Active Packaging of Immobilized Zinc Oxide Nanoparticles Controls *Campylobacter jejuni* in Raw Chicken Meat

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Supplementary figures

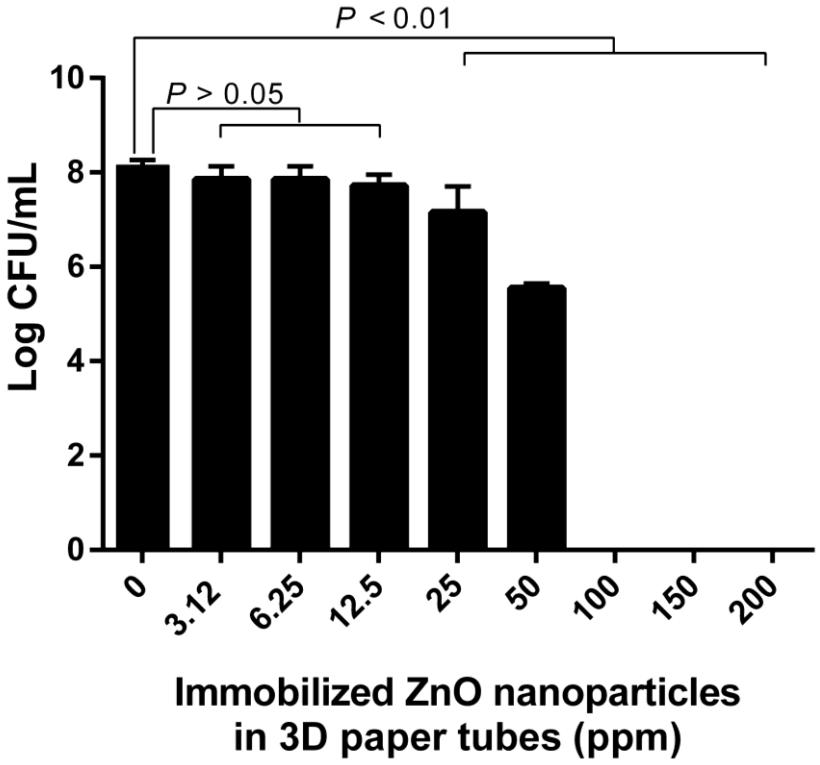

Figure S1. Broth-dilution susceptibility test of the functionalized 3D paper tubes with ZnO nanoparticles. *C. jejuni* F38011 culture was deposited onto the functionalized 3D paper tubes with different concentrations of immobilized ZnO nanoparticles for 3 h at 37°C in a microaerobic condition with constant shaking at 175 rpm. *C. jejuni* counts was quantified using the plating assay, followed by the identification of minimum bactericidal concentration (MBC) of immobilized ZnO NPs. Error bars represent the standard deviation. Data were analyzed by one-way ANOVA, followed by the post hoc Tukey's test for multiple comparisons.

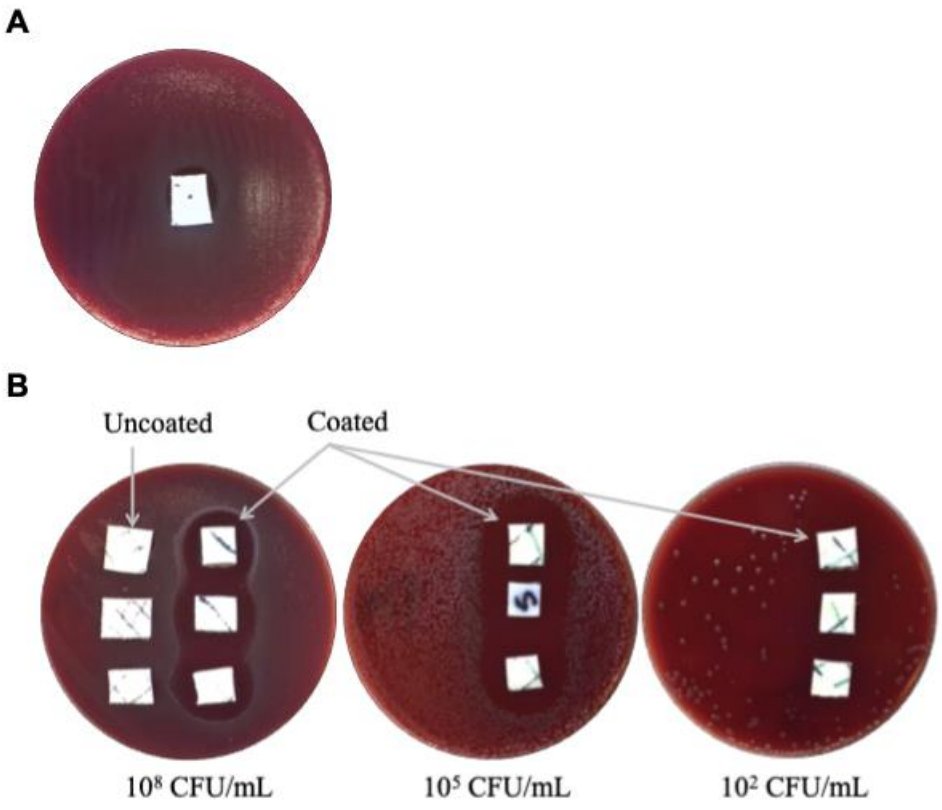

Figure S2. Inhibition zones of the functionalized absorbing pads with immobilized ZnO nanoparticles against *C. jejuni* F38011 at 0.075 (A) and 0.856 mg/cm^2 (B). Each piece of paper in the vertical order represents one batch of the functionalized absorbing pads. Bacterial lawns were grown on Mueller-Hinton agar supplemented with 5% defibrinated sheep blood at 37°C in a microaerobic condition. Imaged were collected after 48 h of incubation.

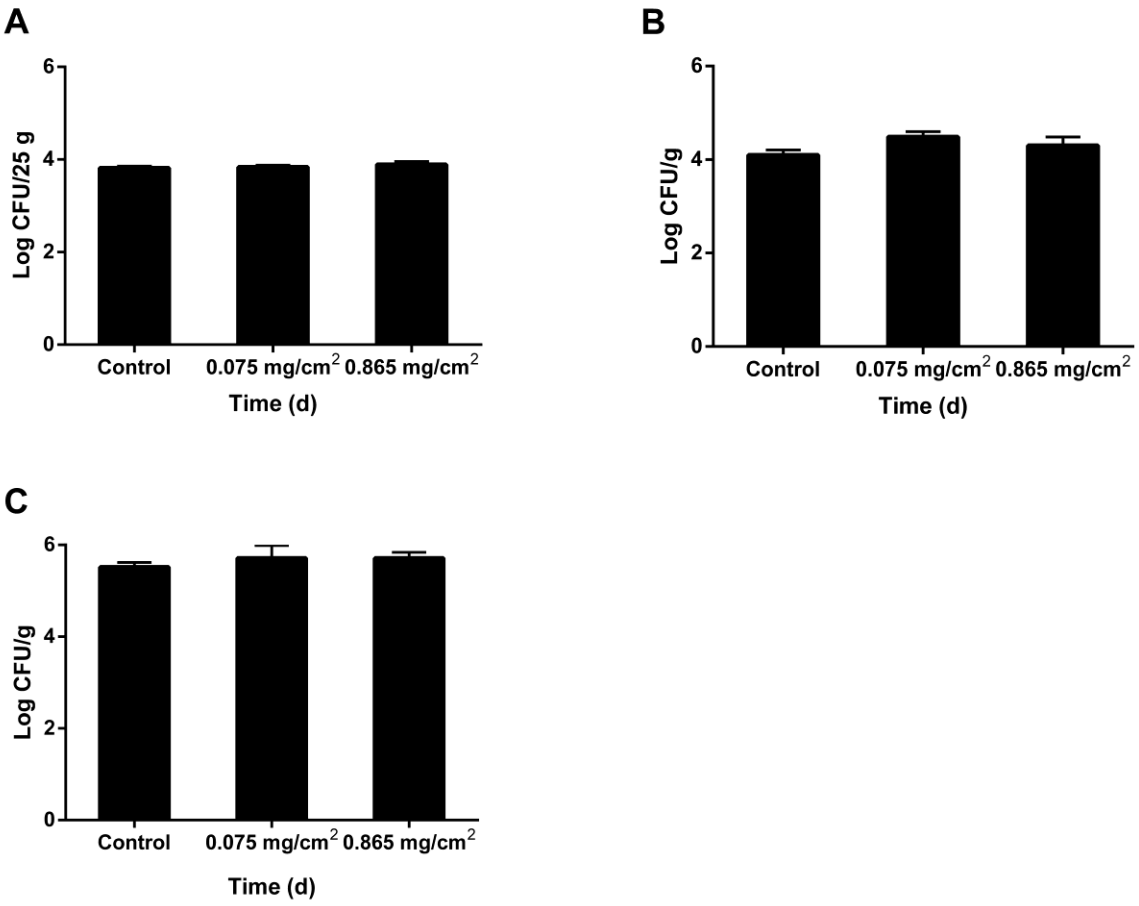

Figure S3. The counts of *Campylobacter jejuni* cocktail (F38011, Human10, 1173, and ATCC 33560) (A), *Lactobacillus* (B), and psychrotrophs (C) on raw chicken breasts stored at 7°C with or without the functionalized absorbing pads including immobilized ZnO nanoparticles for 24 h. The limit of detection was determined to be 500 CFU/sample (*i.e.*, 25 g of chicken breast). Campy-Cefex, DeMan, Rogosa and Sharpe agar (MRS) and Tryptic Soy Agar (TSA) were used as the plating assay of each corresponding bacterium and plates were incubated at 42°C (in a microaerobic condition), 30°C and 7°C (in an aerobic condition), respectively. Data were analyzed by using one-way ANOVA, followed by the post hoc Tukey's test for multiple comparisons.

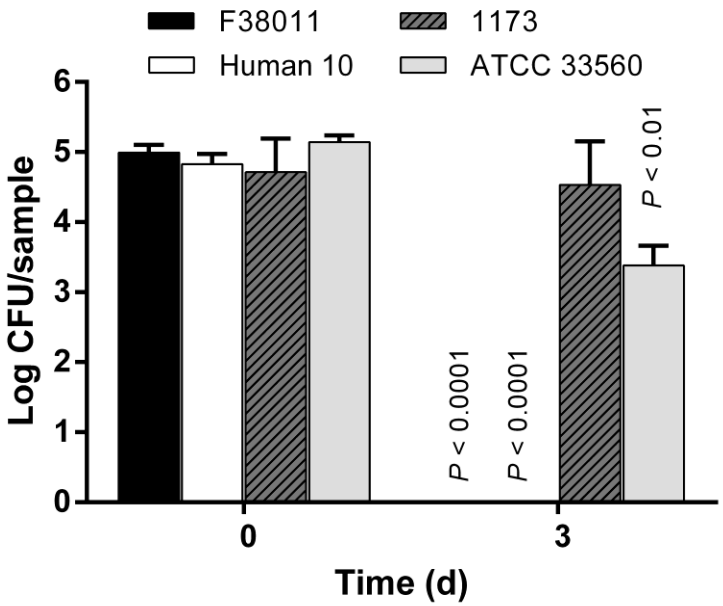

Figure S4. The count of individual *Campylobacter jejuni* strain on raw chicken meat stored for 3 days at 4°C with the functionalized absorbing pads, including immobilized ZnO nanoparticles at 0.856 mg/cm^2. *C. jejuni* F38011 and human10 are clinical isolates; ATCC 33560 is a bovine fecal isolate; 1173 is a chicken isolate. The limit of detection was determined to be 500 CFU/sample (*i.e.*, 5 g of chicken breast). Mueller-Hinton agar supplemented with 5% defibrinated sheep blood was used as the plating assay, and the plates were incubated at 42°C in a microaerobic condition. Data were analyzed by using one-way ANOVA, followed by the post hoc Tukey's test for multiple comparisons (n = 3).