Supporting Information

Photochemical Synthesis of Selenium Nanospheres of Tunable Size and Colloidal Stability with Simple Diketones

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This file contains 4 tables and 5 figures.

Table S1. Acute toxicity data of the tested ketones and their main degradation products with rat as the testing species.

Chemical	LD_{50} (rat, oral) (mg/kg) [a]
Acetone	5800 [b]
AcAc	1000 [c]
BD	1580 [b]
PD	3000 [b]
HD	2076 [b]
I-2959	4082 [b]
BP	> 10000 [b]
Formic acid	1100 [b]
Acetic acid	3310 [b]

[a] LD_{50}, the median lethal dose, represents the dose at which a substance is lethal for 50% of the tested subjects at the given route of delivery. A substance that is innocuous in one species could be lethal in another. The data with rat as the testing species is selected for comparison.

[b] The National Library of Medicine's Hazardous Substances Data Bank (HSDB). See the following web site: https://pubchem.ncbi.nlm.nih.gov/

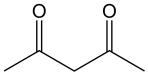
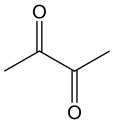
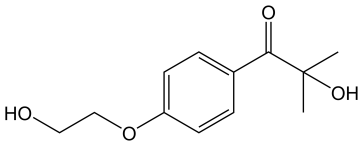
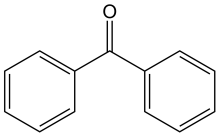
[a] Ballantyne, B.; Cawley, T. J. Toxicology Update. *J. Appl. Toxicol.* **2001**, *21*, 165–171.

Table S2. HPLC conditions for the determination of AcAc, BD, I-2959 and BP

Chemical	λ (nm)	RT [a] (min)	Volume [b] (μL)	Column [c]	Temp [d] (°C)	Mobile phase (v/v)	Flow rate (mL·min^{-1})
AcAc	274	3.55	20	C8, 5 μm 4.6 × 150 mm	25	CH_3OH/1 mM $CuCl_2$	0.24/0.36
BD	315	4.17	20	C18, 5 μm 4.6 × 100 mm	25	CH_3CN/H_2O	0.21/0.39
I-2959	280	1.66	1	C18, 5 μm 4.6 × 100 mm	25	CH_3CN/H_2O	0.24/0.06
BP	258	7.09	5	C18, 5 μm 4.6 × 100 mm	30	CH_3CN/H_2O	0.47/0.53

[a] Retention time, [b] Injection volume, [c] Agilent Eclipse Plus, [d] Column temperature

Table S3. Basic chemical information of the tested ketones

Name	MW	Structure	Formula	S [a] (g·L^{-1})	λ_{max} [b] (nm)	ε [c] (M^{-1}·cm^{-1})
Acetone	58.08		C_3H_6O	Miscible	263	17
AcAc	100.12		$C_5H_8O_2$	160	274	1800
BD	86.09		$C_4H_6O_2$	2	271	32
I-2959	224.25		$C_{12}H_{16}O_4$	10	280	14100
BP	182.22		$C_{13}H_{10}O$	Insoluble (< 1)	258	16610

[a] Water solubility, cited from https://www.chemicalbook.com/ and http://www.xtgchem.cn/upload/20110629045632.PDF

[b] The maximum absorption wavelength

[c] The molar extinction coefficient at the maximum absorption wavelength

Table S4. The electrical energy consumption (EE/O) data of the synthesis methods for nano Se.

Method	Chemicals [a]	Energy input	EE/O ($kWh \cdot L^{-1}$)		
			Energy	Chemical	Total
UV/AcAc	AcAc, Na_2SeO_3	UV	1.8	0.05	1.8
UV/BD	BD, Na_2SeO_3	UV	1.8	0.13	1.9
Hydrothermal route [b]	Glucose, SeO_2, PVP, EtOH, NH_4OH	Heating	7	20	27

[a] The price of the chemicals was obtained from https://www.alibaba.com/ (2021.7.3).

[b] Xie, Q.; Dai, Z.; Huang, W. W.; Zhang, W.; Ma, D. K.; Hu, X. K.; Qian, Y. T. Large-Scale Synthesis and Growth Mechanism of Single-Crystal Se Nanobelts. *Cryst. Growth Des.* **2006**, *6* (6), 1514–1517.

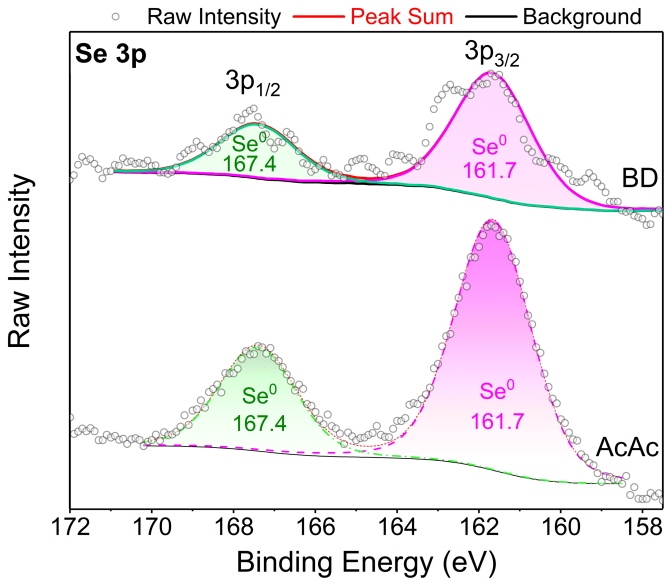


Figure S1. XPS of Se3p spectra of the SeNSs obtained with AcAc and BD.

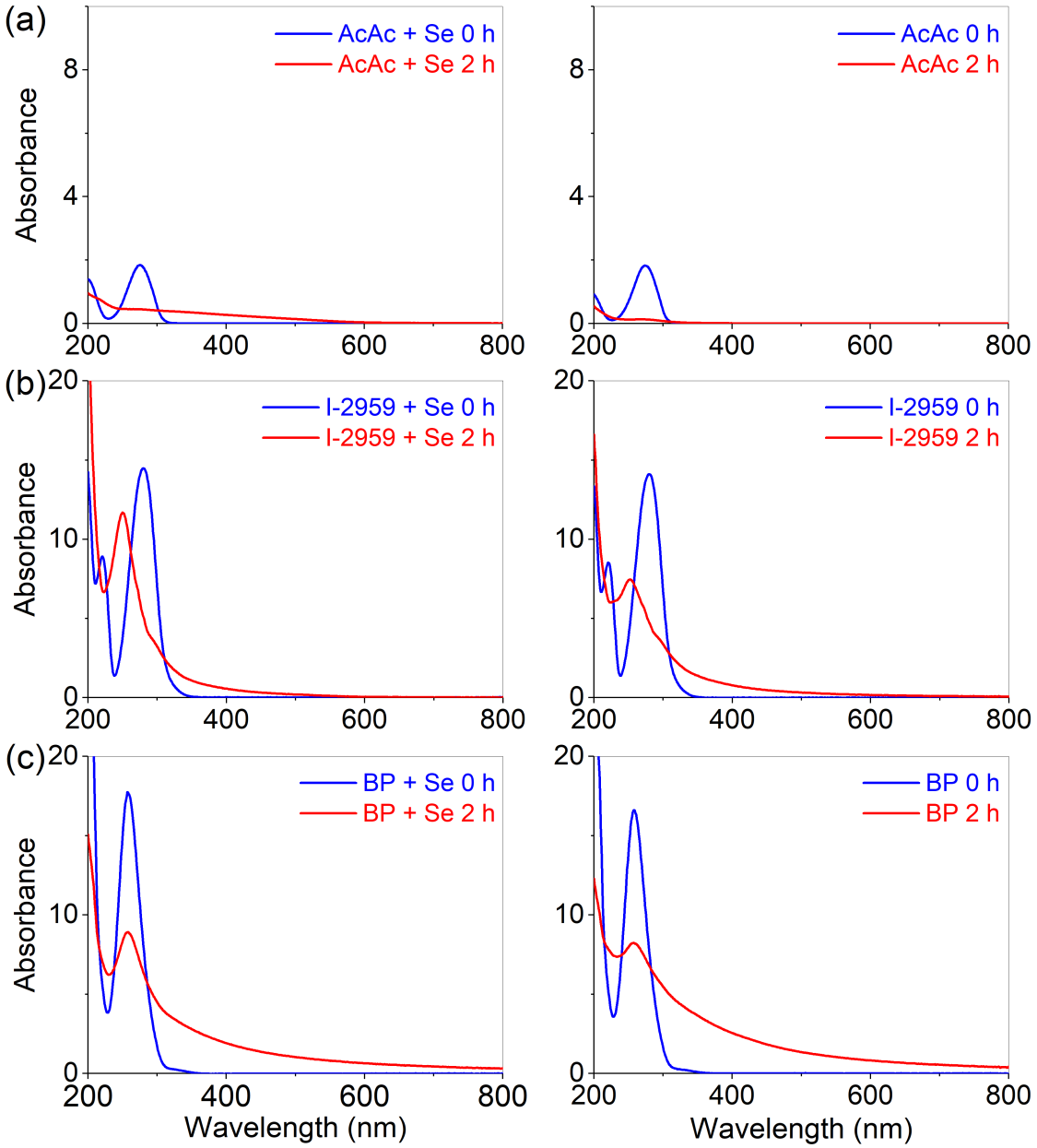


Figure S2. UV-vis spectra of raw and UV irradiated (2 h at 8.6 mW·cm^{-2} at 365 nm) ketone (1.0 mM) solutions w/ or w/o Se(IV) (0.2 mM).

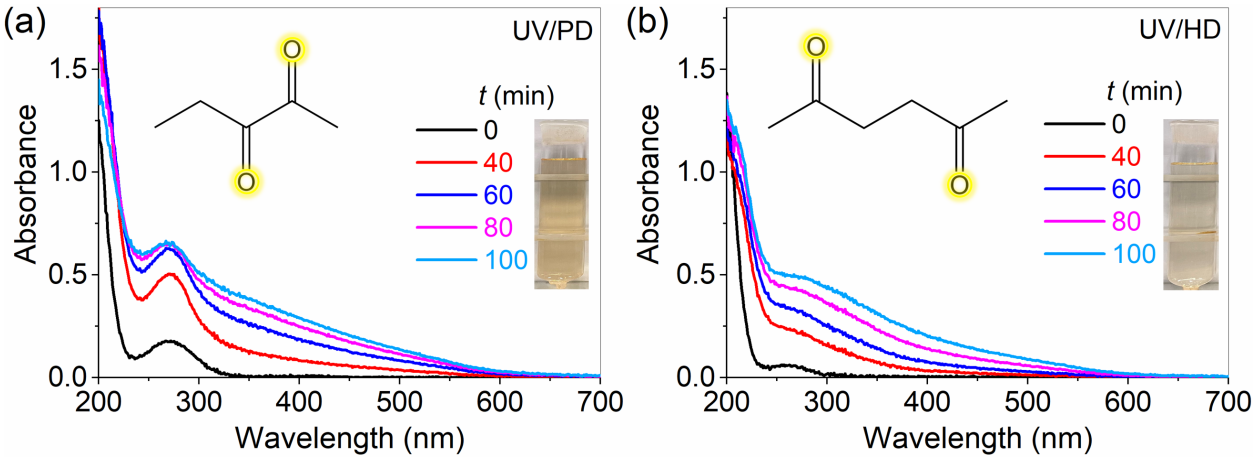


Figure S3. UV-vis spectra of the colloidal solutions of SeNSs obtained with 2,3-pentanedione (PD) and 2,5-hexanedione (HD). [Ketone] = 1.0 mM, [Se(IV)] = 0.2 mM, light intensity: 7.0 mW·cm^{-2} at 365 nm.

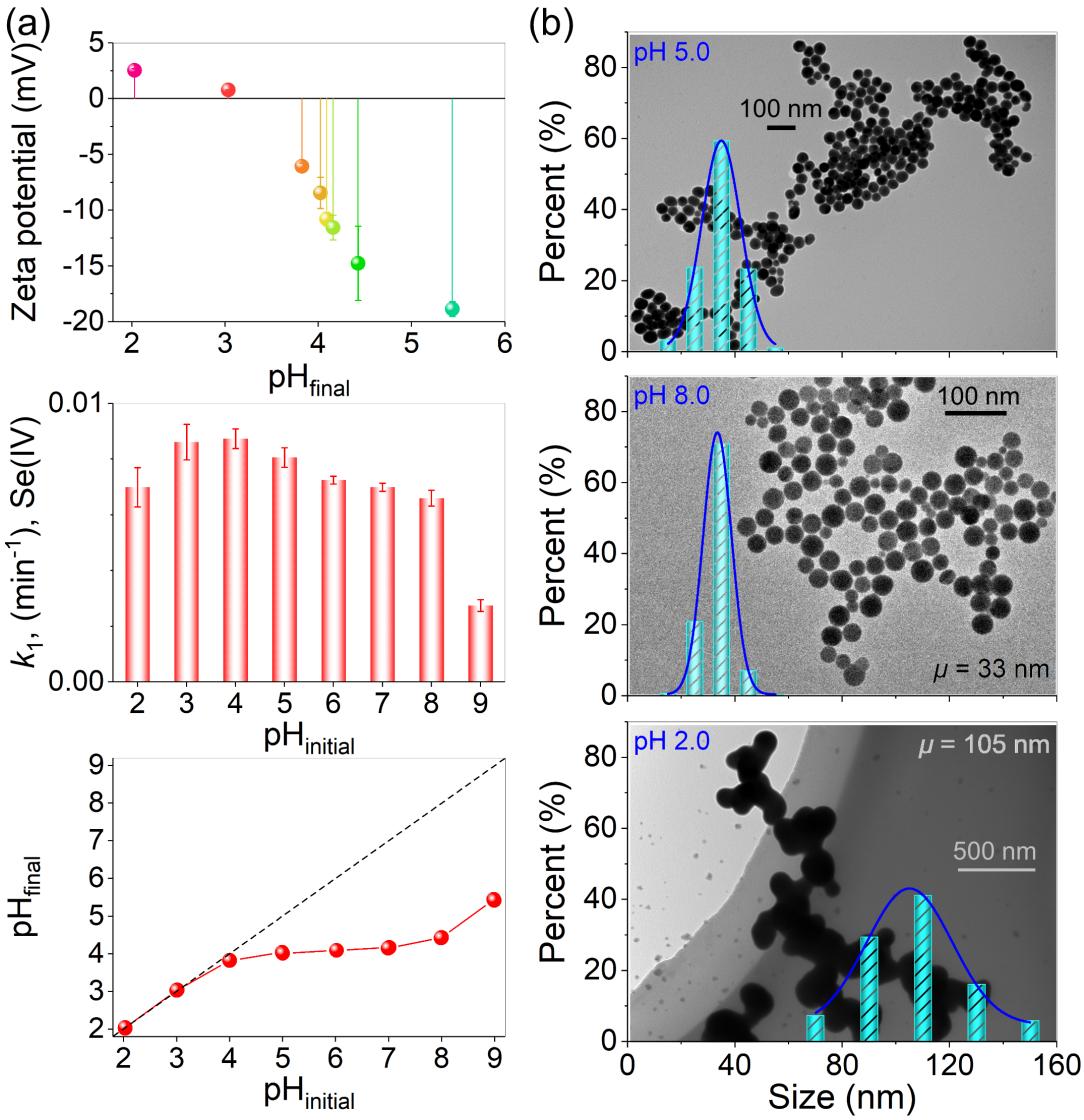


Figure S4. The surface charge (a) and size distributions (b) of the SeNSs obtained with AcAc at different pHs. [AcAc] = 1.0 mM, [Se(IV)] = 0.2 mM, light intensity: 5.0 mW·cm^{-2} at 365 nm, irradiation time: 160 min.

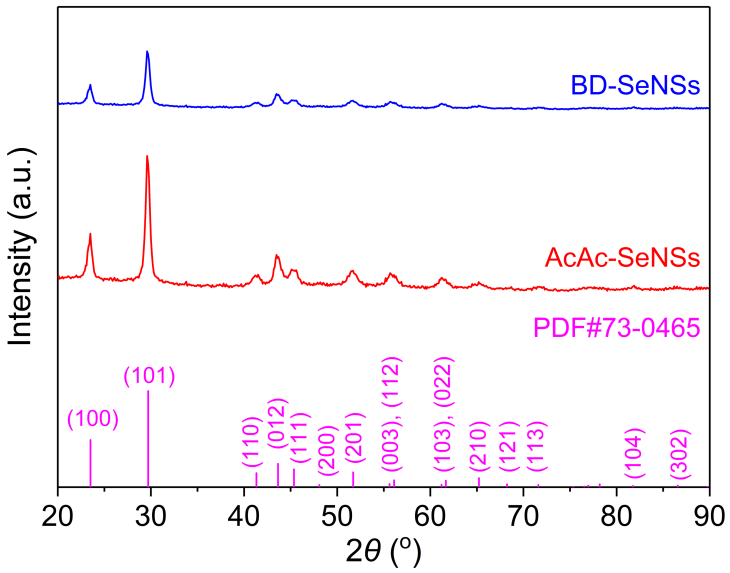


Figure S5. XRD pattern of the SeNSs obtained with AcAc and BD. The patterns are identical to the powder diffraction file (PDF card) JCPDS 73-0465.