Electronic supplementary information (ESI)

Design of hybrid biocatalysts by controlled heteroaggregation of manganese oxide and sulfate latex particles to combat reactive oxygen species

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Table S1. XPS composition analysis of the MnO_2 NPs sample.

Element	**Amount (at%)**[a]
Total C	19.5
Total K	1.3
Total Mn	23.4
Total O	55.8

[a]Amount (at%) is the atomic percentage of a species (represented by a deconvoluted peak) in the whole sample (among species of all peaks). It indicates the contribution of each species to the whole sample. The sum of Amount (at%) for all peaks is 100%.

Table S2. Size and charge data of the synthesized MnO_2 NPs and SL particles together with the fast aggregation rate coefficients and the CCC values at pH 9.

Particle	I_s (kcps)[a]	R_h (nm)[a]	PDI (%)[a]	ζ (mV)[a]	σ (mC/m^2)[b]	$k_{app(fast)}$ (s^{-1})[c]	CCC (mM)[d]
MnO_2	4.4	83	11.9	-37	-5.2	3.26×10^{-2}	10
SL	315.9	441	20.9	-65	-15.0	3.40×10^{-4}	250

[a]I_s is the intensity of the scattered light at 90° (in kilo count per second, kcps, normalized for the same particle number concentration), R_h is the hydrodynamic radius, PDI is the polydispersity index, and ζ is the zeta potential measured for stable suspensions containing 1 mM NaCl at pH 9. [b]Surface charge density (σ) was obtained from the ionic strength dependence of the zeta potential using the Debye-Hückel model (Reference 55). [c]Fast apparent dynamic aggregation rate constant (k_{fast}) was determined in 1.0 M NaCl solutions. [d]CCC values were calculated from the stability ratio versus ionic strength plots with an average error of 10%.

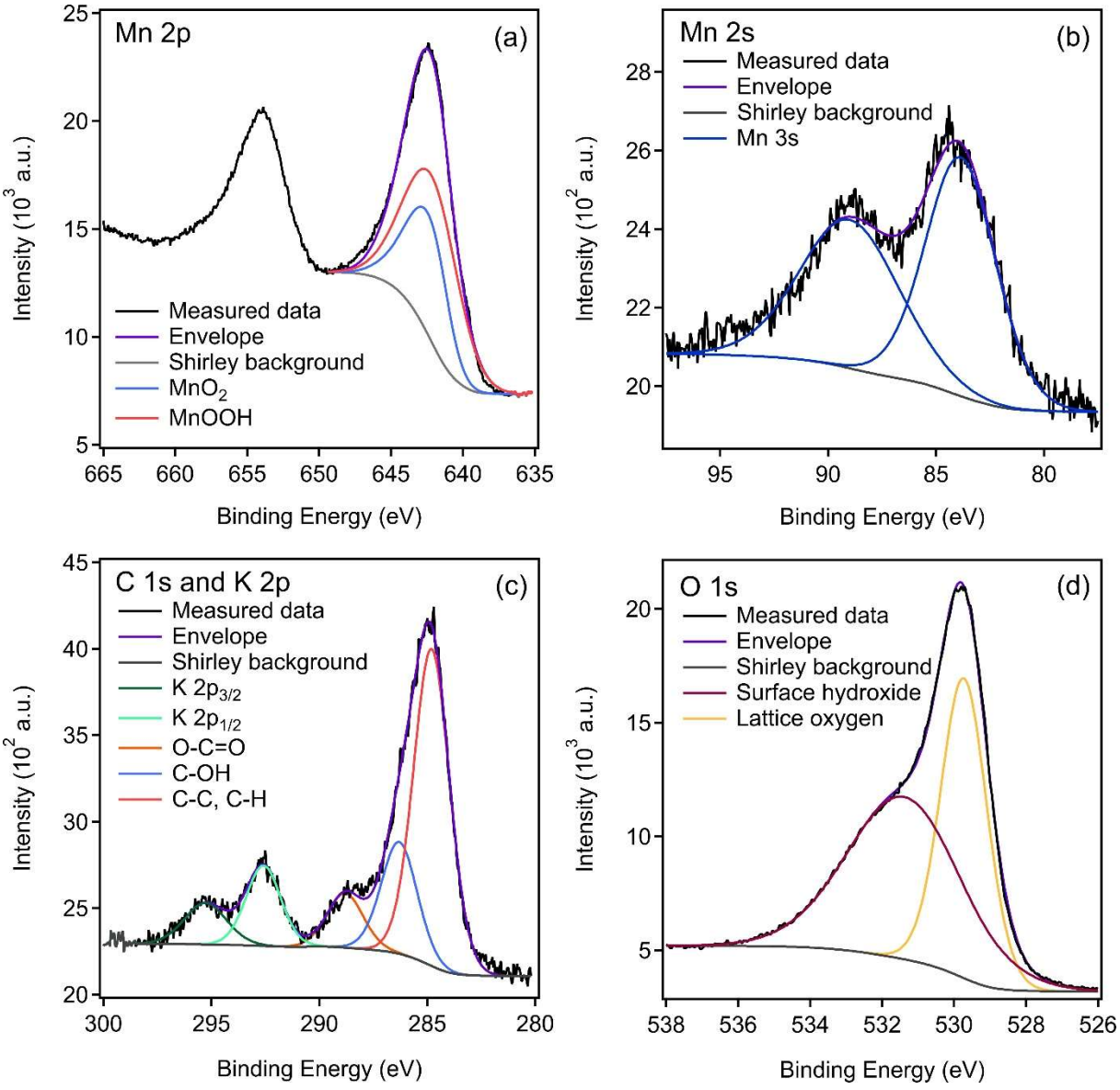

Fig. S1 High resolution XP spectra of (a) Mn 2p, (b) Mn 2s, (c) C 1s and K 2p as well as (d) O 1s regions of MnO_2 NPs.

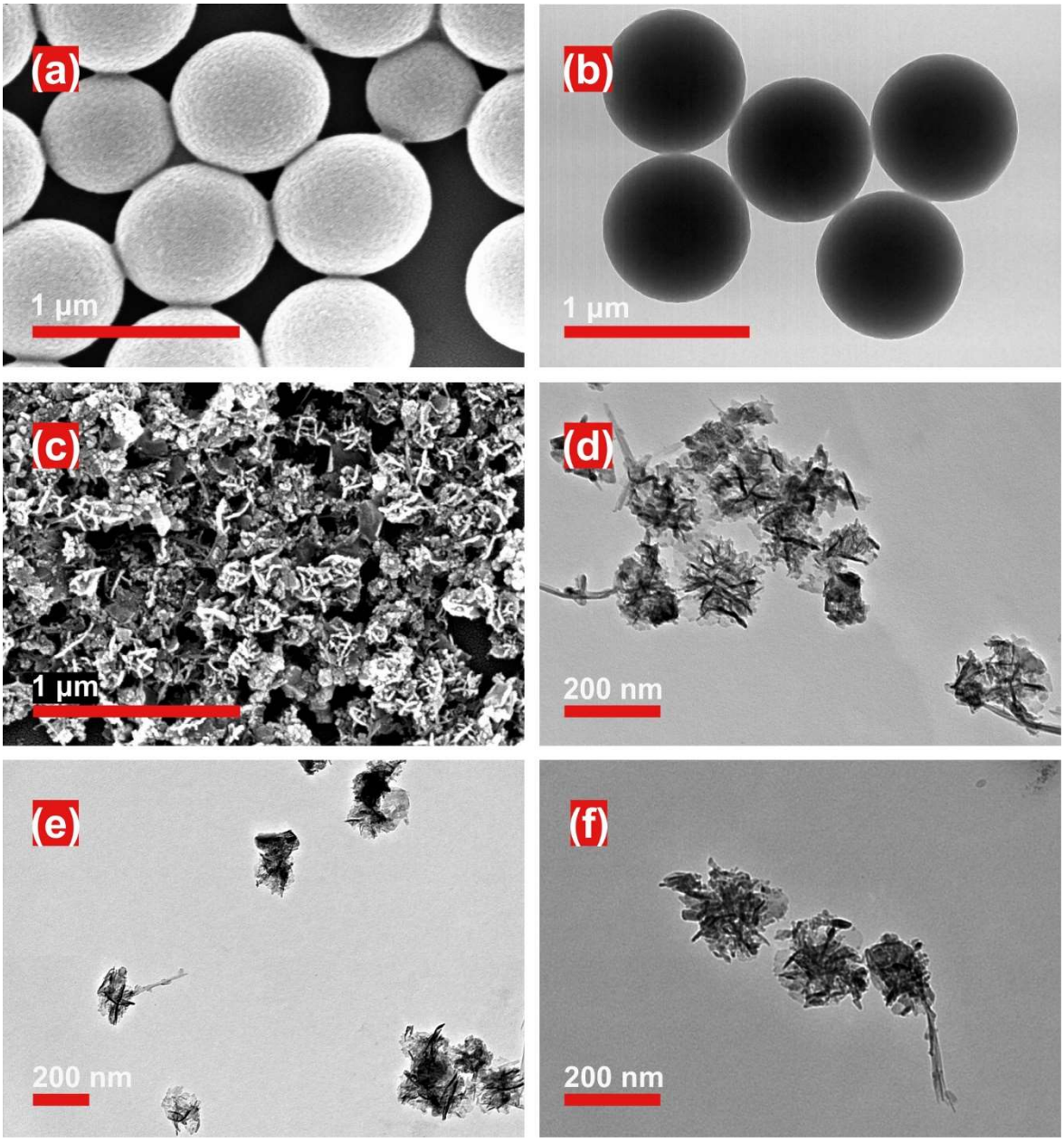

Fig. S2 (a) SEM and (b) TEM images of spherical SL particles as well as (c) SEM and (d-f) TEM images of flaky MnO_2 NPs.