

Supporting Information

Preparation, optimization and in-vitro evaluation of curcumin loaded into niosome@calcium alginate nanocarrier as a new approach for breast cancer treatment

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SI-1. Experimentation

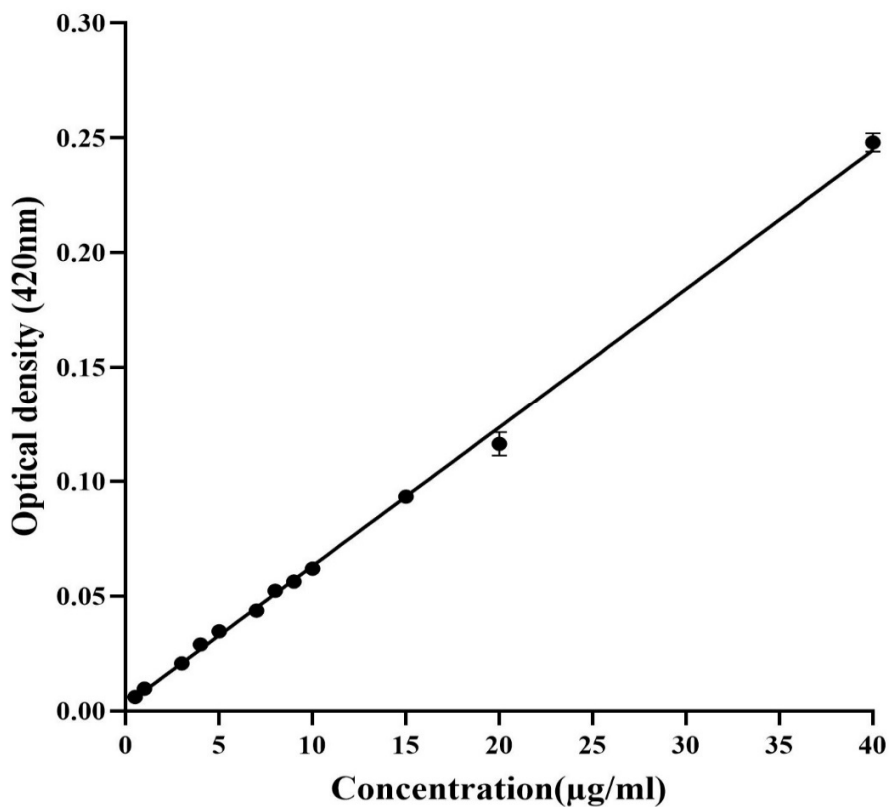


Figure S1. The calibration curve for determination of curcumin based on its maximum absorbance peak at 420 nm in PBS-SDS (0.5%,w/v) solution

SI-2. Kinetic models

The explanation of each kinetic model used in this study is as follow[1]:

- **Zero-order model:** $C_t = C_0 + K_0 t$

where C_t represents the amount of drug released at time t , C_0 is the initial concentration of drug released which is generally zero. In this model, the release process takes place at a constant rate and it is independent of initial drug concentration.

- **First-order model:** $\text{Log } C = \text{Log } C_0 - Kt/2 \cdot 303$

Where C_0 is the initial concentration of the drug, k is the first-order rate constant, and t is the time. C is the drug remaining in the carrier at time t . $\text{Log } C$ and t have a linear relationship and $K/2 \cdot 303$ is the slope of the straight line. This model can be used to describe water-soluble drugs in porous matrices.

- **Higuchi model:** $Q = K_H \sqrt{t}$

where, K_H is the Higuchi constant and it is obtained from the slope of the line. The data obtained were plotted as cumulative percentage drug release versus square root of time. This model can be useful in the case of matrix tablets containing water-soluble drugs.

- **Korsmeyer-Peppas model:** $M_t/M_\infty = Kt^n$

Linear Form: $\log M = \text{Log } K + n \text{ Log } t$

where M_t/M_0 is a fraction of drug released at time t , k is the release rate constant and n is the release exponent. The n value is used to characterize different releases for cylindrical shaped matrices. For the case of spherical tablets:

- $n \leq 0.43$: Fickian diffusion mechanism
- $0.43 < n < 0.85$: non-Fickian transport.
- $n = 0.85$: Case II (relaxational) transport.
- $n > 0.85$: super case II transport.

The first 60% drug release data were fitted in this model. Data obtained from drug release studies were

plotted as log cumulative percentage drug release versus log time. This model is suitable for polymeric systems.

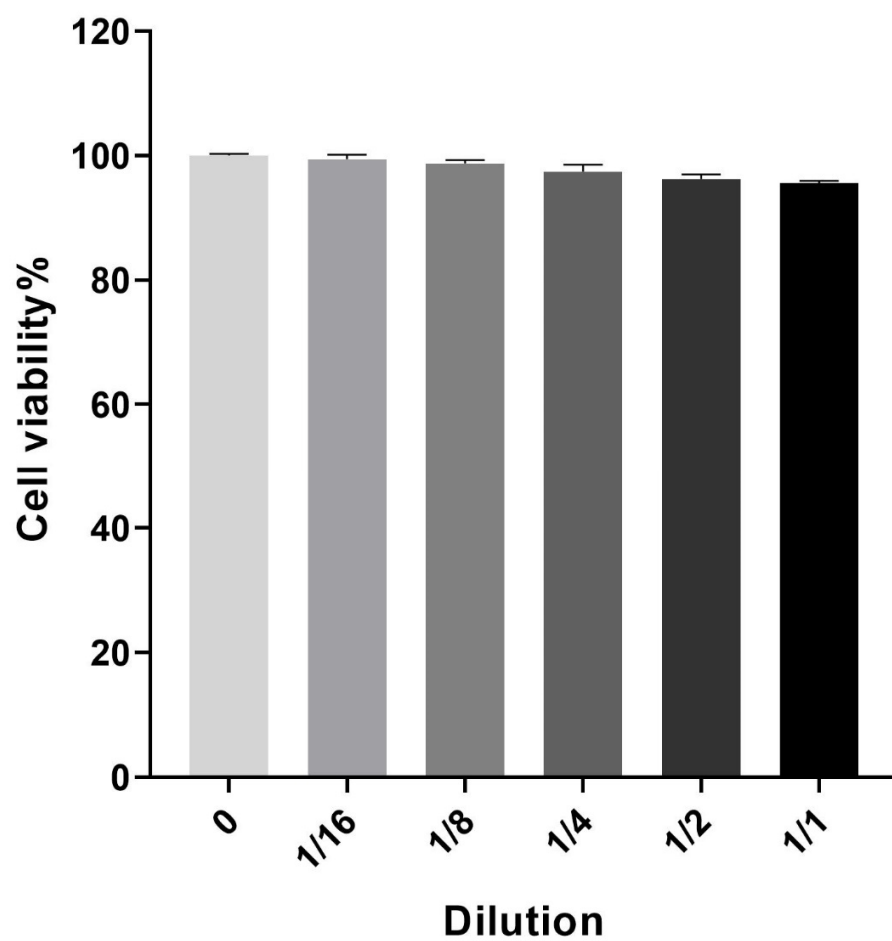


Figure S2. Cell viability of MCF10A cell after 72 h treatment with various dilution of niosomes (Nio).

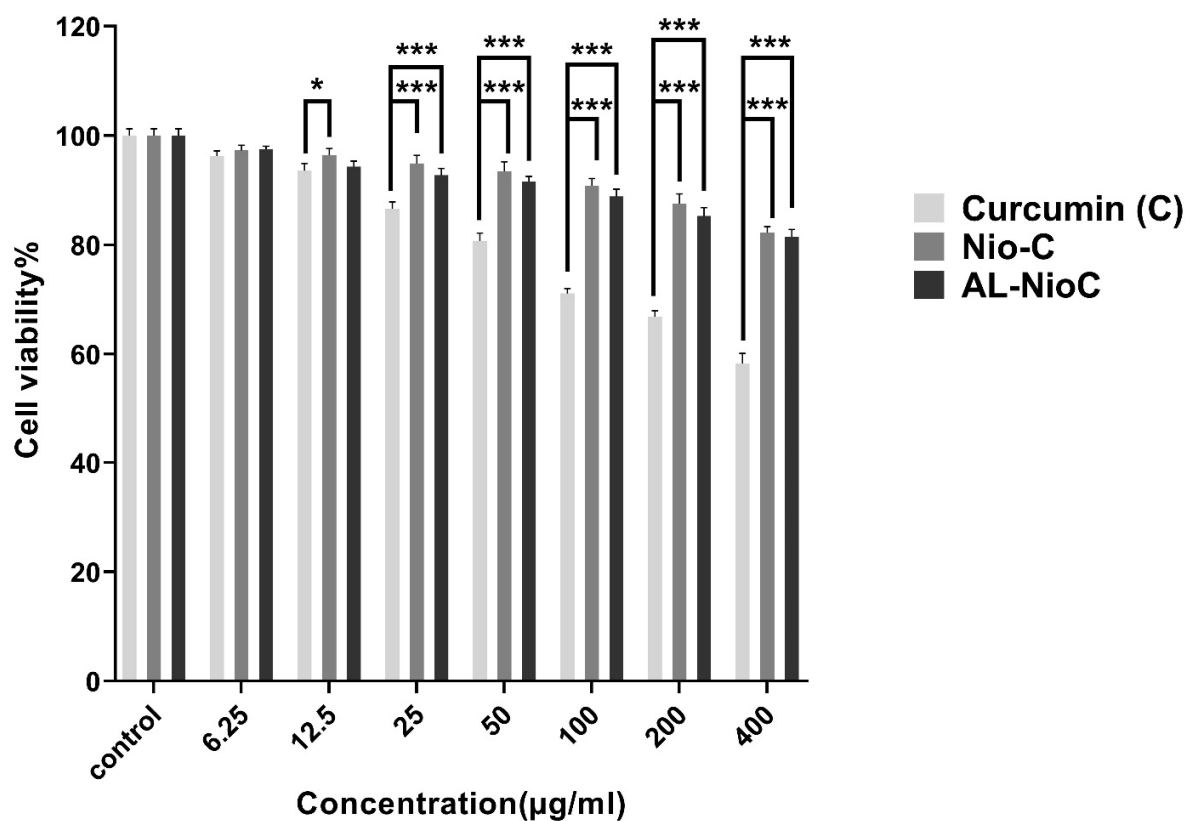
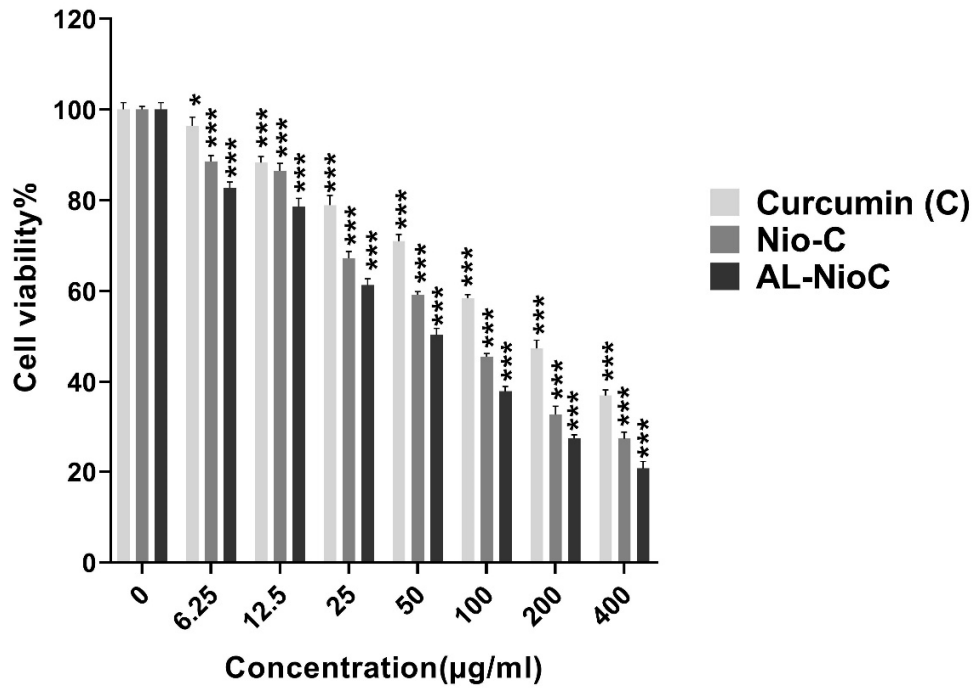


Figure S3. Cell viability of MCF10A cell after 72 h treatment with various concentration of curcumin (C), curcumin loaded niosomes (NioC) and curcumin-loaded niosomes with calcium alginate shell (AL-NioC); Data are represented as Mean \pm SD, n = 5. (* p < 0.05, and *** p < 0.001).

MDA-MB-231



SKBR3

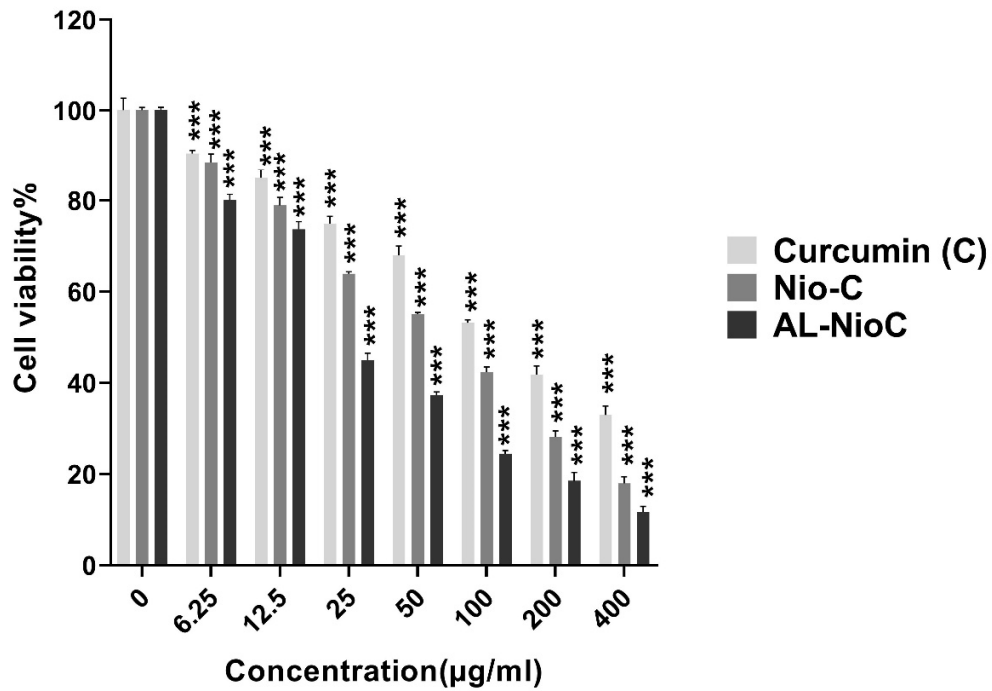


Figure S4. Cell viability of MDA-MB-231 and SKBR3 cells after 72 h treatment with various concentrations of curcumin (C), curcumin loaded niosomes (NioC) and curcumin-loaded niosomes with calcium alginate shell (AL-NioC); Data are represented as Mean \pm SD, n = 5. (* p < 0.05, and *** p < 0.001).

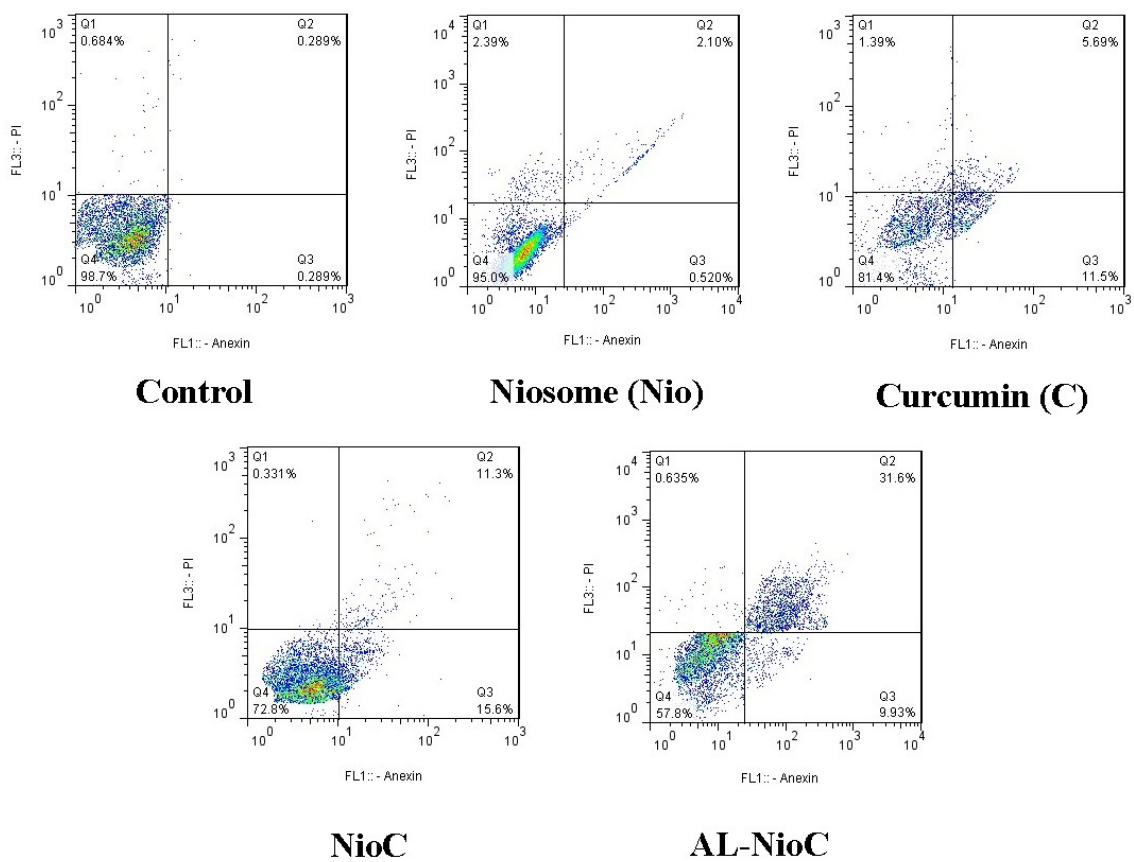


Figure S5. The flow cytometry of MDA-MB-231 cells after treatment with different samples; Lower left panel (Q4): live cells, upper left panel (Q1): necrosis, lower right panel (Q3): early apoptosis, upper right panel (Q2): late apoptosis.

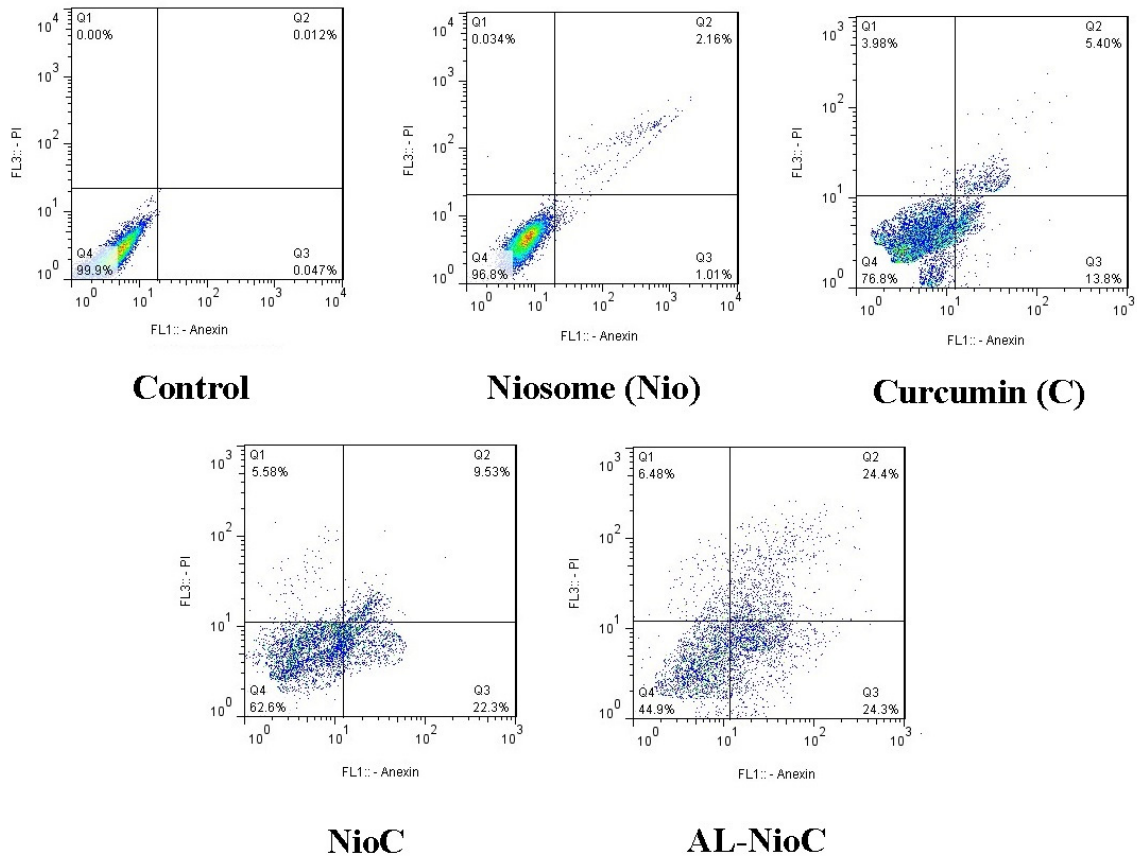


Figure S6. The flow cytometry of SKBR3 cells after treatment with different samples; Lower left panel (Q4): live cells, upper left panel (Q1): necrosis, lower right panel (Q3): early apoptosis, upper right panel (Q2): late apoptosis.

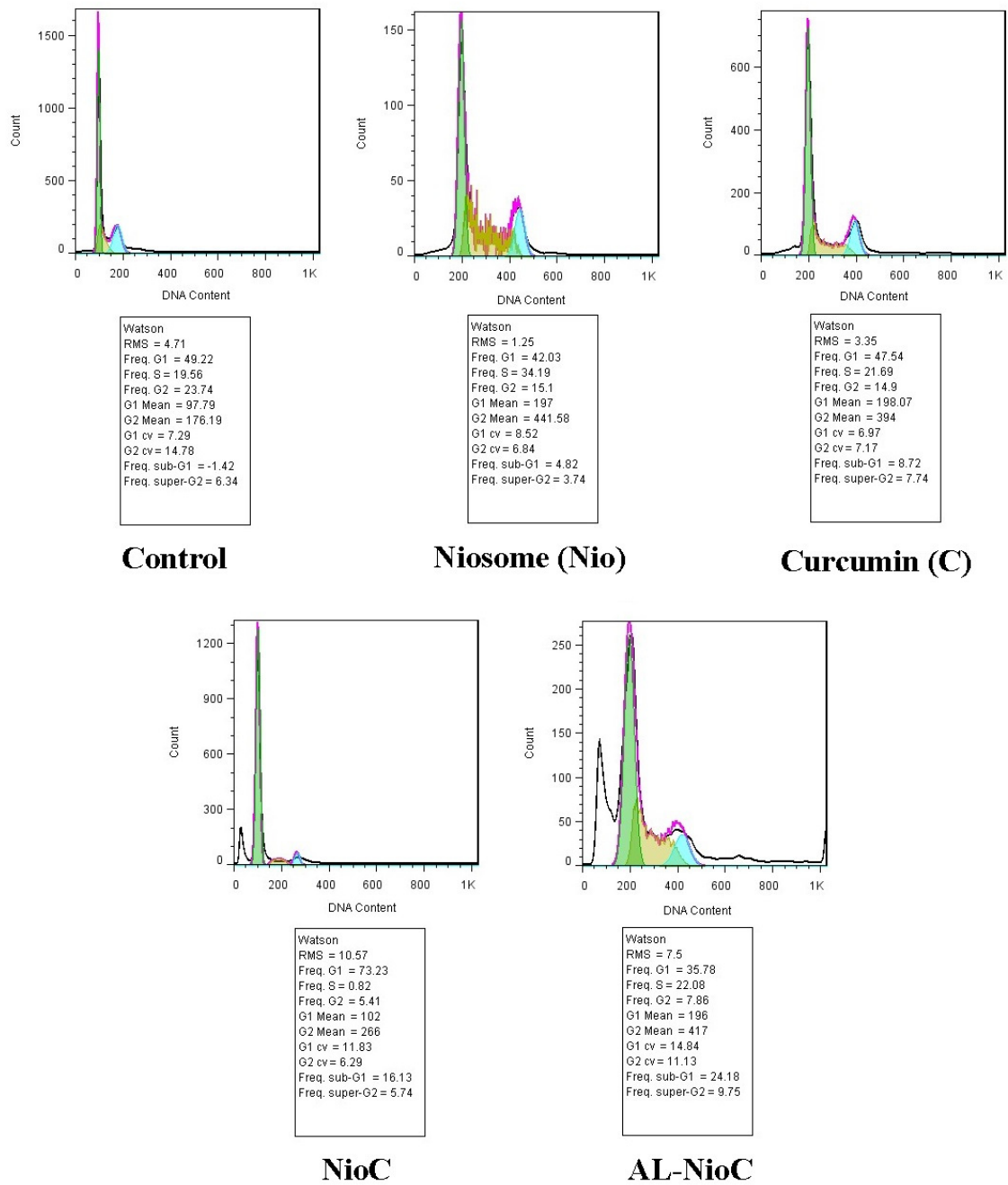


Figure S7. The MDA-MB-231 cell cycle analysis of different samples

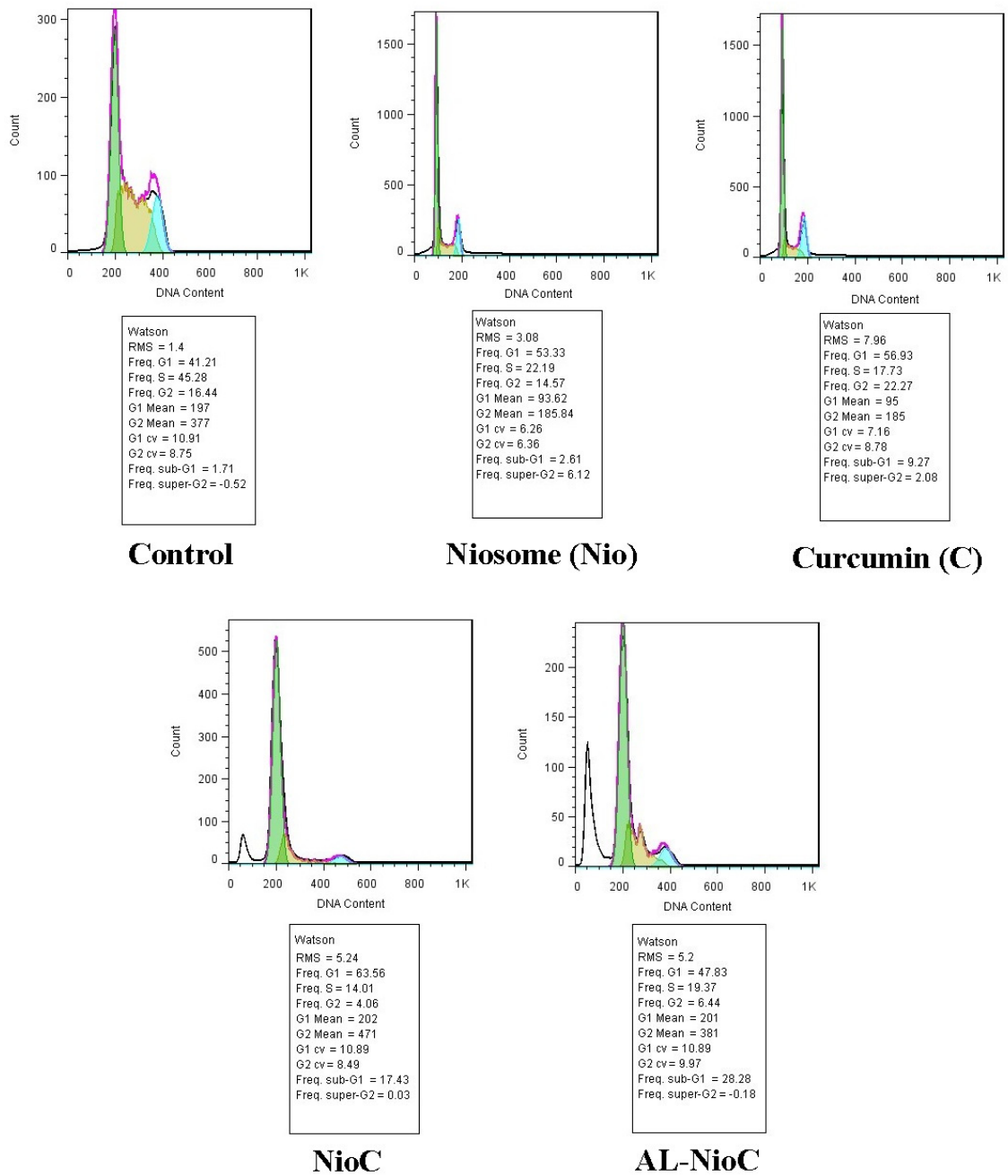


Figure S8. The SKBR3 cell cycle analysis of different samples

Reference:

[1] S. Dash, P.N. Murthy, L. Nath, P. Chowdhury, Acta Pol Pharm, 67 (2010) 217-223.