Magnetic separation of clenbuterol based on competitive immunoassay and evaluation by surface-enhanced Raman spectroscopy

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Magnetic separation and detection of CL pig hair samples

In order to research the matrix effect of the magnetic separation of CL based on competitive immunoassay, two kinds of pig hairs were introduced. One was sheared from the pig which had never absorbed feeds that containing CL, marked as NO.1 pig hair; and the other was sheared from the pig which absorbed feeds that containing CL over a long period of time, marked as NO.2 pig hair. 100 mg of the two kinds of pig hairs were dissolved in 10 mL of 0.1 mol·L^{-1} HCl respectively and digested for about 12 h in a water bath with the temperature of 60 centidegree, after the digestion reaction was complete, pH value of each sample was adjusted to neutral or weak alkaline conditions and the extracting solutions for competitive immunoassay were obtained. Then 1 ng·mL^{-1} of CL dissolved in extracting solution of NO.1 pig hair was served as a spiked sample.

500 μL of (Fe$_3$O$_4$@Au)-CL$_{ab}$ was introduced in 1 ng·mL^{-1} of CL spiked sample dissolved in extracting solution of NO.1 pig hair and real sample of extracting solution of NO.2 pig hair, respectively. SERS intensities after magnetic separations were recorded and compared with the blank of extracting solution of NO.1 pig hair and the original samples before separations, to investigate the separation efficiencies of spiked and real samples of CL, as shown in Fig. S1 and Fig. S2, respectively.

In this case, the intensity of blank sample of extracting solution of NO.1 pig hair was defined as I_0, the I/I_0 values of CL spiked and real samples before separations were 42.68% and 38.99%, respectively; while after magnetic separations, the values increased to about 96.28% and 99.53%, respectively, both of which were within the LOD, indicating the concentrations of CL after separations were comparable to the blank of extracting solution of NO.1 pig hair and this separation approach has good feasibility in CL practical systems.

In summary, it demonstrated that this strategy exhibited promising capacity in separating residues in the real samples.
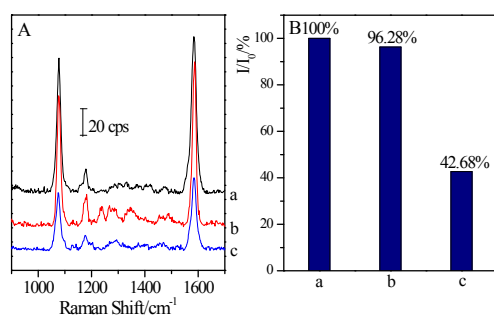

Fig.S1 SERS spectra of magnetic separations on CL spiked samples: blank of extracting solution of NO.1 pig hair (a), 1 ng·mL^{-1} of CL spiked samples before (c) and after (b) magnetic separation.
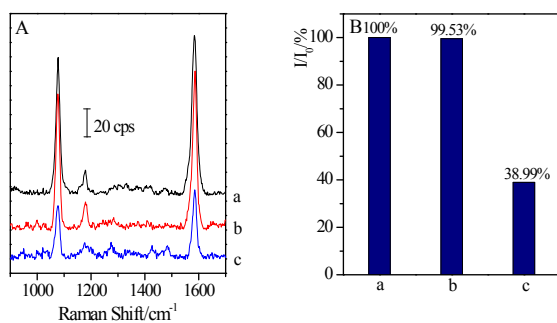

Fig.S2 SERS spectra of magnetic separations on CL real samples: blank of extracting solution of NO.1 pig hair (a), CL real samples of extracting solution of NO.2 pig hair before (c) and after (b) magnetic separation.