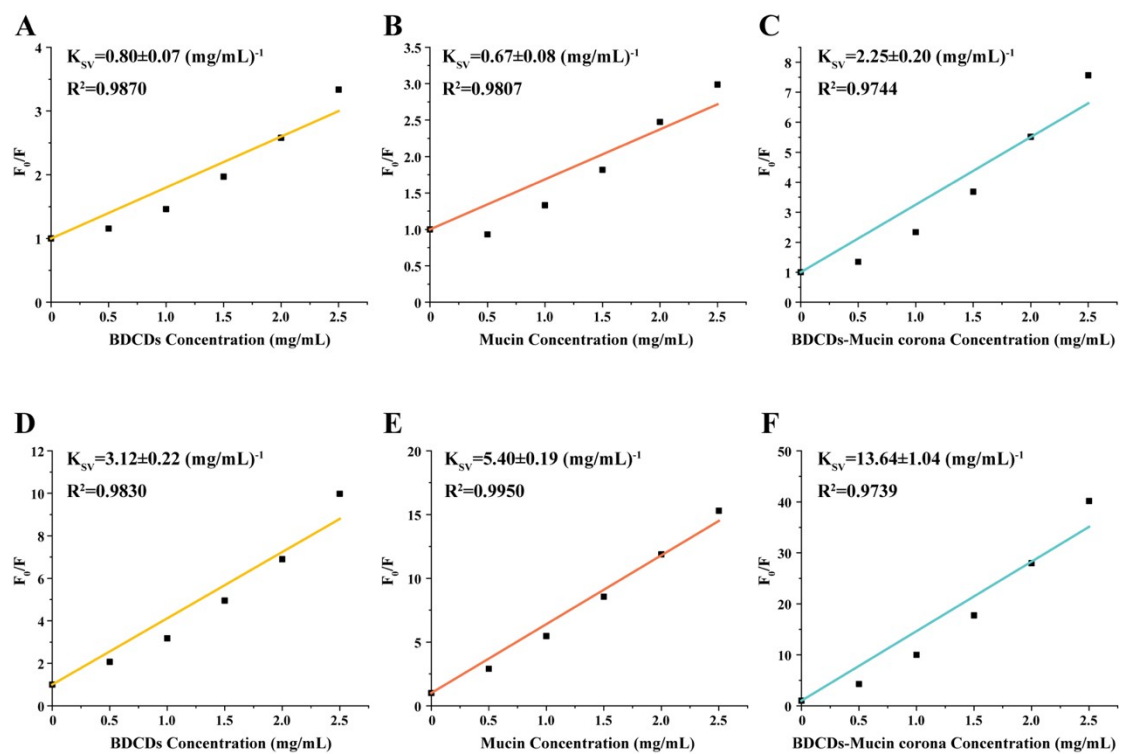
52 **Supplementary Figure 2.**



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55 **Supplementary Figure 3.**



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58 **Supplementary Figure 4.**

