

## Supporting Information

Lipoic acid-modified oligoethyleneimine-mediated miR-34a delivery to  
achieve the anti-tumor efficacy

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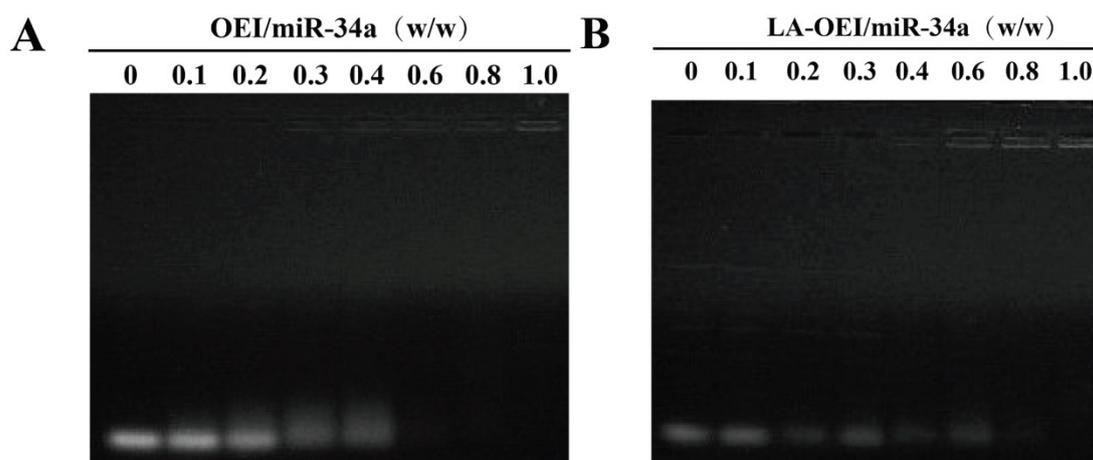
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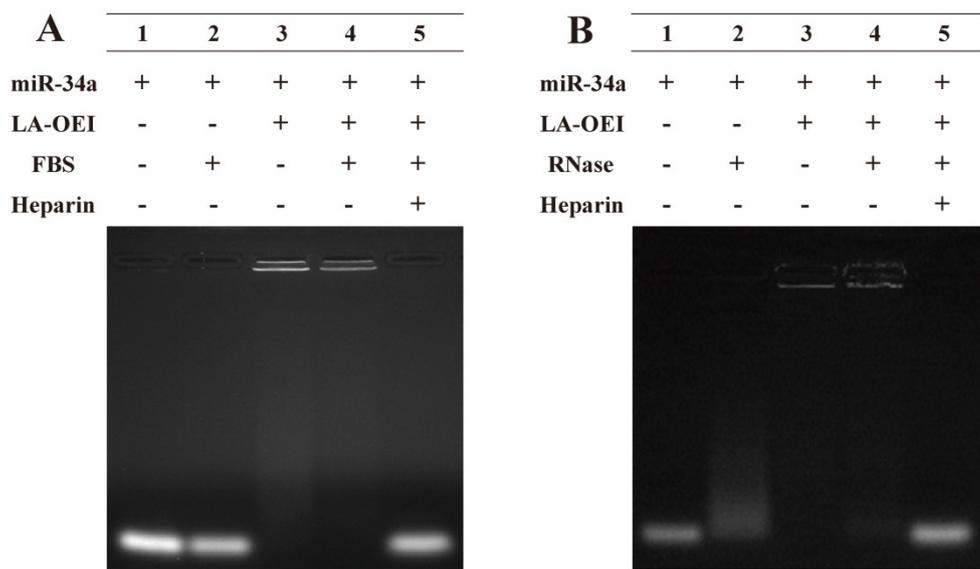
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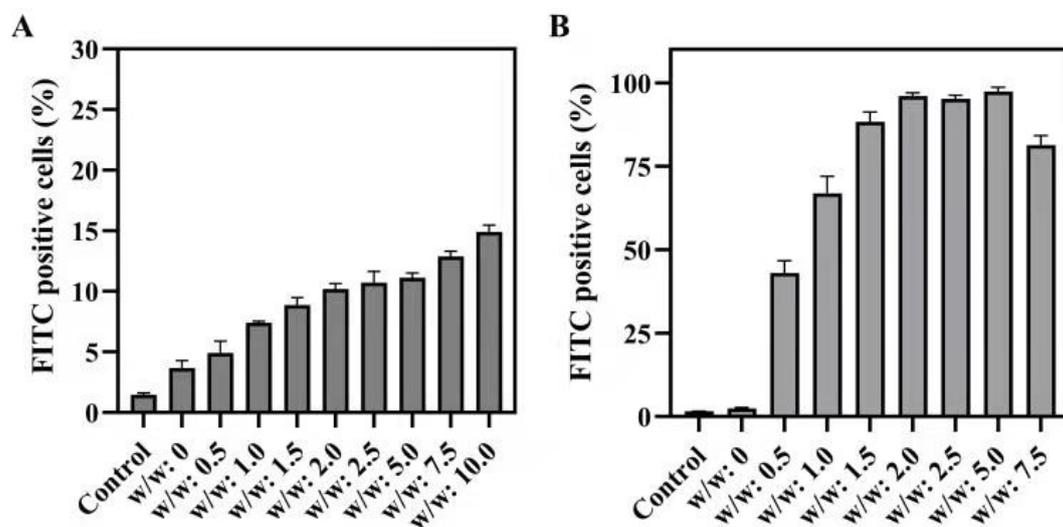
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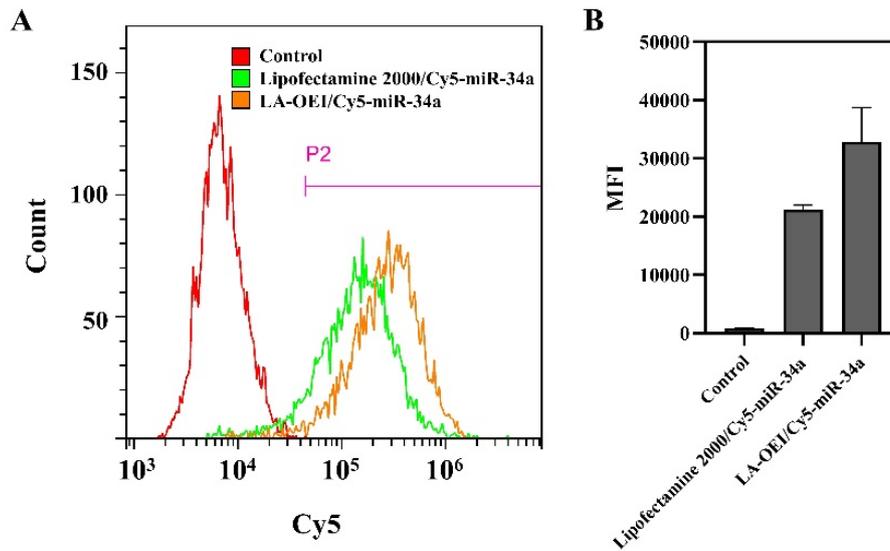
**Figure S1.** The miR-34a binding and condensation ability of different carriers using the gel retardation assay. A: OEI/miR-34a nanoparticles; B: LA-OEI/miR-34a nanoparticles.



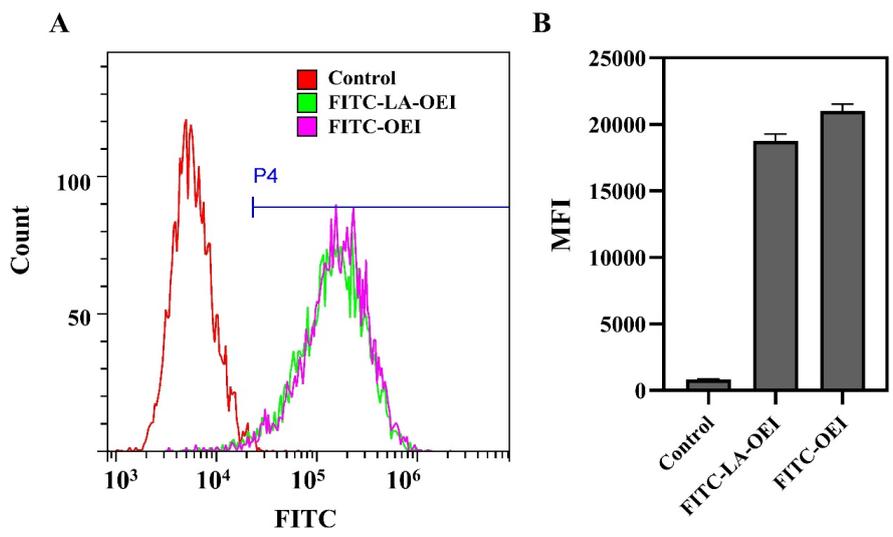
**Figure S2.** The protective effect of LA-OEI from the degradation of miR-34a. A: 50% FBS; B: RNase A.



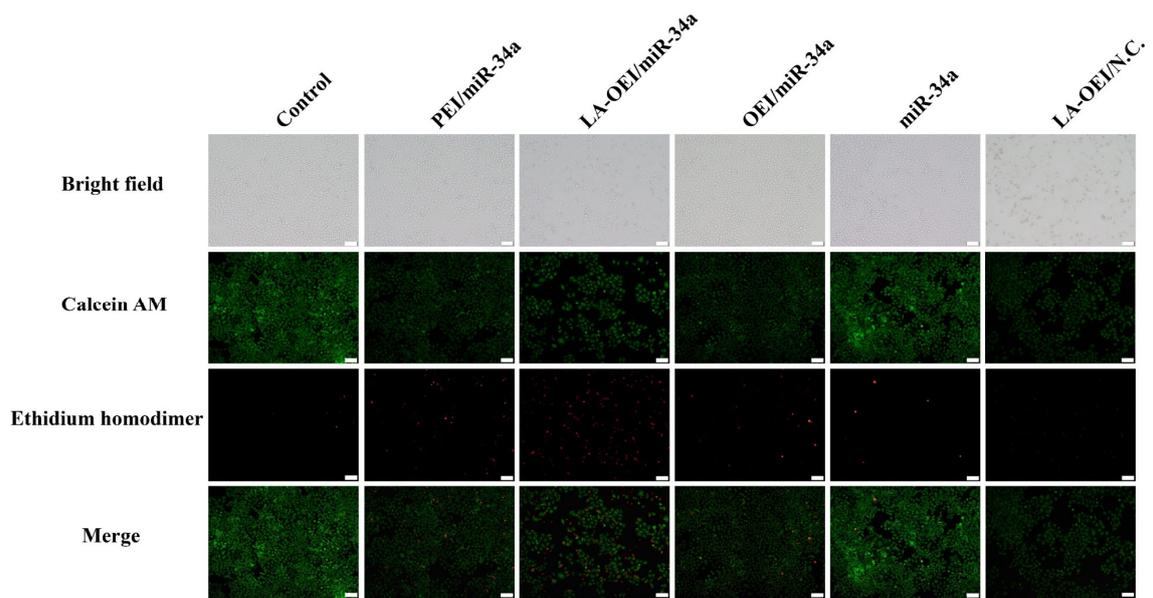
**Figure S3.** Quantitative analysis for the transfection efficiency of nanoparticles at different mass ratios based on FITC positive cells. A: OEI/miR-34a; B: LA-OEI/miR-34a. Data were presented as the mean value  $\pm$  SD of triplicate experiments.



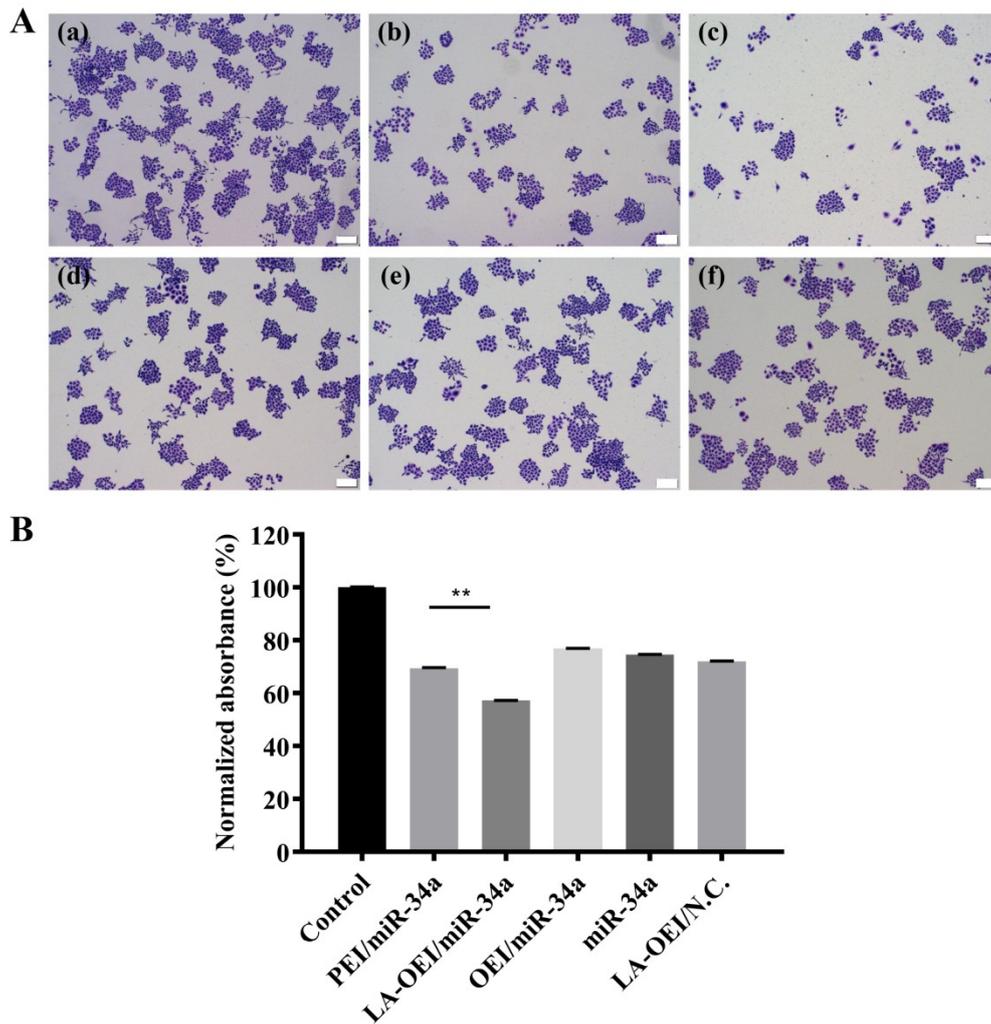
**Figure S4.** Flow cytometric analysis for the transfection efficiency of Lipofectamine 2000/miR-34a and LA-OEI/miR-34a nanoparticles (w/w: 0.5) using Cy5-labeled miR-34a (A) and the quantitative measurement based on mean fluorescence intensity (MFI) (B). Data were presented as the mean value  $\pm$  SD of triplicate experiments.



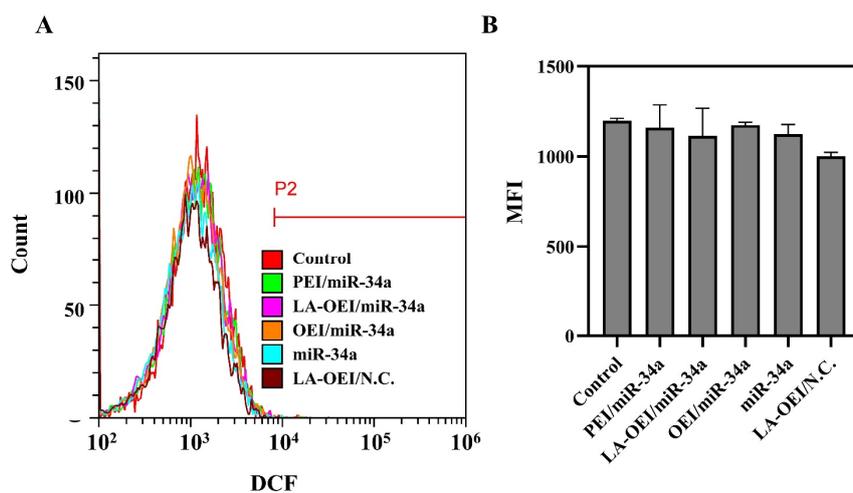
**Figure S5.** Flow cytometric analysis for the endocytosis ability of FITC-labeled OEI and LA-OEI (A) and the quantitative measurement based on mean fluorescence intensity (MFI) (B). Data were presented as the mean value  $\pm$  SD of triplicate experiments.



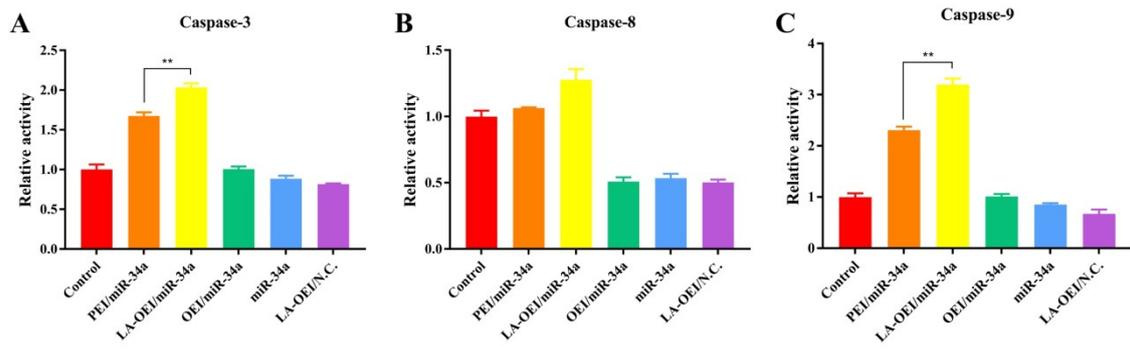
**Figure S6.** Live/dead staining assay of HeLa cells after the treatment with different nanoparticles. The scale bar is 100  $\mu\text{m}$ .



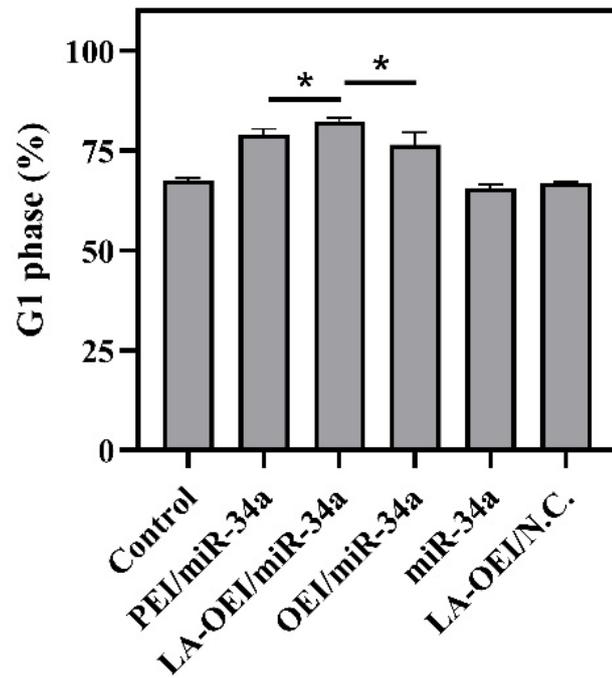
**Figure S7.** The anti-proliferative effect after the miR-34a transfection. A: The colony formation assay of HeLa cells after the treatment with different nanoparticles: (a) control, (b) PEI/miR-34a, (c) LA-OEI/miR-34a, (d) OEI/miR-34a, (e) miR-34a and (f) LA-OEI/N.C. The scale bar is 200  $\mu$ m. B: Quantitative analysis of the colony formation in HeLa cells after the treatment with different nanoparticles. Data were presented as the mean value  $\pm$  SD of triplicate experiments.



**Figure S8.** Flow cytometric analysis for the intracellular ROS level after the transfection of different nanoparticles for 48 h, using DCFH-DA as a probe (A) and the quantitative measurement based on mean fluorescence intensity (MFI) (B). Data were presented as the mean value  $\pm$  SD of triplicate experiments.



**Figure S9.** The relative activities of caspase-3, -8 and -9 in HeLa cells after the treatment with different nanoparticles. Data were presented as the mean value  $\pm$  SD of triplicate experiments.



**Figure S10.** Quantitative analysis for the G1 phase arrest of HeLa cells after miR-34a transfection. Data were presented as the mean value  $\pm$  SD of triplicate experiments ( $*p < 0.05$ ).

**Table S1.** The hydrodynamic diameter and zeta potential values of LA-OEI/miR-34a and OEI/miR-34a nanoparticles.

Nanoparticles	Mass ratio	Hydrodynamic diameter	Polydispersity	Zeta potential
		(nm)	index (PDI)	(mV)
LA-OEI/miR-34a	0.5	293.2 ± 2.6	0.318	-12.0 ± 0.8
	1.0	288.9 ± 3.6	0.373	+10.5 ± 1.2
	2.0	197.7 ± 4.4	0.362	+17.1 ± 0.9
	3.0	187.8 ± 1.2	0.316	+25.8 ± 0.6
	4.0	138.7 ± 0.9	0.234	+30.2 ± 0.9
	5.0	123.4 ± 2.1	0.276	+47.0 ± 0.7
OEI/miR-34a	0.5	386.9 ± 8.8	0.386	-15.0 ± 0.3
	1.0	280.0 ± 7.8	0.244	-0.1 ± 0.8
	2.0	218.5 ± 6.3	0.113	+5.3 ± 0.4
	3.0	190.2 ± 2.3	0.199	+8.2 ± 0.7
	4.0	181.9 ± 1.9	0.127	+13.6 ± 0.5
	5.0	167.0 ± 2.0	0.131	+17.5 ± 0.7