

Application of magnetic microspheres in the chemiluminescence platform of carcinoembryonic antigen (CEA) detection

Background:

Carcinoembryonic antigen (CEA) is a member of the cell surface glycoprotein family. This protein is highly expressed in human colon cancer and many other cancers. CEA has been used as a specific marker for early diagnosis of colon cancer and rectal cancer. After a lot of clinical practice, it has been noticed that the increase of CEA not only occurs in malignant tumors of the gastrointestinal tract, but also in the serum of breast cancer, lung cancer and other malignant tumors. Carcinoembryonic antigen is considered to be a broad-spectrum tumor marker. Although it cannot be used as a specific indicator for the diagnosis of certain malignant tumors, it still has important clinical applications in the differential diagnosis of malignant tumors, disease monitoring, and efficacy evaluation. Therefore, it is necessary to establish a sensitive, rapid and accurate CEA detection method for early and effective diagnosis and treatment.

Advantages of Magnetic Microspheres Based Chemiluminescence Detection of CEA

Enzyme-linked immunosorbent assay (ELISA) is a widely used method to detect CEA. This method is based on the principle of immunoassay for enhanced detection of biomolecular enzymes in the field of life sciences. ELISA is a useful and sensitive detection method, but it is very time-consuming and labor-intensive. However, the chemiluminescence method is a very effective method for detecting this protein. Compared with ELISA, this method has the advantages of low detection limit and wide detection range. The analysis time can be reduced to one third of ELISA. This method has great potential for detecting CEA or other biomarkers (such as AFP).

1. Experimental method:

The carcinoembryonic antigen quantitative detection kit was used to compare the stability, precision, and reactivity of VDO Biotech's magnetic microspheres and Company J's magnetic microspheres at 37°C.

2. Material and reaction system:

(1) Standard: CEA

(2) Reaction mode: one-step reaction

(3) Magnetic microspheres: CMP1003CA (VDO Biotech) compared to Company J's magnetic microspheres

(4) Coated antibody: 20μg antibody/mg-beads

Labeled antibody: the molar ratio of antibody/ acridinium ester is 1/20

(5) Process: add 10μL sample, 100μL acridinium ester, and 40μL streptavidin magnetic microspheres into a tube, incubate at 37°C for 20 minutes, and then wash 5 times.

3. Result:

(1) Stability test at 37°C

The magnetic microspheres CMP1003CA (VDO Biotech) and Company J magnetic microspheres were coated with antibodies

and divided into 2 parts separately. One part was placed at 2-8°C, and the other part was placed at 37°C. The signal intensity was tested on the 8th day. According to the following results, under the same experimental conditions, the signal intensity and stability of VDO magnetic microspheres are equivalent to that of Company J magnetic microspheres.

	Company J's Magnetic Microspheres			VDO Magnetic Microspheres		
Antigen concentration (ng/mL)	2-8°C	37°C	Deviation	2-8°C	37°C	Deviation
0	595	589	-1.01%	557	564	1.26%
2.29	5129	5241	2.18%	4884	4967	1.70%
11.43	21118	21772	3.10%	18987	19423	2.30%
102.68	180875	183407	1.40%	171731	174478	1.60%
414.13	759088	787174	3.70%	723924	747813	3.30%
918.34	1216901	1240022	1.90%	1180381	1205169	2.10%

Stability test data at 37°C

(2) Precision test of magnetic microspheres

Select antigen concentration of 0, 2.29, 102.68ng/mL, and test 6 times for each concentration. The results are as follows, which proves that the VDO magnetic microspheres are comparable in precision and repeatable compared with the Company J magnetic microspheres.

	Company J's Magnetic Microspheres			VDO Magnetic Microspheres		
Antigen concentration (ng/mL)	0	2.29	102.68	0	2.29	102.68
Signal strength	496	5131	18045	674	4813	16511
	590	5275	18093	710	5049	16931
	620	5099	18824	560	4810	16537
	634	5262	17912	590	4906	16437
	525	5092	18805	619	4890	16306
	575	5291	17460	706	5002	17128
AVERAGE	573.3	5191.7	18189.8	643.2	4911.7	16641.7
STDEV	53.8	93.8	533.1	62.8	97.6	317.1
CV	9.38%	1.81%	2.93%	9.76%	1.99%	1.91%

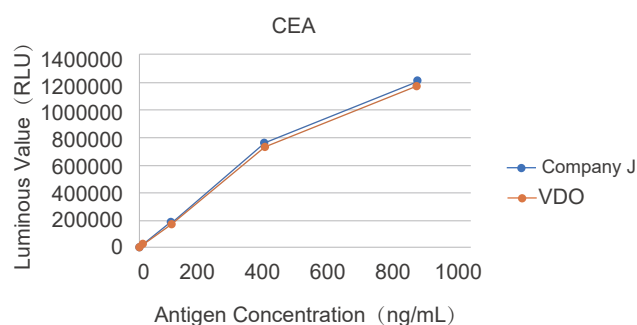
Precision test of magnetic microspheres

(3) Reactivity test of magnetic microspheres

Test the reactivity of each antigen concentration of 0, 2.29, 11.43, 102.68, 414.13, 918.34ng/mL. Under the same conditions, the signal strength of VDO's and Company J's magnetic microsphere are comparable.

Detection of carcinoembryonic antigen (CEA) by magnetic microsphere chemiluminescence method

Antigen Concentration	Company J's Magnetic Microspheres	VDO's Magnetic Microspheres
0ng/ml	595	557
2.29ng/ml	5129	4884
11.43ng/ml	21118	18987
102.68ng/ml	180875	171731
414.13ng/ml	759088	723924
918.34ng/ml	1216901	1180381



▲ Under the same conditions, the signal strength of VDO's and Company J's magnetic microspheres are comparable.

Reactivity test of magnetic microspheres

4. Conclusion:

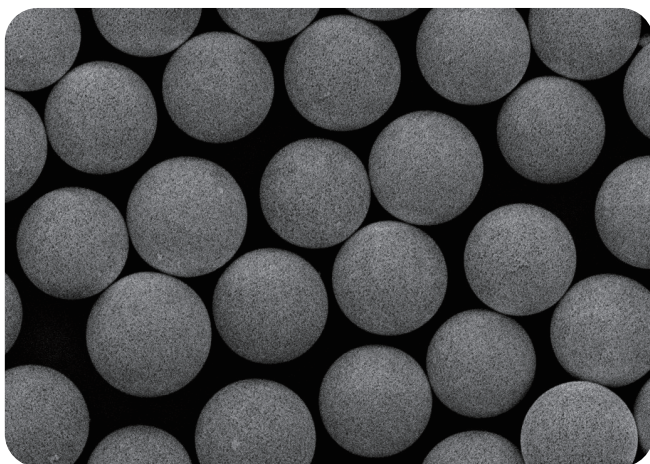
In the CEA test, VDO Biotech's streptavidin magnetic microspheres and Company J magnetic microspheres have comparable test results on key indicators such as stability, precision, and signal intensity, and are suitable for this test.

Reference:

1. Hasanzadeh M, Shadjou N. Advanced nanomaterials for use in electrochemical and optical immunoassays of carcinoembryonic antigen. A review[J]. Microchimica Acta, 2017, 184(2): 389-414.
2. Tsai H Y, Chang C Y, Li Y C, et al. Detection of carcinoembryonic antigen using functional magnetic and fluorescent nanoparticles in magnetic separators[J]. Journal of Nanoparticle Research, 2011, 13(6): 2461-2467.

VDO Biotech Magnetic Microspheres for Chemiluminescent

VDO Biotech's magnetic microspheres for chemiluminescent have superparamagnetism and moderate magnetic content, excellent resuspendability and fast magnetic response. With our advanced microsphere synthesis technology, proprietary surface coating process, and variety selections of functional groups, our magnetic microspheres provide comprehensive solutions to meet customers' specific needs of different technology route development. The high-load functional group guarantees the binding capacity, and this series of products show outstanding performance in the field of immunoassay.



Cat. No.	Particle Size	Color	Surface Groups	Solids	Size
CMP0600CA	0.6 μm	Brownish yellow	COOH	2.5%	10ml, 100ml, 1L
CMP1001CA	1 μm	Brownish yellow	COOH	2.5%	10ml, 100ml, 1L
CMP1003CA	3 μm	Brownish yellow	COOH	2.5%	10ml, 100ml, 1L
CMP0600SA	0.6 μm	Brownish yellow	SA	1.0%	10ml, 100ml, 1L
CMP1001SA	1 μm	Brownish yellow	SA	1.0%	10ml, 100ml, 1L
CMP1003SA	3 μm	Brownish yellow	SA	1.0%	10ml, 100ml, 1L



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