

**Table S1.** The aptamer sequences used in the sensing assay.

Name	Sequences (5' to 3')
PD-L1	AAGACGGACCAGCCTTGCCGCAAGACGGACCAGGGATT
Biotin-PD-L1	Biotin-AAGACGGACCAGCCTTGCCGCAAGACGGACCAGGGATT
Cy3-PD-L1	Cy3-AAGACGGACCAGCCTTGCCGCAAGACGGACCAGGGATT
Biotin-PD-L1-srambled	Biotin-ACGACATACCGGCCTTTCCGCAAGACGGACCAGGGGT

**Table S2.** The recovery (%) of the sensing assay.

Spiked (EVs/mL)	Recovery (%)
10 <sup>6</sup>	96.49 ± 3.59
10 <sup>7</sup>	95.85 ± 2.94
10 <sup>8</sup>	90.05 ± 3.14

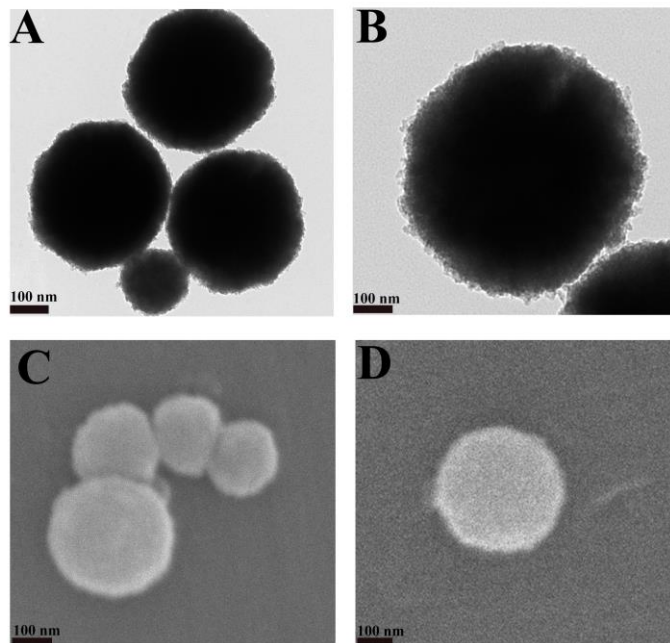
*Note: The readings were obtained in triplicate for each sample.*

*The data is shown as mean ± standard deviation (%).*

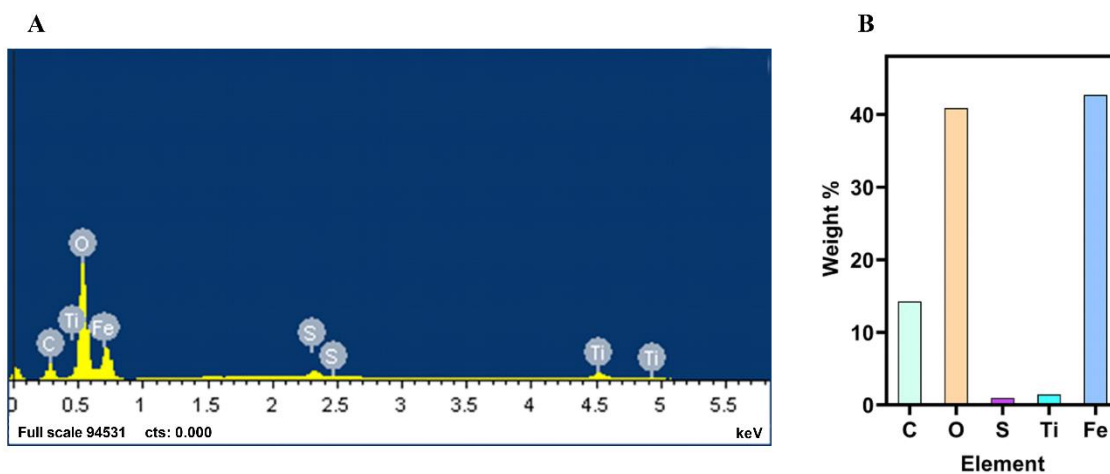
**Table S3.** Clinical information of the patients enrolled in the study.

S/No	Age	Sex	CEA (ng/mL)	CA-125 (U/mL)	CYFRA21-1 (ng/mL)	NSE (ng/mL)	EGFR	T	N	M	Stage
1	45	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	56	F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	37	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	43	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	42	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	39	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	57	F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	66	M	1.06	21.7	2.66	18.5	+	T2b	N0	M0	IIB
9	65	M	2.07	23.7	3.89	16.9	+	T1b	N0	M0	IA2
10	63	M	3.53	28.2	2.64	15.9	+	T4	N1	M0	IIA
11	56	F	1.62	24.5	11.4	41.8	+	T2a	N2	M0	IIB
12	70	M	1.07	53.7	2.4	14.9	+	T1c	N0	M0	IA3
13	71	F	1.07	53.7	2.4	14.9	+	T1c	N0	M0	IA3
14	72	F	1.3	17.80	1.90	11.75	+	T2a	N0	M0	IB
15	56	F	0.97	15.4	1.03	12.2	+	T2a	N1	M0	IIB
16	64	M	3.53	28.2	2.64	15.9	+	T4	N1	M0	IIB
17	46	F	0.68	6.5	1.58	13.6	+	T2a	N0	M1	IV
18	66	M	0.58	28.3	3	11.7	+	T2b	N1	M1	IV
19	61	M	50.84	80	21.1	57.7	+	T3	N2	M1	IV
20	69	M	31.97	82.3	10.2	13.6	+	T2	N3	M1	IV
21	59	F	1.8	6.8	5.4	9.80	+	T3	N3a	M1	IV
22	57	M	7.07	35	3.84	9.88	+	T2	N3	M1	IV
23	61	M	50.84	80	21.1	57.7	+	T2	N1	M1	IV
24	61	F	43.19	89.4	2.71	12.8	+	T1	N3	M1	IV
25	73	M	>100	76	4.89	15.7	+	T4	N3	M1	IV

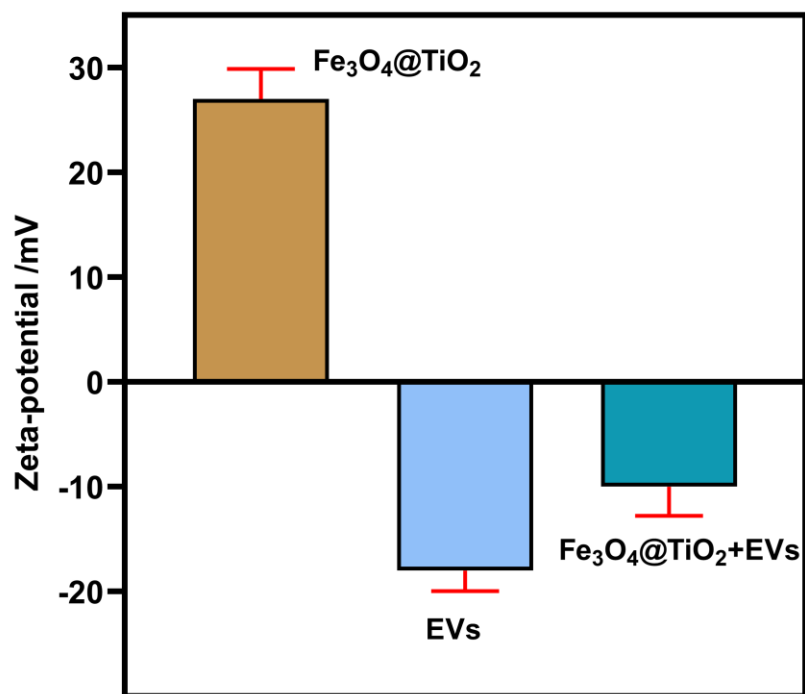
**Note:** Carcinoembryonic antigen (CEA), Cancer antigen (CA)-125, cytokeratin 19 fragment antigen (CYFRA 21-1), Neuron-specific enolase (NSE), Epidermal growth factor receptor (EGFR), Tumor Size (T), Nodules (N), Metastasis(M), Not available (N/A).



**Figure S1.** TEM and SEM images of  $\text{Fe}_3\text{O}_4@\text{TiO}_2$ . (A) multiple  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  (B) single  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  (C) multiple  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  (D) Single  $\text{Fe}_3\text{O}_4@\text{TiO}_2$ .



**Figure S2.** XDS analysis of  $\text{Fe}_3\text{O}_4@\text{TiO}_2$ . (A) XDS spectrum of the  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  beads (B) Percentage weight of respective elements.



**Figure S3.** Zetapotential of  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  beads, EVs and  $\text{Fe}_3\text{O}_4@\text{TiO}_2$  with EVs.

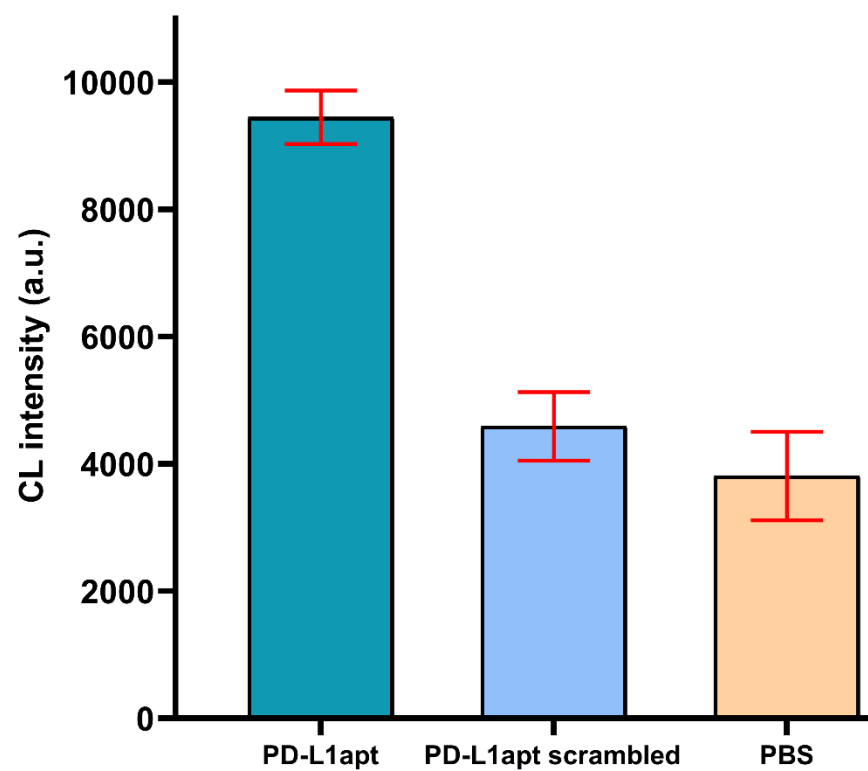


Figure S4. PD-L1 aptamer specificity.

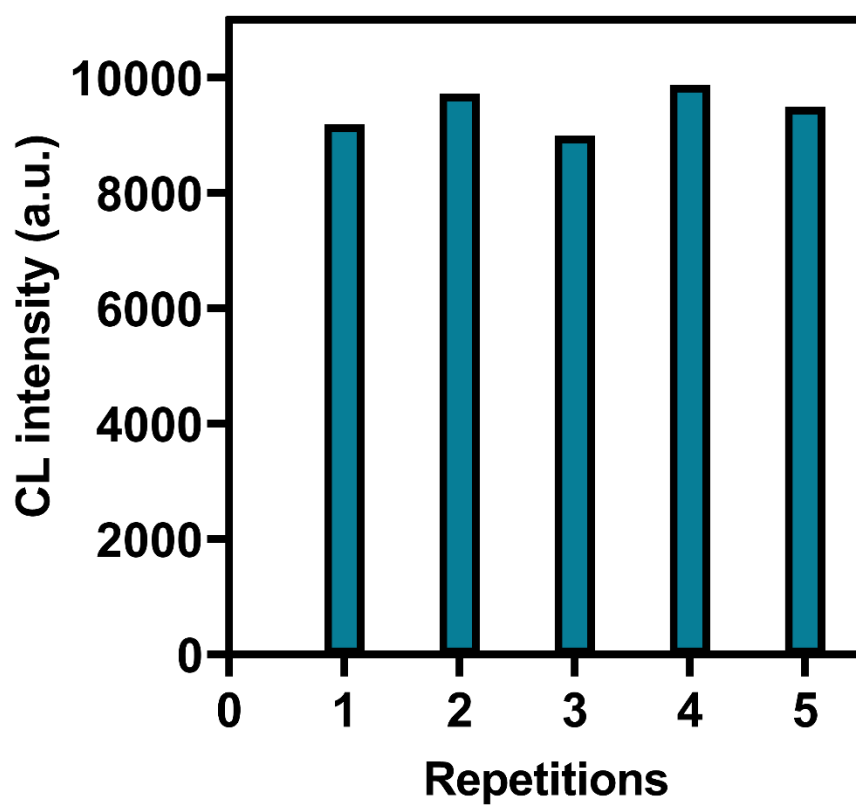


Figure S5. Repetitions for the confirming the analytical performance of the method.  
Repetitions (1-5) of  $10^7$  EVs/mL. (Relative standard deviation=**4.41** %, mean value=9276.4).