Supporting Information for

Bibliometric analysis of photocatalytic oxidation for volatile organic compounds from 1998 to 2023

Xinjie Zhu [a], Yifan Sui [a], Xiuli Li [a], Jie Guan [a], Xiaojiao Zhang [a,*], Gangfeng Zhang [b], and Yaoguang Guo [a,*]

[a] *Shanghai Collaborative Innovation Centre for WEEE Recycling, School of Resources and Environmental Engineering, Shanghai Polytechnic University, Shanghai 201209, China;zhuxinjie1231@163.com (X. Zhu); suiyifan333@163.com; xlli@sspu.edu.cn (X. Li); guanjie@sspu.edu.cn (J. Guan); xjzhang@sspu.edu.cn (X. Zhang); ygguo@sspu.edu.cn (Y. Guo)*

[b] *Shanghai Academy of Environmental Sciences, Shanghai 200233, China; gf.zh@foxmai.com (G. Zhang)*

* Corresponding authors.

E-mail addresses: xjzhang@sspu.edu.cn (X. Zhang); ygguo@sspu.edu.cn (Y. Guo)

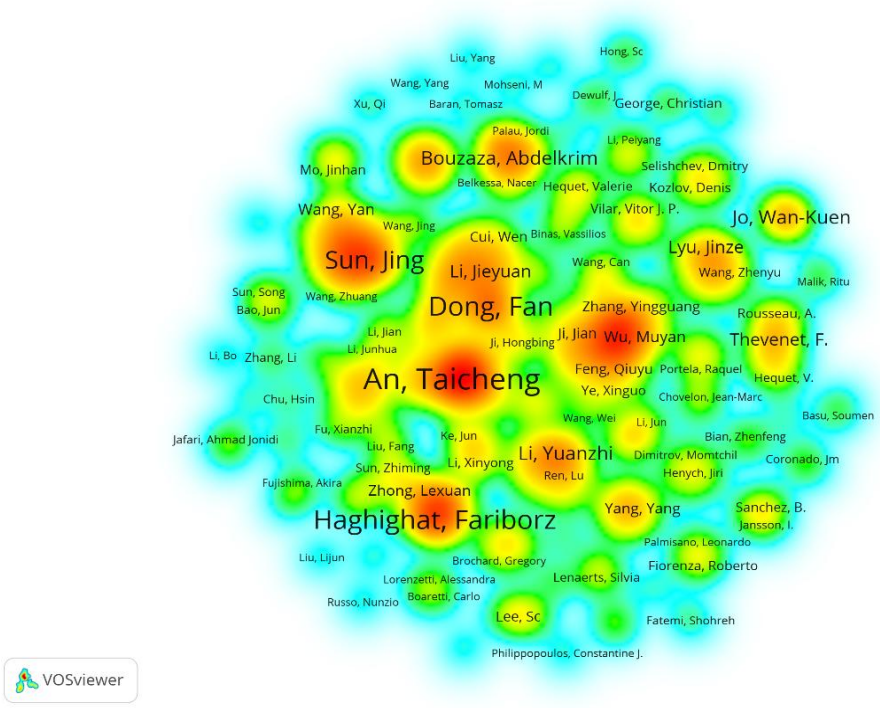

Figure S1. Strength of linkage map between authors in the field of photocatalytic oxidation of VOCs.

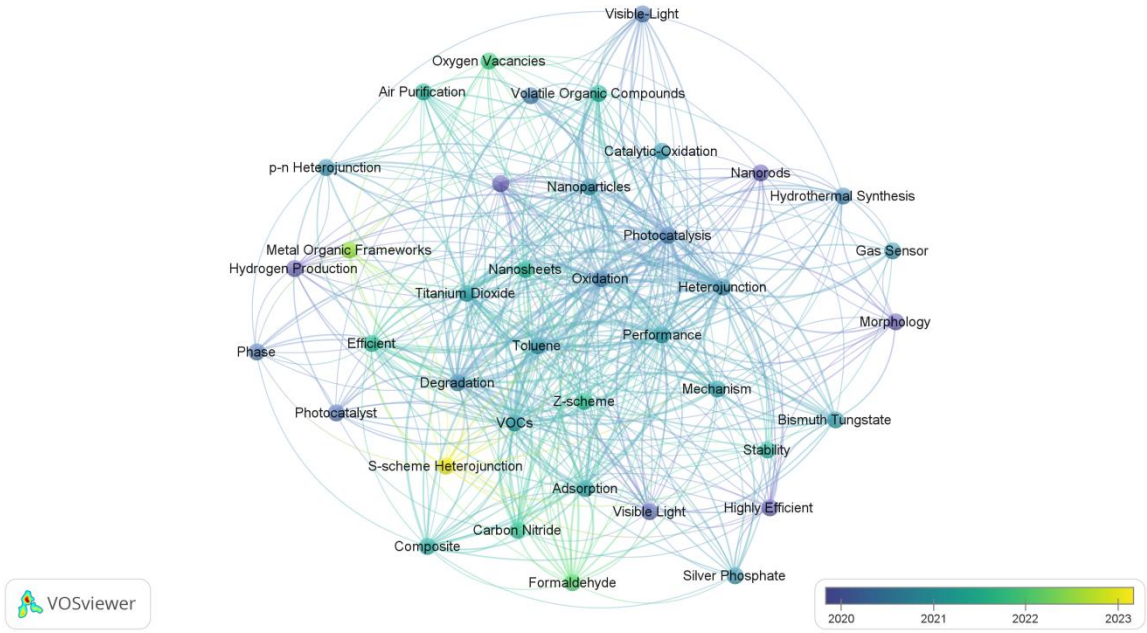

Figure S2. Keywords analysis of heterojunction strategies in photocatalytic degradation of VOCs.

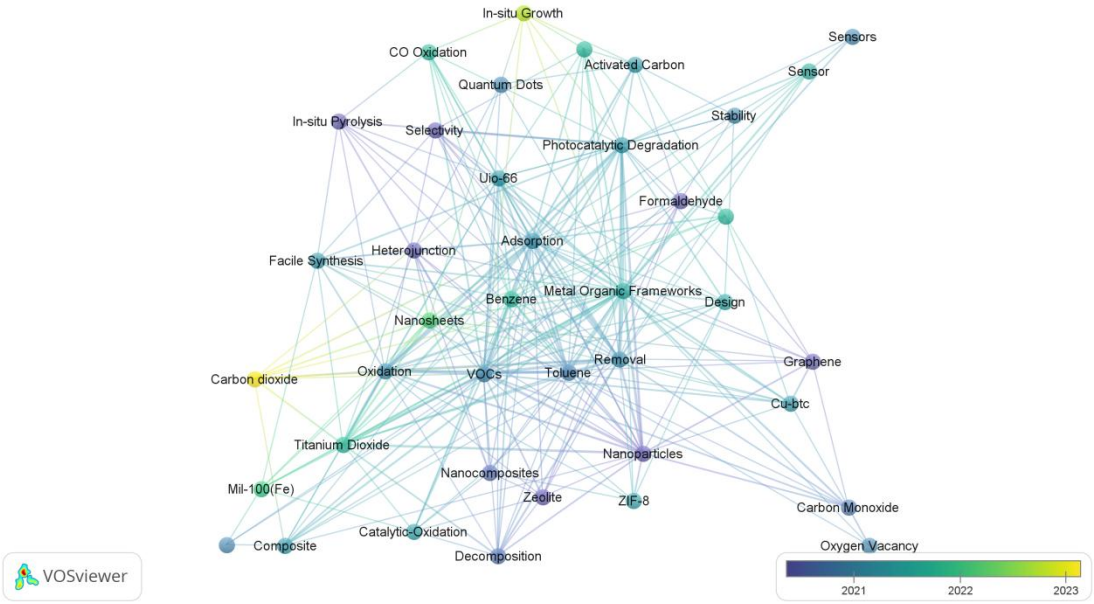

Figure S3. Keywords analysis of MOFs in photocatalytic degradation of VOCs.

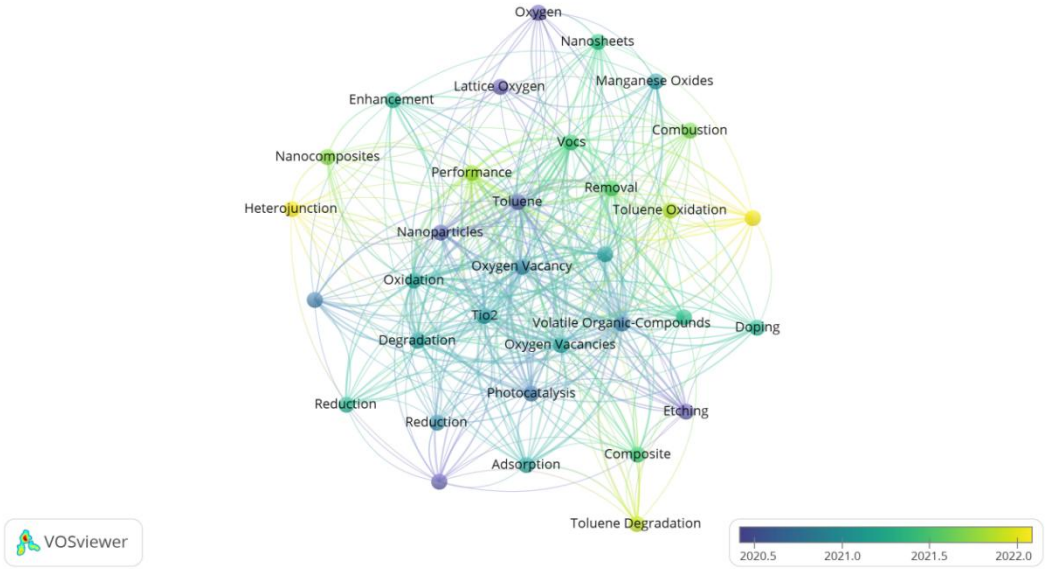

Figure S4. Keywords analysis of Oxygen vacancy in photocatalytic degradation of VOCs.

Table S1. Number of publications, citations and total linkage strength of each country.

Country	Documents	Citations	Total link strength
China	1144	46702	325
USA	226	18463	185
France	205	7567	125
South Korea	198	6417	121
India	124	3361	118
Japan	122	5802	70
Canada	101	4537	54
Spain	98	4123	69
Iran	86	4552	40
Italy	77	5329	57

Table S2. Top 10 most cited articles

No.	Title	Author	Year	Citations	References
1	Photoinduced reactivity of titanium dioxide	Carp, O., et al.	2004	4160	[1]
2	A review on the visible light active titanium dioxide photocatalysts for environmental applications	Pelaez, M., et al.	2012	3342	[2]
3	Fundamentals and Catalytic Applications of CeO_2-Based Materials	Montini, T., et al.	2016	1800	[3]
4	Defective TiO_2 with oxygen vacancies: synthesis, properties and photocatalytic applications	Pan, X., et al.	2013	1614	[4]
5	Protocol for the development of the Master Chemical Mechanism, MCM v3 (Part A): tropospheric degradation of non-aromatic volatile organic compounds	Saunders, S.M., et al.	2003	936	[5]

6	Photocatalytic oxidation for indoor air purification: a literature review	Zhao, J., et al.	2003	883	[6]
7	Photocatalytic purification of volatile organic compounds in indoor air: A literature review	Mo, J., et al.	2009	756	[7]
8	TiO_2 photocatalyst for removal of volatile organic compounds in gas phase-A review	Shayegan, Z., et al.	2017	712	[8]
9	Titanium Dioxide Photocatalysis in Atmospheric Chemistry	Chen, H., et al.	2012	668	[9]
10	Low temperature catalytic oxidation of volatile organic compounds: a review	Huang, H., et al.	2015	564	[10]

Table S3. Treatment processes for the removal of VOCs.

Photocatalyst	**Synthetic precursor**	**Target pollutants**	**Eg(eV)**	**Ref.**
TiO_2	/	benzyl alcohol	3.2	[11]
F-TiO_2	$C_{16}H_{36}O_4Ti$, HF	toluene	/	[12]
Pd/TiO_2	$Pd(OAc)_2$, TiO_2	benzene	/	[13]
F-0.5%Ce-TiO_2	$TiOSO_4 \cdot xH_2O+H_2SO_4$, $Ce(NO_3)_3 \cdot 6H_2O$, NH_4F	methyl ethyl ketone	3.0	[14]
$TiO_2/H_2Ti_3O_7$	SiO_2, $C_{12}H_{28}O_4Ti$	toluene and acetone	3.3	[15]
TiO_2/Pd	Commercial TiO_2 powder, $Pd(NO_3)_2$	*n*-octane, isooctane, *n*-hexane, and cyclohexane	2.8	[16]
$Cu_2O/CuO/TiO_2$	$Ti(OBu)_4$, $Cu(NO_3)_2 \cdot 3H_2O$	acetone	/	[17]
bentonite/M-TiO_2 (M= Au, Ag and Pd)	$AgNO_3$, $HAuCl_4$, $PdCl_2$, $NaBH_4$	benzaldehyde	2.93, 2.95, 2.98	[18]
Au/TiO_2-CeO_2	$Ce(NO3)_3 \cdot 6H_2O$, $HAuCl_4$	2-propanol	/	[19]
C-TiO_2	carbon black, P25-TiO_2	methyl ethyl ketone	2.35	[20]
N@S-TiO_2	$C_{12}H_{28}O_4Ti$, CH_4N_2S	ethano	2.93	[21]
F-FeTi-0.4%	$TiOSO_4 \cdot xH_2O+H_2SO_4$, $FeSO_4 \cdot 7H_2O$	methyl ethyl ketone	2.89	[22]
Pd/TiO_2	$PdCl_2$, P25-TiO_2	formaldehyde,	/	[23]

		toluene and xylenes		
Mn/meso-TiO_2	$C_{16}H_{36}O_4Ti$, $(CH_3COO)_2Mn$	benzene	/	[24]
TiO_2-WO_3	$C_{16}H_{36}O_4Ti$, H_2WO_4	xylene	/	[25]
Mn^{2+}/USTiO_2	$C_{16}H_{36}O_4Ti$, $MnCl_2 \cdot 4H_2O$	toluene	/	[26]
Ag_2CO_3-TiO_2-GO	GO, Ag_2CO_3, TiO_2	o-xylene	2.62	[27]
Er_1-TiO_2/La_1-TiO_2	$La(NO_3)_3 \cdot nH_2O$, $Er(NO_3)_3 \cdot 6H_2O$, $C_{12}H_{28}O_4Ti$	methanol and acetaldehyde	/	[28]
CQDs/TiO_2	$C_{16}H_{36}O_4Ti$, HF, $C_6H_8O_7$	benzene, p-xylene, and toluene	3.12	[29]
$BiVO_4$/TiO_2	$Bi(NO_3)_3 \cdot 5H_2O$, $Ti(OiPr)_4$	benzene	2.87	[30]
TiO_2/SiO_2/Bi_2O_3	SiO_2, $Bi(NO_3)_3 \cdot 5H_2O$, $TiOSO_4$	benzene	2.8	[31]
Fe-TiO_2	$Ti(OC_4H_9)_4$, $Fe(NO_3)_3$	toluene	2.96	[32]
N-TiO_2	$N(CH_2CH_3)_3$, HNO_3, $Ti(OC_4H_9)_4$	toluene	3.0	[33]
$TiBi_xZn_yO_2$	$Bi(NO_3)_3 \cdot 5H_2O$, $Zn(NO_3)_2 \cdot 6H_2O$;$TiOSO_4$	toluene	2.54	[34]
Cu_2O/TiO_2	$NiCl_2 \cdot 6H_2O$, $Ti(OBu)_4$	toluene	2.08/2.77	[35]
Ni–TiO_2/SnO_2	$Ti(OBu)_4$, $NiCl_2 \cdot 6H_2O$, $(C_6H_5)_3Sn$-OH	toluene	/	[36]
N-TiO_2	$TiCl_3$, $CO(NH_2)_2$	formaldehyde	/	[37]
Pt/TiO_2	$H_2PtCl_6 \cdot 6H_2O$, $C_{16}H_{36}O_4Ti$	NOx	2.73	[38]
TiO_2 /HAp	$TiCl_4$, $(NH_4)_2HPO_4$, $NH_3 \cdot H_2O$, $Ca(NO_3)_2 \cdot 4H_2O$, C_2H_6O	NO	/	[39]
UO_2^{2+}/TiO_2	$UO_2(NO_3)_2$, TiO_2 powder	acetone, cyclohexane alcohols, ethanol and propan-2-ol	/	[40]
g-C_3N_4/Ag–TiO_2	$C_3H_6N_6$, $AgNO_3$, P25 TiO_2	acetaldehyde	2.70	[41]
NCDs@TiO_2	$C_6H_8O_7$, $CO(NH_2)_2$, $AgNO_3$, HF, $C_{16}H_{36}O_4Ti$, $NaBH_4$	toluene	3.27	[42]
GF-Fe-TiO_2	$Ti[O(CH_2)_3CH_3]_4$, $Fe(NO)_3$, glass fibers	benzene, toluene, ethylbenzene, and o-xylene	/	[43]

N-TiO_2	Ti ($OCH_2CH_2CH_3)_4$, NF	ethylbenzene	2.91	[44]
N-TiO_2	$C_2H_4N_4$, P25-TiO_2	benzene	2.57-2.91	[45]
F-TiO_2	NH_4HF_2, $C_{16}H_{36}O_4Ti$	toluene	/	[46]
MnO_2/TiO_2	$C_{16}H_{36}O_4Ti$, $KMnO_4$	toluene	2.25	[47]
Fe_2O_3/TiO_2	$Fe(NO_3)_3·9H_2O$, P25-TiO_2	acetaldehyde and o-xylene	2.3	[48]
CuO/TiO_2	$Cu(NO_3)_2·3H_2O$, H_3BTC (BTC = 1, 3, 5–benzoic acid), DMSO, Anatase TiO_2	xylene	2.68-2.75	[49]
ZnO/TiO_2	$Zn(CH_3COO)_2·2H_2O$, P25-TiO_2	toluene	2.95	[50]
TiO_2-CeO_2	$Ce(OH)_4$, CHO_4Ti	toluene	2.54	[51]
Pt-MoS_2/TiO_2	$TiCl_4$, $(NH_4)_6Mo_7O_{24}·4H_2O$, CH_4N_2S, K_2 $PtCl_6$	toluene	/	[52]
CuS/TiO_2	Na_2S, $Cu(NO_3)_2$	toluene	2.77	[53]
CdS/TiO_2	$Cd(NO_3)_2$, Na_2S	benzene	3.01	[53]
CuS-CdS/TiO_2	$Cd(NO_3)_2$, Na_2S, $Cd(NO_3)_2$	toluene	2.55	[53]
CdS/TiO_2	$CdCl_2$, $Na_2S·9H_2O$	benzene	2.2	[54]
CdSe/TiO_2	$CdCl_2$, selenium powder	acetaldehyde	2.4	[54]
CdTe/TiO_2	Na_2TeO_3, $CdCl_2$	acetaldehyde	2.8	[54]
(Mn)g-C_3N_4/TiO_2	$C_{16}H_{36}O_4Ti$, $C_3H_6N_6$, $Mn(NO_3)_2·4H_2O$	benzene	3.12	[55]
$LaVO_4$/TiO_2	$La(NO_3)_3$, NH_4VO_3, TiO_2	toluene	2.1	[56]
Ag–ZnO	$AgNO_3$, $Zn(NO_3)_2·6H_2O$	benzene, toluene, and xylene	/	[57]
ZnO–rGO	$Zn(OAc)_2$, GO	phenol and acetone	/	[58]
Fe/ZnO	$FeCl_3·6H_2O$, $ZnCl_2$	toluene and nitrobenzene	/	[59]
ZnO-X/ND	ZnO, Pure nanodiamond	formaldehyde	3.25	[60]
Ag/F-$SrTiO_3$	$Ti(C_4H_9O)_4$, $Sr(NO_3)_2$, NH_4F	aromatics	2.86	[61]
$Znln_2S_4$/In_2O_3	$InCl_3$, $ZnIn_2S_4$	toluene	2.17	[62]

Ni-g-C_3N_4	$C_3H_6N_6$, $Ni(NO_3)_2$	toluene	2.25	[63]
Biochar/MnO_2/g-C_3N_4	$(C_6HO_5)_n$, $KMnO_4$	toluene	2.23	[64]
$H_3PW_{12}O_40$/g-C_3N_4	CH_4N_2O, $C_8H_{12}O_8Si$, $H_3PW_{12}O_{40}$	toluene	2.78	[65]
α-MnO_2/Mn_3O_4	$MnCO_3$, $MnSO_4$	phenol and toluene	1.82	[66]
CeO_2	$Ce(NO_3)_3·H_2O$, CH_4N_2O	toluene	2.86-2.97	[67]
$CaTiO_3$	$CaZnTiO_3$	toluene	3.2	[68]
Eu^{3+}-$CaTiO_3$	$CaZnTiO_3$, $Eu(NO_3)_3·6H_2O$	toluene	3.0	[68]
Pt/$SrTiO_3$	$Ti(C_4H_9O)_4$, $Sr(NO_3)_2$, H_2PtCl_6	toluene	1.92	[69]
$BaZrO_3$	$ZrOCl_2·8H_2O$, $C_{19}H_{42}BrN$	toluene	4.8	[70]
$SrZrO_3$	$C_{19}H_{42}BrN$, $Sr(NO_3)_2$	benzyl alcohol	/	[70]
Pt/Er-$KTaO_3$	Ta_2O_5, KOH, H_2PtCl_6, $Er(NO_3)_3·5H_2O$	toluene	3.34	[71]
$ZnFe_2O_4$	$Zn(NO_3)_2·6H_2O$, $Fe(NO_3)_3·6H_2O$	benzene	1.87	[72]
Pt/Bi_2WO_6	$Bi(NO_3)_3·5H_2O$, $Na_2WO_4·2H_2O$, $H_2PtCl_6·6H_2O$	methyl ethyl ketone	2.33	[73]
$BiVO_4$	$Bi(NO_3)_3·5H_2O$, NH_4VO_3	toluene and acetone	2.17	[74]
CuS-CdS-$(BiO)_2CO_3$	$Bi(NO_3)_3·5H_2O$; $Cu(NO_3)_2·6H_2O$; $Cd(NO_3)_2·6H_2O$	*n*-octane, isooctane, *n*-hexane, and cyclohexane	2.25	[75]

Table S4. Heterojunction strategy in photocatalytic degradation of VOCs.

Scheme	Photocatalyst	Eg(eV)	Target pollutants	Pollutant Degradation Effect	Ref.
p-n	Co_3O_4/TiO_2	2.02	Toluene	90% (100mg catalyst; 300W Xe Lamp; 200℃)	[76]
p-n	CoO/WO_3	2.43	toluene	85.4% (20mg catalyst; 300W Xe Lamp; 4h)	[77]
p-n	graphene oxide-TiO_2	2.9-3.15	Methanol	90% (10mg catalyst; UV Light; 5h)	[78]
p-n	α-Fe_2O_3/CaFeO	/	Acetaldehyde	80% (50mg catalyst; Xe Lamp; 180min)	[79]
p-n	Ag/Ag_2O@Ti	/	toluene	99.1% (0.01 g/cm2 catalyst;	[80]

	O_2			256nm UV Light; 1h)	
p-n	$LaVO_4$/BiOBr	2.63	toluene and acetone	95.4% and 87.1% (0.2g catalyst; 500W Xe Lamp;	[81]
p-n	$CuInS_2$/Bi_2WO_6	2.6	toluene	90% (0.2g catalyst; 500 W Xe lamp;5h)	[82]
p-n	Co_3O_4/TiO_2	/	benzene	95% (0.1g catayst; UV Light; 40min)	[83]
p-n	TiO_2–Cu_2O	2.08	toluene	90% (50mg catalyst; 500W Xe Lamp; 180min)	[84]
Z-scheme	Ag_3PO_4-g-C_3N_4	2.7	toluene	87.52% (300mg catalyst; Xe Lamp; 100min)	[85]
Z-scheme	Ag/Ag_3PO_4/CeO_2	/	C6H6	90.18% (300W Xe Lamp; 3h)	[86]
Z-scheme	Ag/WO_3/Bi_2WO_6	2.57	chlorobenzene	80% (0.2g catalyst; 300W Xe Lamp; 10h)	[87]
Z-scheme	MnO_2/g-C_3N_4	2.54	formaldehyde	91.78% (0.3g catalyst; 500W Xe Lamp; 3h)	[88]
Z-scheme	Bi_2WO_6/BiOCl	2.49	toluene	99% (0.2g catalyst; 350 W Xe Lamp; 3h)	[89]
Z-scheme	WO_3/Bi_2WO_6	/	toluene	92% (0.2g catalyst; 300 W Xe Lamp; 1h)	[90]
Z-scheme	g-C_3N_4/Bi_2WO_6	2.53	toluene	93.6% (0.4g/cm2 catalyst; 300 W Xe Lamp;2h)	[91]
Z-scheme	MnO2/g-C_3N_4	/	formaldehyde	100% (50mg catalyst; 300 W Xe Lamp; 1.5h)	[92]
S-scheme	tubular g-C_3N_4/$BiVO_4$	/	formaldehyde	95.4%(3g catalyst; 500 W Xe Lamp; 40min)	[93]
S-scheme	CdS/Bi_2MoO_6	/	C2H4	100% (0.2g catalyst; 300 W Xe Lamp; 70min)	[94]
S-scheme	TiO_2/$BaTiO_3$	/	toluene	86.3% (0.1mg catayst; 300 W High-pressure Mercury Lamp; 1h)	[95]
S-scheme	CeO_2@CN	/	formaldehyde	100% (0.3g catalyst; Xe Lamp; 100min)	[96]
S-scheme	CeO_2/Cu_2O	/	toluene	100% (Xe Lamp; 50min)	[96]

Table S5. Application of MOFs materials in photocatalytic degradation of VOCs.

Photocatalyst	**Eg(eV)**	**SBET (m^2g^{-1})***	**Target pollutants**	**Pollutant Degradation Effect**	**Ref.**

UiO-66/TiO_2	/	1432.7	dimethyl sulphide (DMS)	99% (UV Lamp; 80min)	[97]
MXene(Ti_3C_2)/ NH_2-UiO-66	2.4	1391	acetone (CH3COCH3)	95% (0.1g catalyst; Xe Lamp; 60min)	[98]
TiO2/NH_2-UiO -66	2.82	/	styrene	99% (0.1g catalyst; 300W Xe Lamp; 10h)	[99]
AUiO-66(Zr/Ti)	2.78	413	toluene	80%(0.1g catalyst; 350W Xe Lamp;3h)	[100]
$Br_{0.2}$@UiO-66	3.97	/	acetaldehyde	95% (0.1g catalyst; 125 W Mercury Lamp; 1h)	[101]
TiO_2-UiO-66-NH_2	2.96	1121	toluene	90%(0.1g catalyst; 125 W Mercury Lamp;)	[102]
micro-mesopor ous UiO-66	/	1240	toluene	Capacity (mg g^{-1}): 394	[103]
ZIF-67/PDA	1.84	662.65	toluene	78.9% (30mg catalyst; 500W Xe Lamp; 6h)	[104]
GC-N-TiO_2	2.76	/	toluene	100% (50mg catalyst; 300W Xe Lamp; 1h)	[105]
Zn-His-GQDs	/	63.3	Toluene Tthyl acetate	Capacity (mg g^{-1}): 350 and 669 (0.2g catalyst)	[106]
Au@ZnO/ZIF-8	/	923.75	formaldehyde	/	[107]
P-NH_2-MIL-12 5	2.53	1423	toluene chlorobenzene	91.9% and 100% (10mg catalyst; 300W Xe Lamp; 1h)	[108]
Disk-like N-TiO_2	2.87	/	toluene	99.1% (0.05g catalyst; 100W LED Lamp; 8h)	[109]
MIL-125(N-Ti 9Zn)	1.85	1415–14 19	CH_3CHO	99% (0.1g catalyst; vis-light; 25min)	[73]
MIL-100(Fe)	2.74	/	acetone	90% (25mg catalyst; 300W Xe Lamp; 1h)	[110]
MIL-100(Fe)/α -Fe_2O_3	/	1138	o-xylene	100% (95mg catalyst; 250W Xe Lamp; 5h)	[111]
MIL-101/TiO_2/ PDVB	/	461.47	toluene	90.67% (100mg catalyst; 125 W Mercury Lamp; 8h)	[76]
NaFe-MOXs	2.66	554	acetaldehyde	65%(50mg catalyst; 300W Xe Lamp; 140min)	[112]

* BET specific surface area

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