**Supplementary material**

**Methacrylic functionalized hybrid carbon nanomaterial for the selective adsorption and detection of progesterone in wastewater**

**Xia Cui a, b, Hua Shu a, b, Lu Wang a, b, Guoning Chen a, b, Jili Han a, b, Qianqian Hu a, b, Kamran Bashir a, b, Zhimin Luo a, b, Chun Chang a, b, Jia Zhang c, Qiang Fu a, b, c \*.**

a Department of Pharmaceutical Analysis, School of Pharmacy, Xi’an Jiaotong University, Xi’an 710061, China

b Institute of Drug Safety and Monitoring, Academy of Pharmaceutical Science and Technology, Xi’an Jiaotong University, Xi’an 710061, China

c Shaanxi Hanjiang Pharmaceutical Group Co., Ltd, Hanzhong 723000, China

\*Corresponding author at: Department of Pharmaceutical Analysis, School of Pharmacy, Xi’an Jiaotong University, Xi’an 710061, China, and Institute of Drug Safety and Monitoring, Academy of Pharmaceutical Science and Technology, Xi’an Jiaotong University, Xi’an 710061, China

E-mail address: fuqiang@mail.xjtu.edu.cn (Q. Fu)

Telephone and fax number: 029-82655382.

The preparation of CNT@CS:

CNT@CS complex was synthesized using our previously reported procedure with slight modification. Typically, 100 mg of chitosan powder was dissolved in 100 mL acetic acid aqueous solution (1%) and stirred to dissolve. After adding 1.0 g CNTs, the solution was homogenized by ultrasound for 15 minutes. Subsequently, glutaraldehyde (25%) was added as a crosslinking agent and the mixture was stirred for 3 h at room temperature. The obtained products were washed several times with purified water and dried overnight in the oven at 50 ℃.

Supplementary Table 1-2

Table S1 Optimization of the amount of MAA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number | Ratio of CNT@CS to MAA | CNT@CS (mg) | MAA (mg) | EGDMA (mg) | *Q*  (mg/g) |
| 1 | 2:1 | 100 | 50 | 50 | 11.67 |
| 2 | 1:1 | 100 | 100 | 50 | 11.77 |
| 3 | 1:2 | 100 | 200 | 50 | 13.39 |
| 4 | 1:4 | 100 | 400 | 50 | 15.15 |
| 5 | 1:6 | 100 | 600 | 50 | 14.04 |

Table S2 Optimization of the amount of EGDMA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number | Ratio of CNT@CS to MAA | CNT@CS (mg) | EGDMA (mg) | *Q*  (mg/g) | *Q*E  (mg/g) | *SC*P4/E |
| 6 | 1:4 | 100 | 10 | 16.75 | 13.6 | 1.23 |
| 7 | 1:4 | 100 | 30 | 14.33 | 6.86 | 2.09 |
| 8 | 1:4 | 100 | 50 | 13.31 | 6.26 | 2.13 |

**Supplementary Figures 1-5**

****

Fig. S1 XRD images of the bare CNTs (A), CNT@CS (B), CNT@CS/P(MAA) (C).



Fig. S2 The nitrogen adsorption-desorption isotherm. A: CNTs B: CNT@CS/P(MAA).



Fig. S3 The thermal gravity analysis curves of CNTs (A) and CNT@CS/P(MAA) (B).



Fig. S4 Effects of different conditions on adsorption capacity. A: water content; B: pH

value; C: adsorption temperature.



Fig. S5 Reusabilities of CNT@CS/P(MAA) (n=3).