Supporting Information

Motion-based phenol detection and degradation using 3D hierarchically AA-NiMn-CLDHs@HNTs-Ag nanomotors

Ningning Xing[a], *Yangsai Lyu*[b], *Jie Yang*[a], *Xiaolei Zhang*[a], *Yang Han*[a], *Weilin Zhao*[a], *Dickon H.L. Ng*[c], *Jia Li*[a]*

[a]*School of Material Science and Engineering, University of Jinan, Jinan, 250022, China*
[b] *Department of Mathematics and Statistics, Queen's University, Kingston, K7L 3N6, Canada*
[c]*School of Science and Engineering, The Chinese University of Hong Kong (Shenzhen), Shenzhen, China.*
** Corresponding author: mse_lij@ujn.edu.cn (Jia Li), +8613953185430.*

Pre-treatment of HNTs

The pristine HNTs powders (2 g) were dispersed in sodium hexametaphosphate solution (0.05 wt%, 100mL) under vigorous stirring for 0.5 h and let stand for 30 minutes. The supernatant was collected and centrifuged to obtain pure HNTs. The purified HNTs were dried at 60℃ in vacuum.

The purified HNTs were evenly dispersed in 50 mL PVP solution (3 wt%) by stirring for 30 min. The homogeneous suspension was sonicated for 45 min at 550W using an ultrasonic cell disruptor. The resulting HNTs suspension was centrifuged at 6000 rpm for 45 min by supercentrifuge. Then the supernatant was transferred into another centrifugal tube and centrifuged again at 10000 rpm for 10min. The final precipitate was collected and washed by DI water and ethanol alternately, each for three times and then dried at 60℃.

The activated HNTs were obtained by calcination of pretreated HNTs in an inert atmosphere. Typically, pretreated HNTs (1.0 g) were put into crucible and placed in tubular furnace. Then the samples were calcined at 800℃ in nitrogen atmosphere for 4h with heating rate of 10 ℃ min^{-1}. After cooling down to room temperature, the activated HNTs were obtained.

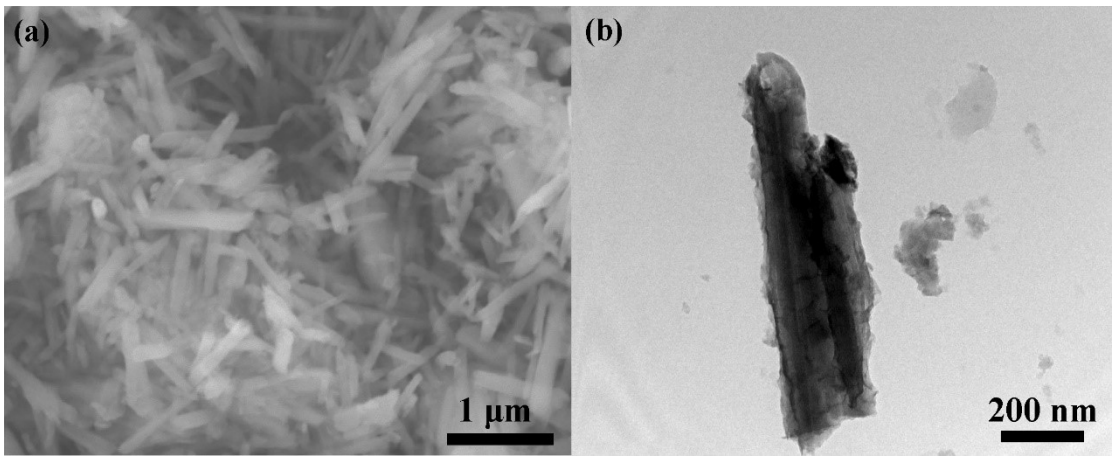

Fig. S1 SEM image (a) and TEM image (b) of AA-NiMn-CLDHs@HNTs-Ag nanomotors.

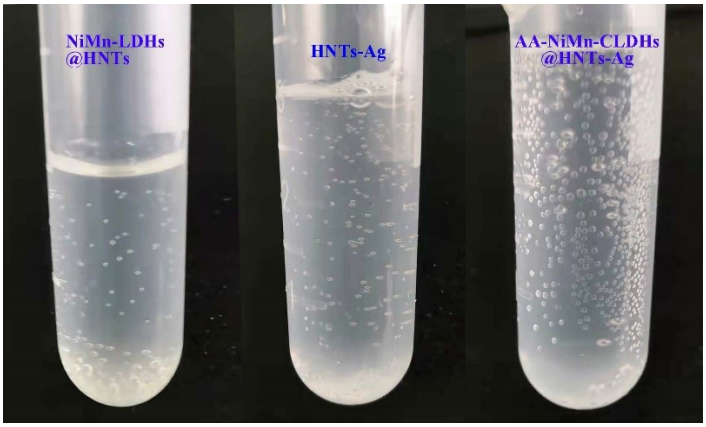

Fig. S2 The photograph of different nanomotors in 5 wt% H_2O_2.

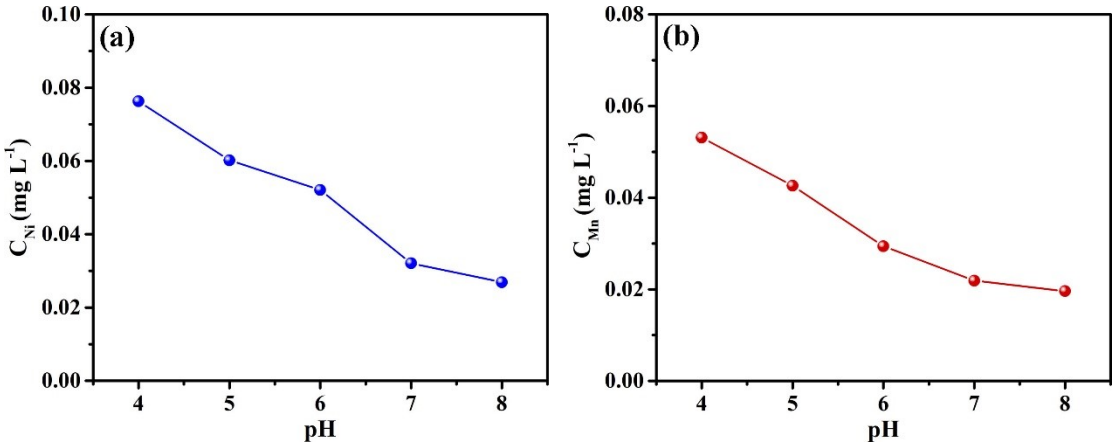

Fig. S3 Concentration of nickel ion (a) and manganese ion (b) in solution at different pH value.

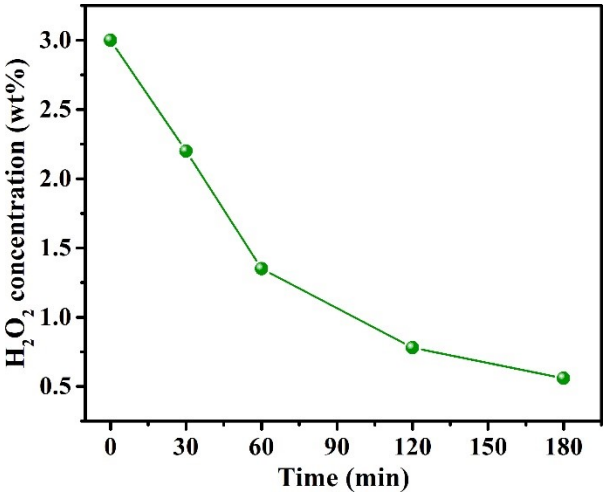

Fig. S4 Consumption of H_2O_2 by AA-NiMn-CLDHs@HNTs-Ag nanomotors during Fenton-like process.

Table S1 Pore texture parameters of AA-NiMn-CLDHs@HNTs-Ag nanomotors.

Sample	S_{BET} (m^2g^{-1})	V_{Total} (cm^3g^{-1})	D_p (nm)
1#	22.15	0.079	3.492
2#	40.55	0.199	9.620

[a] S_{BET}: BET specific surface area; V_{Total}: total pore volume; D_p: average pore diameter. 1#: HNTs, 2#: AA-NiMn-CLDHs@HNTs-Ag nanomotors.