1 **Supplementary material**

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3 **for**
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5 **Application of microwave irradiated manganese dioxide in the**
6 **removal of polychlorinated biphenyls from soil contaminated by**
7 **capacitor oil**

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Fig S1. XRD spectrum of synthesized δ -MnO₂, α -MnO₂ and β -MnO₂.

Section 1

δ -MnO₂ was prepared following the method of [Cai and Ren \(2006\)](#). 200 mL of 35 g L⁻¹ KMnO₄ was added dropwise to 200 mL 45 g L⁻¹ MnSO₄·H₂O solution mixed by a magnetic stirrer under neutral reaction conditions. The precipitate was centrifuged and washed several times with Milli-Q water, recovering the MnO₂ each time by vacuum filtration. Additional washes were performed if necessary until no SO₄²⁻ in the filtrate could be tested by Ba²⁺. The product was dried by heating at 103 °C for 12 h, and then stored in a jar for use.

α -MnO₂ and β -MnO₂ were prepared following the method of [Wang et al. \(2002\)](#). Analytical grade hydrate manganese sulfate (MnSO₄·H₂O, 0.008 mol) and an equal amount of ammonium persulfate ((NH₄)₂S₂O₈) were put into distilled water at room temperature to form a homogeneous solution, which was then transferred into a Teflon-lined stainless steel autoclave, sealed, and maintained at 120 °C for 12 h. After the reaction was completed, the resulting black solid product was filtered, washed with distilled water to remove ions possibly remaining in the final products, and

33 finally dried at 120 °C in air. The whole process, appropriate for the preparation of
34 α -MnO₂ nanorods, can be conveniently adjusted to prepare β -MnO₂ nanowires by
35 simply adding analytical grade ammonium sulfate ((NH₄)₂SO₄, 0.015 mol) to the
36 reaction system.

37 In order to verify the crystal structure of minerals, samples of solids were
38 characterized using X-ray powder diffraction (XRD). XRD data were collected with a
39 Shimadzu LabX XRD-6000 diffractometer using Cu K α radiation (40 kV, 40 mA).
40 Fig. S1 shows the XRD profile of synthesized MnO₂. In Fig. S1a, only a weak peak
41 could be found at 37°, which is in good accordance with the XRD profile of δ -MnO₂.
42 Four diffraction peaks at $2\theta = 28.6^\circ$, 37.3° , 42.7° , and 56.6° are shown in Fig. S1b
43 and S1c, which are in good accordance with the XRD profiles of α -MnO₂ and
44 β -MnO₂ reported by [Wang et al. \(2002\)](#).

(a)

(b)

(c)

Fig S2. SEM image of synthesized δ -MnO₂ (a), α -MnO₂ (b) and β -MnO₂ (c).

Section 2

The morphologies of MnO_2 were characterized using field-emission scanning electron microscopy (FE-SEM; Philips XL-30). The SEM image in Fig. S2a shows that the synthesized $\delta\text{-MnO}_2$ was composed of granular and rod-shaped particles. The diameter of the rods was approximately 100 nm. As shown in Figs. S2b and S2c, the morphology of the synthesized $\alpha\text{-MnO}_2$ was composed of nanorods with diameters about 50 nm and lengths ranging between 1.0 and 2.0 μm , while the synthesized $\beta\text{-MnO}_2$ was composed of nanowires with diameters about 30 nm.

Fig S3. Chromatograms of 1.0 g PCB-contaminated soil samples before (a) and after (b) MW irradiation by 800 W MW for 45 min in the presence of 0.2 ml H₂O and 0.1 g δ -MnO₂.

Section 3

The chromatograms of actual PCBs-contaminated soil samples before (S3a) and after (S3b) MW irradiation are shown in Fig. S3, indicating that PCBs in the actual soil could be considerably degraded by MW irradiated MnO₂.

69 **Literature Cited for Supplementary Information**

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