

1 **The mechanism of chronic toxicity induced by graphene suspended in**
2 **water column to *Daphnia magna*¹**

3 Wenhong Fan,^{*a} Yingying Liu,^a Zhizhen Xu,^b Xiangrui Wang,^a Xiaomin Li^a and Shenglian Luo ^{*c}

4 **Supplementary Information**

5 Number of supplementary information pages: 8

6 Number of Tables: 2

7 Number of Figures: 5

8

^a School of Space and Environment, Beihang University, No. 37, XueYuan Road, HaiDian District, Beijing 100191, PR China. Email: fanwh@buaa.edu.cn; Tel: (86)-10-82338630; fax: (86)-10-82338630

^b Key Laboratory of Occupational Safety and Health, Beijing Municipal Institute of Labor Protection, Beijing 100054, PR China

^c School of Environmental and Chemical Engineering, Nanchang Hangkong University, No. 696, FengHe Road, Nanchang, Jiangxi 330063, PR China. Email: slou@hnu.edu.cn; Tel: (86)-791-83953373; fax: (86)-791-83953373

9 **Table S1** Data of *D. magna* after 21-day chronic exposure to 10 mg/L PVP solution. Results are
 10 expressed as the mean (10 replicates) \pm standard deviation.

	Control	PVP
Mortality (%)	0	0
Length on 21st day (mm)	3.02 \pm 0.15	3.12 \pm 0.09
Average number of offspring (individual)	36.0 \pm 7.0	35.0 \pm 9.6
Time to first brood (d)	11.3 \pm 1.2	11.7 \pm 0.9
Neonates of first brood (individual)	4.4 \pm 2.1	4.1 \pm 2.0

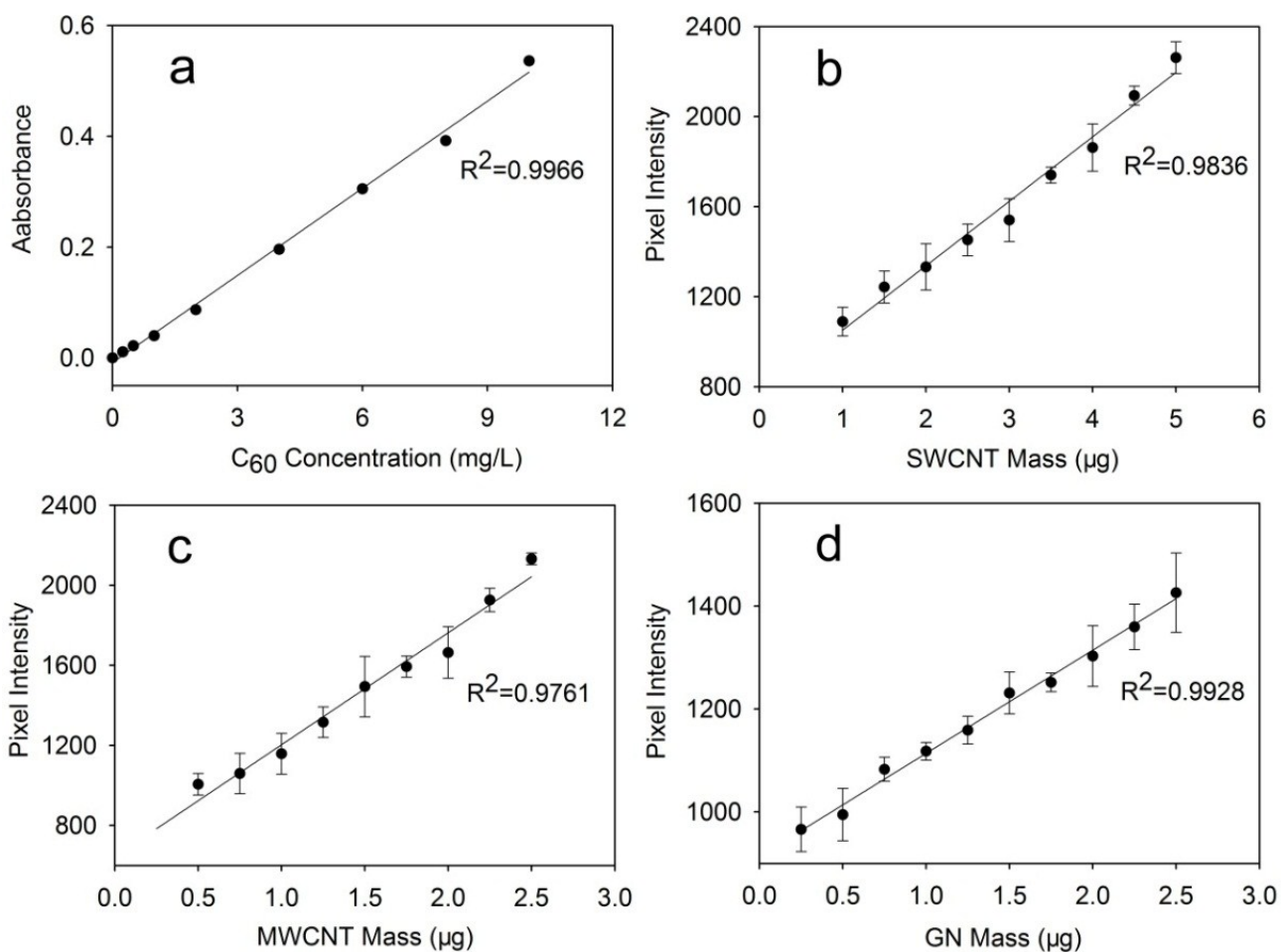
12 **Table S2** Metallic impurity contents of the four CNMs^a

CNMs	Metallic impurity contents (wt%)				
	Mo	Co	Ni	Y	Cu
C60	— ^b	—	—	—	0.06
SWCNT	—	0.73	0.33	0.17	—
MWCNT	0.55	0.16	0.38	—	—
GN	—	—	—	—	0.15

13 ^a The metallic impurity contents are measured using ICP-MS, n=3. The relative standard deviations

14 are within $\pm 5\%$.

15 ^b No information



16

17 **Fig. S1.** The standard curves of C₆₀ (a), SWCNT (b), MWCNT (c), and GN (d) prepared with our
 18 standard PVP-CNM suspension. The standard deviations in C₆₀ (a) are generally smaller than the dot
 19 sizes.

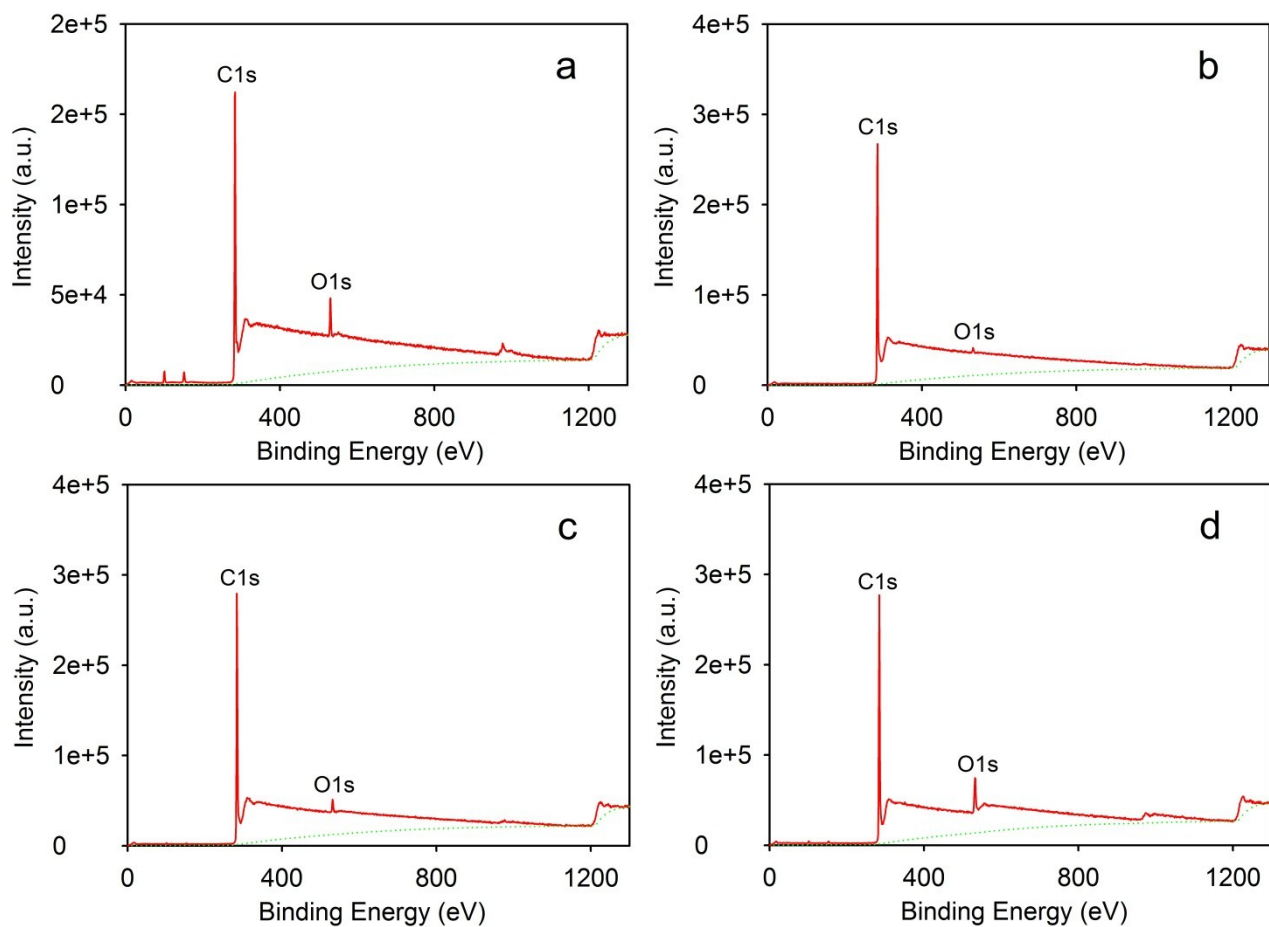
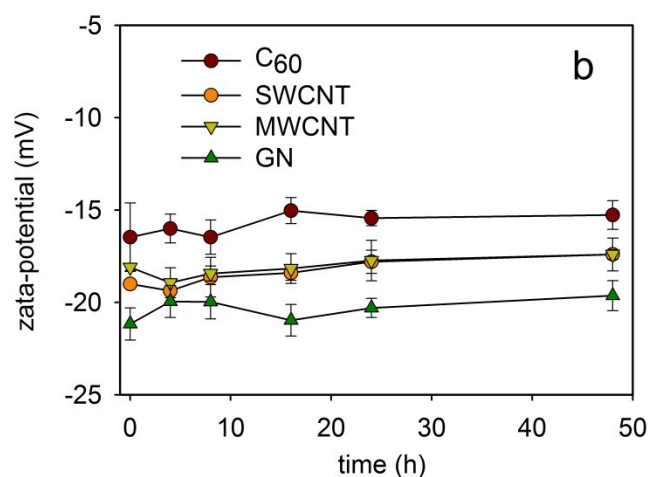
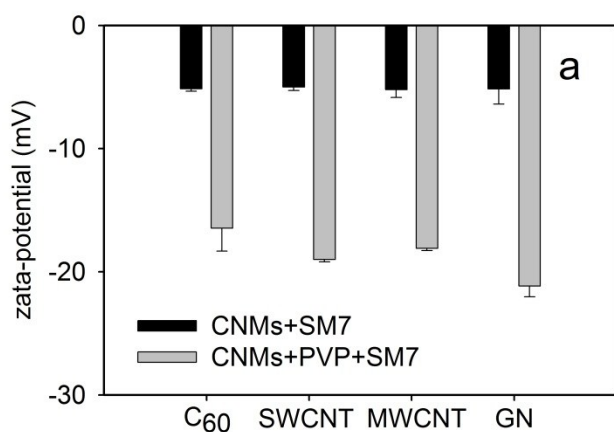
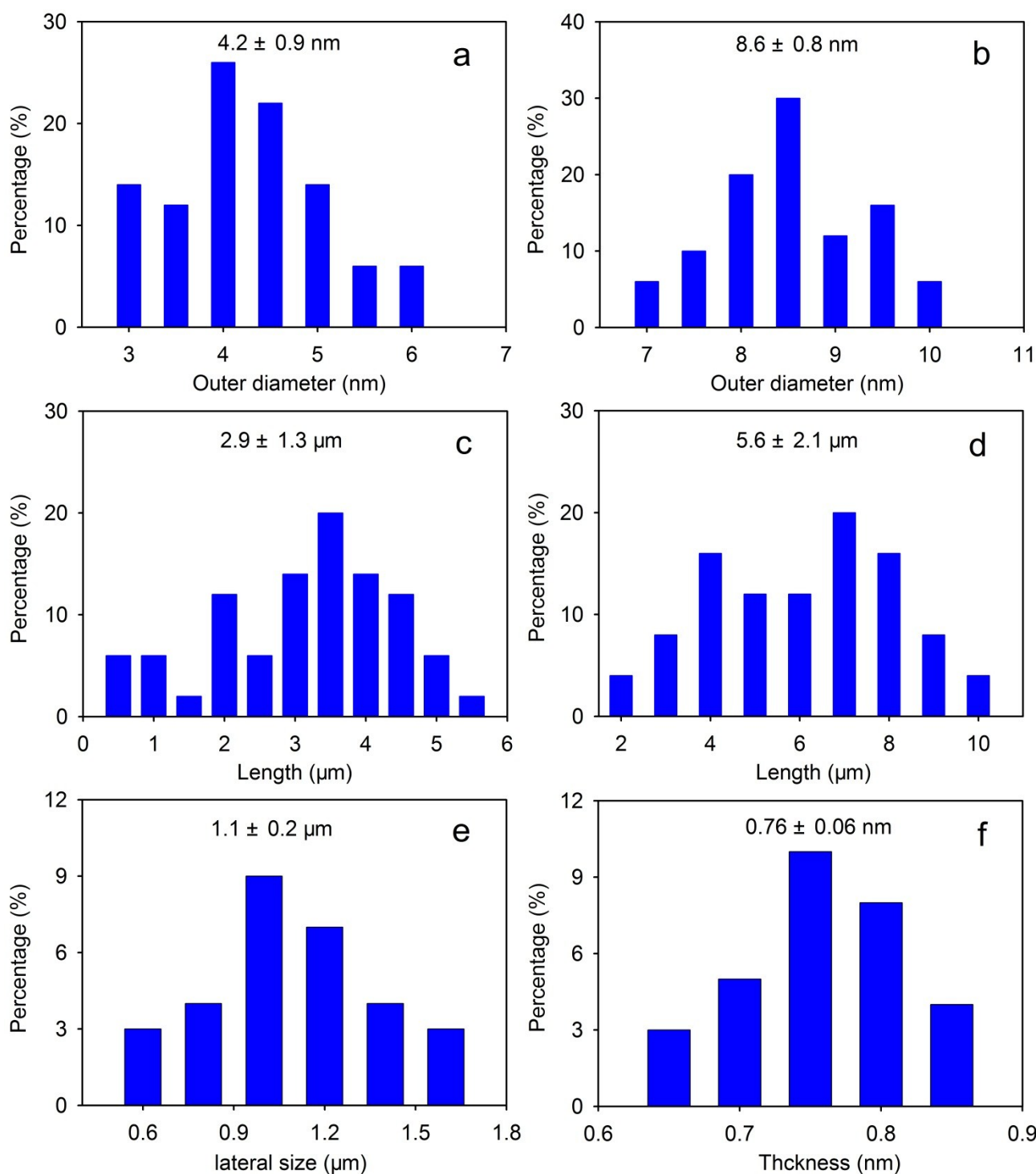


Fig. S2. XPS spectra of the four CNMs. C₆₀ (a), SWCNT (b), MWCNT (c), and GN (d)



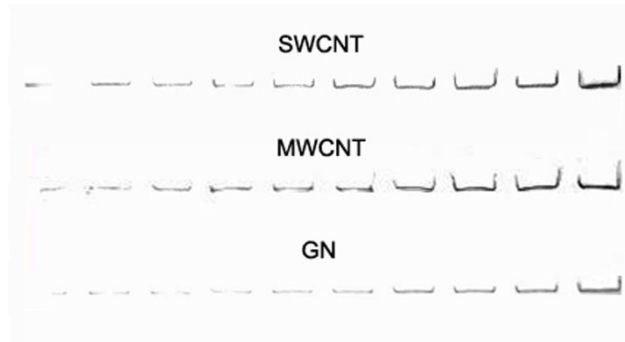
23

24 **Fig. S3.** (a). Zeta potentials of 1 mg/L CNMs in SM7 medium with PVP or without PVP. (b). Zeta
 25 potentials of 1 mg/L CNMs in SM7 medium with the presence of PVP during a period of 48 h. All the
 26 values are the means of 3 replicates.



27

28 **Fig. S4.** Histograms of CNM size distribution. (a) Outer diameter of SWCNT. (b) Outer diameter of
 29 MWCN. (c) Length of SWCNT. (d) Length of MWCNT. (e) Lateral size of GN. (f) Thickness of GN. The
 30 lengths and outer diameters are measured using TEM, $n = 100$. The lateral size and thickness are
 31 measured using AFM, $n = 30$. The statistical results are expressed as the mean \pm standard deviation.



33

34 **Fig. S5.** Optical image for bands of CNM standard samples after electrophoresis. The mass of
35 standard samples in gels are 1-5 μg for SWCNT, and 0.25-2.5 μg for MWCNT and GN, corresponding
36 to that of standard curves shown in Fig. S1.

37