**SUPPLEMENTARY FILE**

**Table S1.** Tyrosinase and melanogenesis inhibition of CA-NE formulation.

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| --- | --- | --- |
| **Concentration of CA-NE (mg/mL)** | **Tyrosinase Inhibition**  **(%)** | **Melanogenesis Inhibition**  **(%)** |
| 0.25 | 8 ± 5.00 | 28 ± 0.96 |
| 0.5 | 14.24 ± 4.57 | 30 ± 2.41 |
| 1 | 22.60 ± 2.88 | 46 ± 3.19 |



**Figure S1.** Calibration curve of CA (n =3).



**Figure S2.** Mutagenicity results of CA, blank-NE, and the finalized CA-NE formulation on *S. typhimurium* TA98 (A1: 0.25 mg/plate of blank-NE; A2: 0.5 mg/plate of blank-NE; A3: 1 mg/plate of blank-NE) (B1: 0.045 mg/plate of CA; B2: 0.09 mg/plate of CA; B3: 0.18 mg/plate of CA) (C1: 0.25 mg/plate of the finalized CA-NE; C2: 0.5 mg/plate of the finalized CA-NE; C3: 1 mg/plate of the finalized CA-NE). Data are presented as mean ± standard error (*p* < 0.05).



**Figure S3.** Mutagenicity results of CA, blank-NE, and the finalized CA-NE formulation on S. typhimurium TA100(A1: 0.25 mg/plate of blank-NE; A2: 0.5 mg/plate of blank-NE; A3: 1 mg/plate of blank-NE) (B1: 0.045 mg/plate of CA; B2: 0.09 mg/plate of CA; B3: 0.18 mg/plate of CA) (C1: 0.25 mg/plate of the finalized CA-NE; C2: 0.5 mg/plate of the finalized CA-NE; C3: 1 mg/plate of the finalized CA-NEs). Data are presented as mean ± standard error (p < 0.05)