


**Figure S1**. Continuous adsorption equipment.



**Figure S2.** Arsenic adsorption experiment location in groundwater.




**Figure S3.** Heavy metal rapid screening equipment.

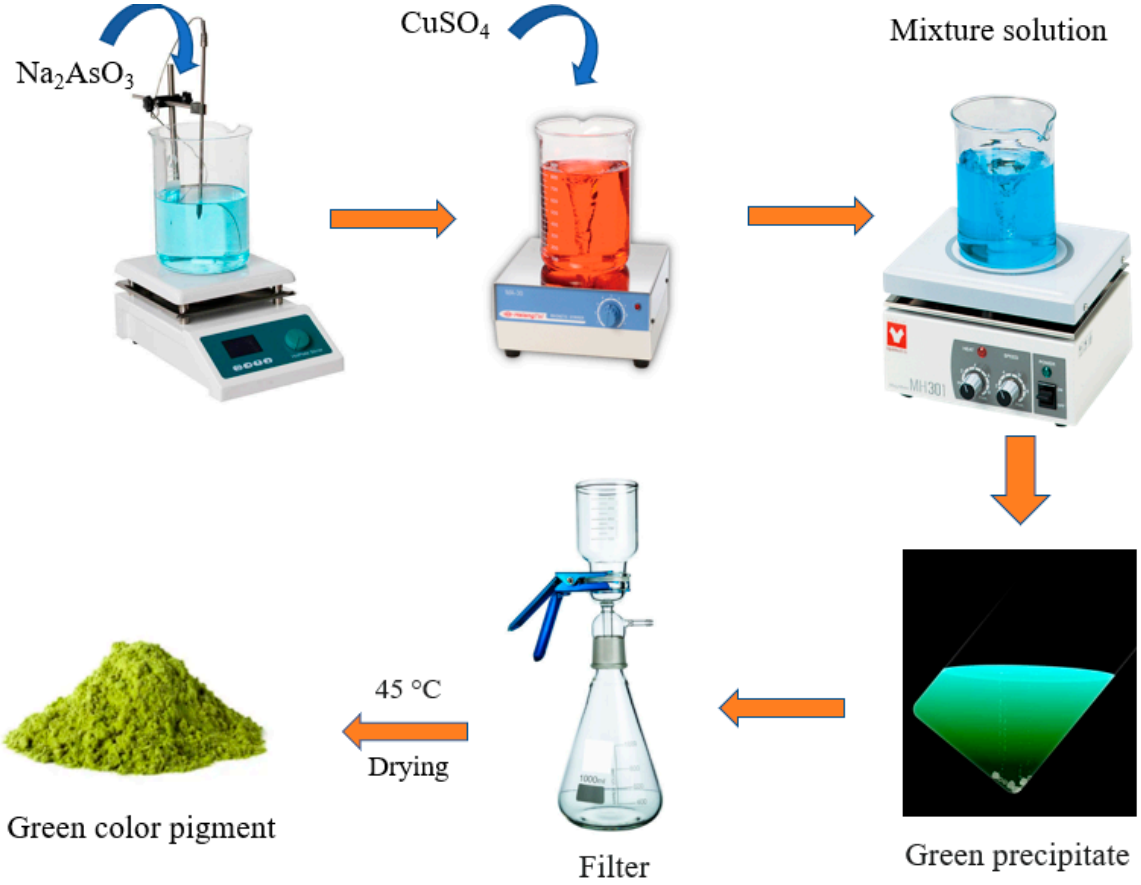


**Figure S4**. Pigment preparation method.

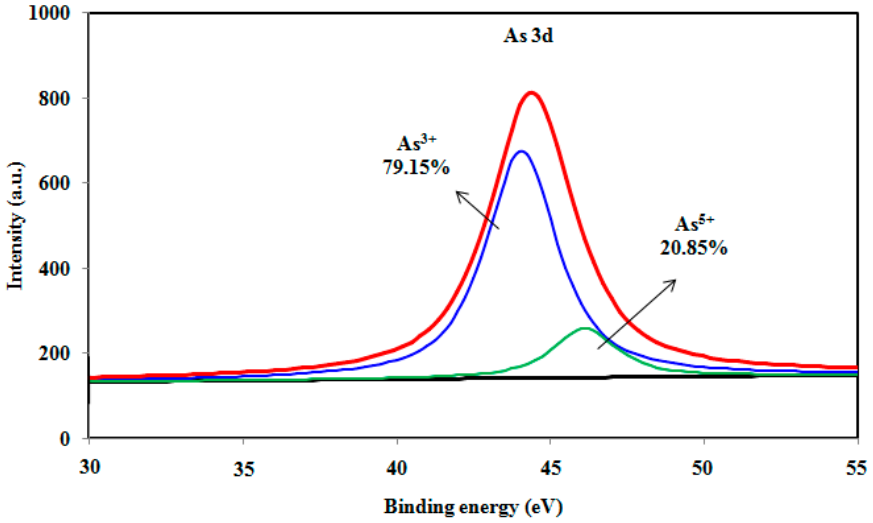


**Figure S5.** XPS of the As3d state of As(III) present SBC.

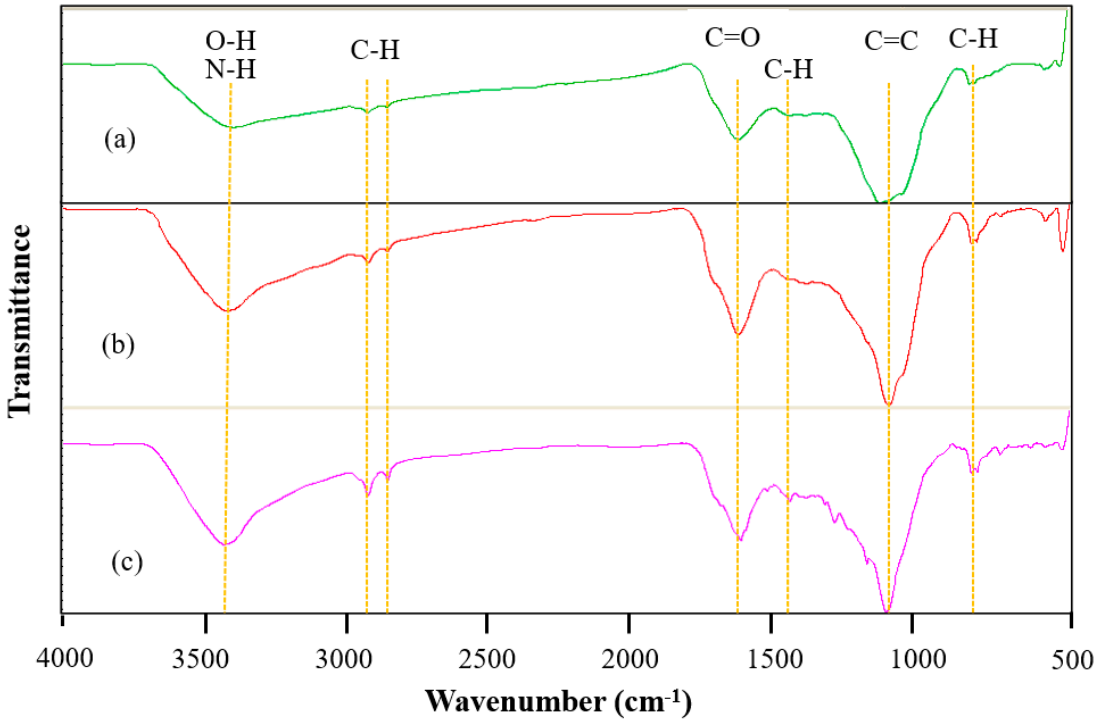


**Figure S6.** FTIR spectrums of (a) Sludge, (b) SBC and (c) Fe-SBC.

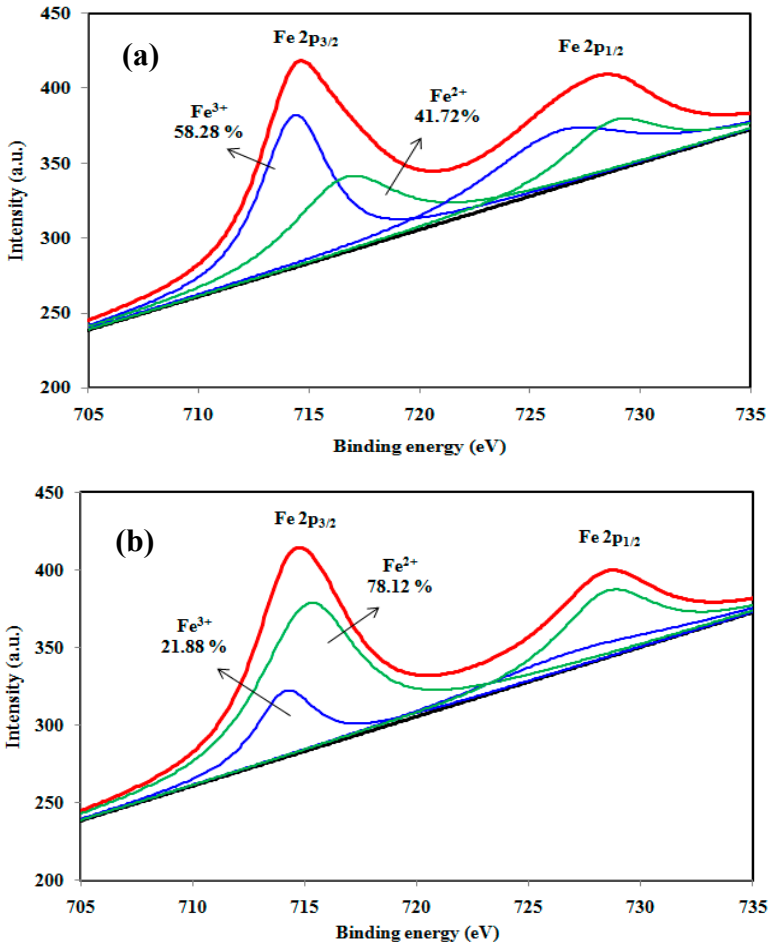


**Figure S7.** XPS of the Fe2p state of Fe present in 8% Fe-SBC: (a) Before and (b) after As(III) adsorption.

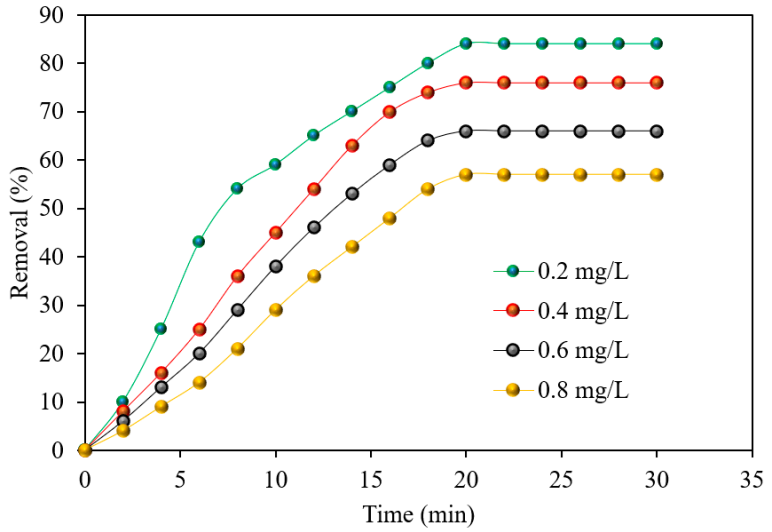


**Figure S8.** The adsorption time of equilibration under varying initial concentrations of As(III).

**Table S1.** The effect of material surface charge under different pH conditions.

| pH | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | $pH_{zpc}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| As(III) | ± | ± | ± | ± | ± | ± | ± | - | - | - | |
| As(V) | ± | - | - | - | - | - | - | - | - | - | |
| SBC | + | + | + | - | - | - | - | - | - | - | 4.32 |
| 8% Fe-SBC | + | + | - | - | - | - | - | - | - | - | 3.87 |

Table S2. Comparison of the first-order and second-order adsorption kinetic models.

| | Conc. (ppm) | Pseudo-first-order | | Pseudo-second-order | |
|---|---|---|---|---|---|
| | | Linear equation | R-squared | Linear equation | R-squared |
| As(III) | 0.2 | Y = -0.0008X-0.4280 | $R^2$ = 0.703 | Y= 16.461X+20.708 | $R^2$ = 0.996 |
| | 0.4 | Y = -0.0014X-0.2088 | $R^2$ = 0.804 | Y= 8.745X+25.859 | $R^2$ = 0.984 |
| | 0.6 | Y = -0.0016X-0.1378 | $R^2$ = 0.872 | Y= 7.136X+25.449 | $R^2$ = 0.978 |
| | 0.8 | Y = -0.0019X-0.1023 | $R^2$ = 0.777 | Y= 5.270X+47.427 | $R^2$ = 0.973 |

Table S3. Effects of different bacteriostatic agents on E.coli and SA.

| Sample | E.coli (cm) | SA (cm) |
|---|---|---|
| $S_1$ | 4.4 | 2.5 |
| $S_2$ | 2.8 | 2.7 |
| Amp | 3.2 | 1.8 |

Table S4**.** EDS result of the pigments.

| Element | Weight (%) | | | |
|---|---|---|---|---|
| | S-1 | S-2 | S-3 | S-4 |
| C | 13.11 | 29.08 | 28.14 | 30.12 |
| O | 33.03 | 30.48 | 21.27 | 34.00 |
| As | 28.22 | 29.47 | 31.03 | 14.47 |
| Cu | 25.64 | 10.96 | - | - |
| Fe | - | - | 19.56 | 21.47 |
| Total | 100 | 100 | 100 | 100 |