Table.AM1 Zeta potential of MBFA9 (pH=5.5)

	MBFA9-Pb(II)	MBFA9
Zeta potential/mv	-0.45	-9.84

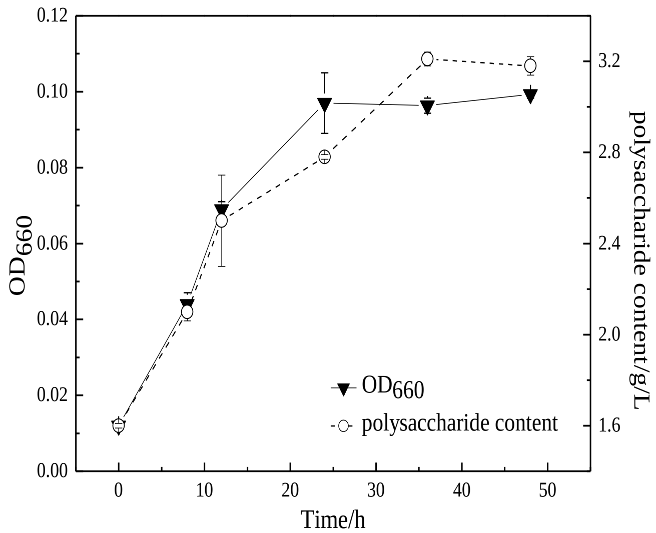


Figure. AM1 Growth curve of A9 and the change of polysaccharide content

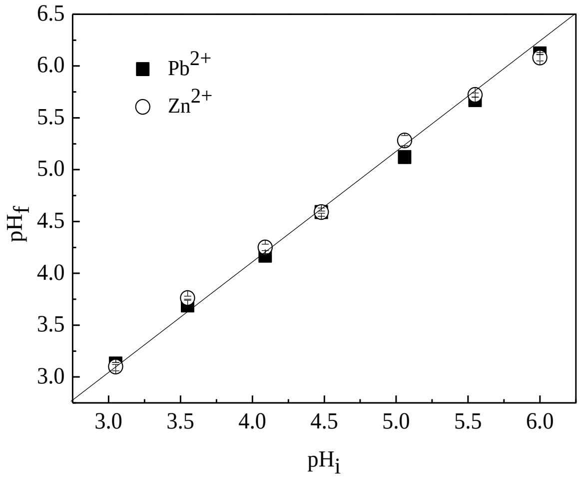
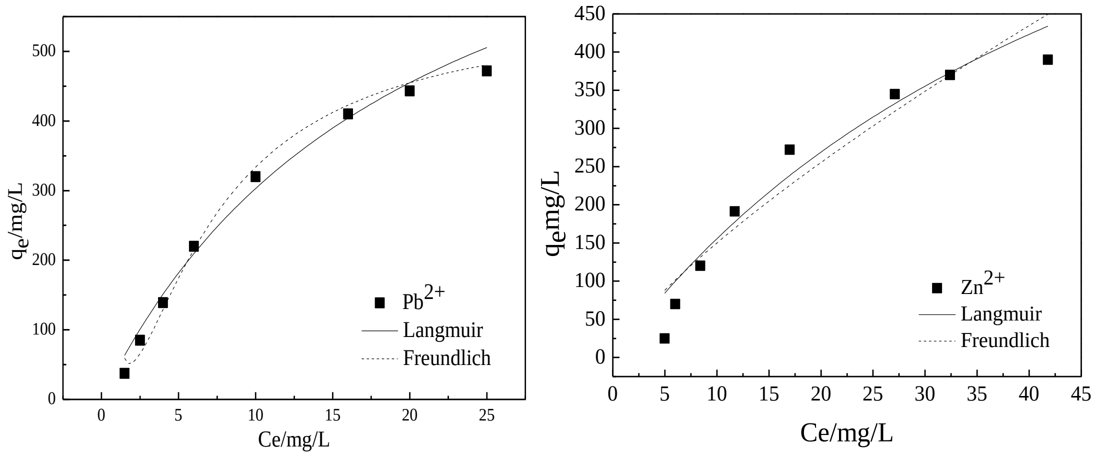


Figure. AM2 pH variation during the process of capturing Pb(II) or Zn(II) by MBFA9



(a)Pb2+ (b)Zn2+

Figure. AM3 Adsorption isotherms of capturing Pb(II) or Zn(II) by MBFA9

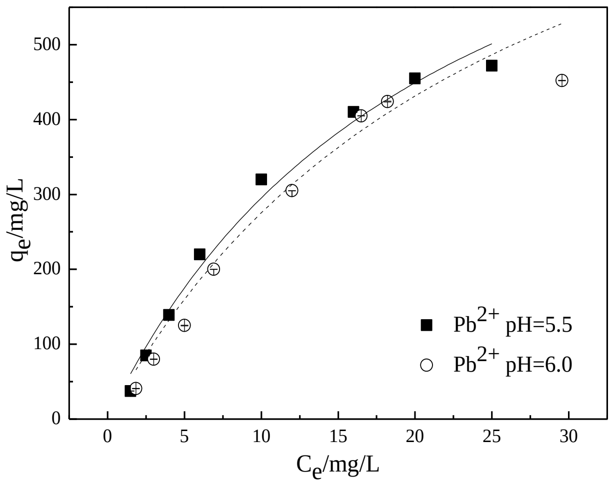
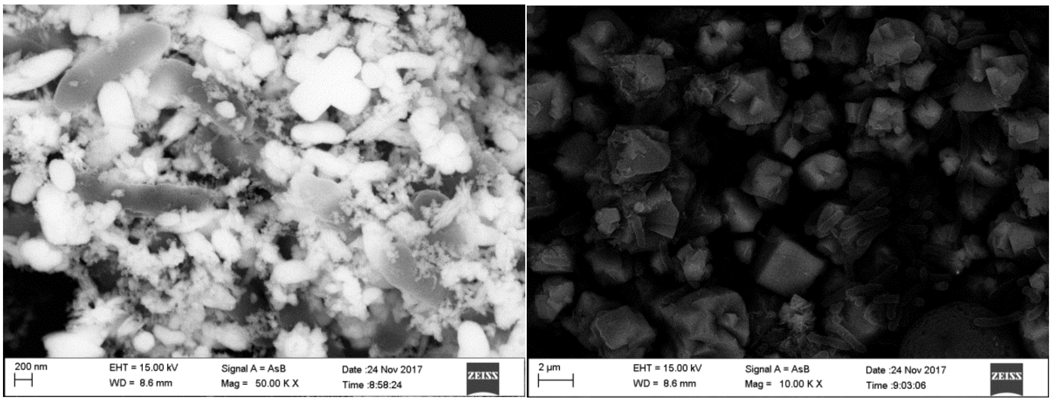
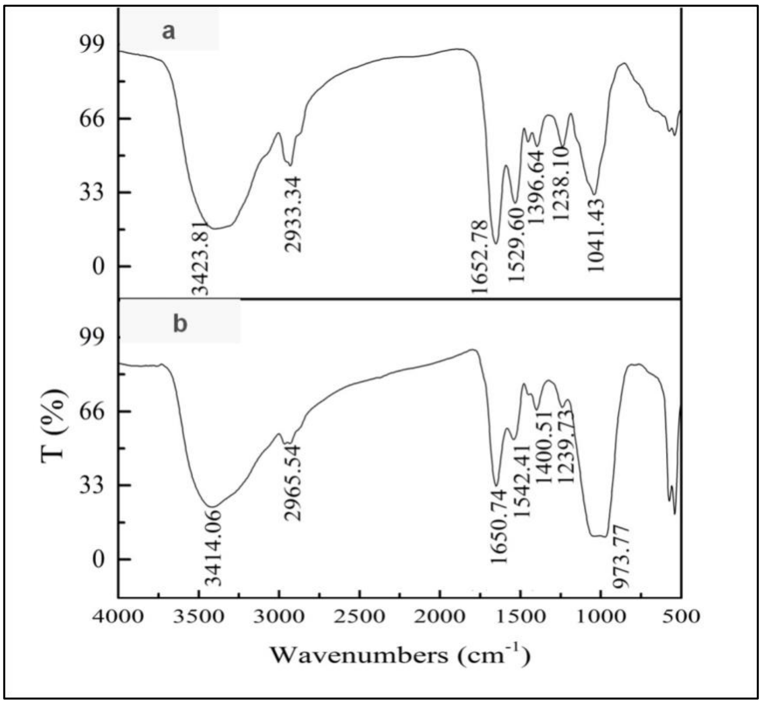


Figure. AM4 Pb(II)adsorption isotherms (pH=5.5、6.0)



(a) Pb(II) (b) Zn(II)

Figure. AM5 FESEM characterization of MBFA9 capturing Pb(II) and Zn(II) in the SingalA=AsB



(a) MBFA9, (b) MBFA9-Pb(II)

Figure. AM6 FTIR spectroscopy of MBFA9 and MBFA9-Pb(II)

FESEM and EDS analysis of MBFA9, MBFA9-Pb(II) **and** MBFA9-**Zn(II)**

FESEM was applied to analyze the surface ultrastructure of **MBFA9,** MBFA9-Pb(II)

and MBFA9-**Zn(II)** at nanometer scale and low voltage. After Pb(II) or Zn(II) captured under conditions of 50.0mg L^{-1} Pb(II) or Zn(II) solution(100.0mL) , 5% FBA9 dosage, temperature of 30℃, pH of 5, the contact time of 35 min, MBA9-Pb(II) and MBFA9-**Zn(II)** were centrifuged 15min at 8000rpm, glutaraldehyde elution centrifugation and 4h glutaraldehyde immobilized, the collected bacteria and sediments were cleaned by phosphate buffer and ethanol gradient dehydration. Then dried samples were sprayed gold and scanned with ULTRA/PLUS field emission scanning electron microscope.

FTIR analysis of MBFA9 and MBFA9-Pb(II)

The fermentation broth of A9 (FBA9) was diluted three times with distilled water and centrifuged for 15 minutes at a speed of 8000r min^{-1}. After evaporation and concentration by rotary evaporator, ethanol was precipitated three times, stored at 4℃ for 24 hours, washed with 95% ethanol, and MBFA9 was collected for Pb(II) or capture under conditions of 50.0mg L^{-1} Pb(II) solution(100.0mL), 5% FBA9 dosage, temperature of 30℃, pH of 5, the contact time of 35 min. MBFA9 and MBFA9-Pb(II) (MBFA9 after Pb(II) capture) were used for FTIR detection.

A mass of dry MBFA9 or MBFA9-Pb(II) was mixed with dry finely powdered potassium bromide in a ratio of 1:100. The mixture was spread uniformly in a suitable disk and subjected to a pressure of 800 MPa, and spectra were recorded in the range of 500 to 4000cm^{-1} using a Nicolet 380 Thermo Scientific fourier transform infrared spectrometer.

All adsorption models are as follows:

1、Adsorption isotherms

(1)Isothermal model of single component adsorption

The Langmuir and Freundlich isotherm models were carried out by conducting biosorption experiments with different initial Pb(II) or Zn(II) concentrations. The experimental data conformed to the linear forms of Langmuir and Freundlich models expressed as the following (1)and(2) ,respectively:

$$q_e=q_{max}bC_e/(1+bC_e) \qquad (1)$$

$$\ln q_e=\ln K_f+n\ln C_e \qquad (2)$$

where q_{max} and b are Langmuir constants related to adosorption capacity (mg/g) and adsorption rate constant (L/mg);Ce is equilibrium concentration of metal ions (mg/L) and q_e is the amount of the metal adsorbed (mg) by MBFA9 (g); K_f and n are Freundlich constants which correlated to the adsorption equilibrium constant and adsorption intensity, respectively.

(2)Isothermal model of multicomponent adsorption

Extent-Langmuir model:

$$q_i=b_iq_{m,i}C_{e,i}/(1+\sum^{n}_{j=1}b_jC_{e,j})$$

Where q_i is adsorption capacity of MBFA9 for component i in mixed ion solution, mg/g;

$C_{e,i}$ is equilibrium concentration of component i , mg/L;

b_i is Langmuir adsorption constant of component i,L/mg;

$q_{m,i}$ is the amount of component i adsorbed (mg) by MBFA9 (g)。

(2)Langmuir-Freundlich model

$$q_i=q_{m,i}b_iC_{e,i}C_{e,j1}/n_j/(1+\sum_{nj=1}b_jC_{e,j})$$

Where q_i is adsorption capacity of MBFA9 for component i in mixed ion solution, mg/g;

$C_{e,i}$ is equilibrium concentration of component i , mg/L;

b_i is Langmuir adsorption constant of component i,L/mg;

$q_{m,i}$ is the amount of component i adsorbed (mg) by MBFA9 (g);

n_i is Freundlich adsorption constant of component i,L/mg。

2、Adsorption kinetics

(1)pseudo first order rate equation：

$\ln(1-q_t/q_e)=k_1 t$

q_e is adosorption capacity of MBFA9，mg/g；

q_t is the amount of metal ions adsorbed by MBFA9 when reaction time is t，mg/g；

t is reaction time，min；

k_1 is adsorption rate constant of pseudo first order rate equation，g/mg/min。

(2)pseudo second order kinetic equation：

$t/q_t=1/k_2q_e+t/q_e$

k_2 is adsorption rate constant of pseudo second order kinetic equation，g/mg/min；

q_e is adsorption capacity at equilibrium，mg/g；

t is reaction time，min；

q_t is adsorption capacity when reaction time is t, mg/g.