Supplementary Material

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Fig. S1. On-site pictures in Tahe Oilfield, Xinjiang (in order are oil-contaminated soil,

soil thermal desorption device and condensed wastewater)
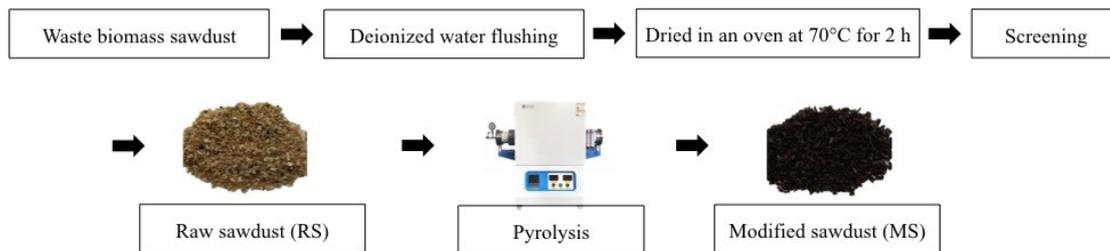
Fig. S2. Sawdust pyrolysis modification process
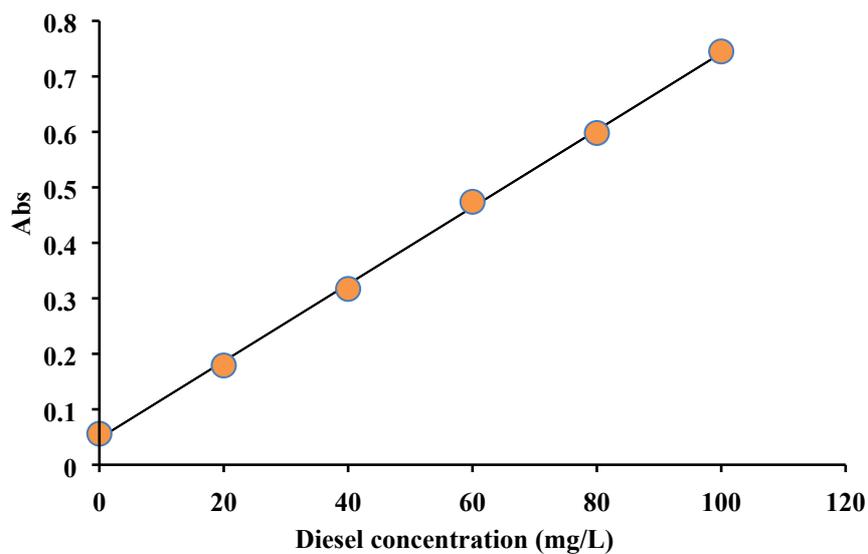
Fig. S3. Diesel concentration standard curve
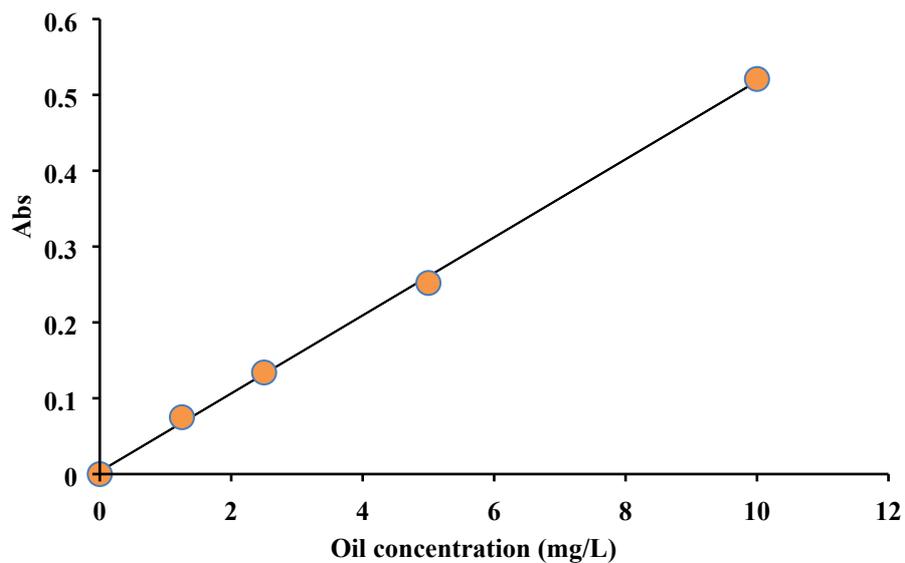
Fig. S4. Oil concentration standard curve
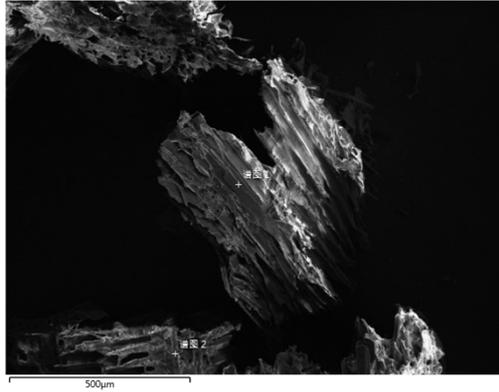
Spectrogram1
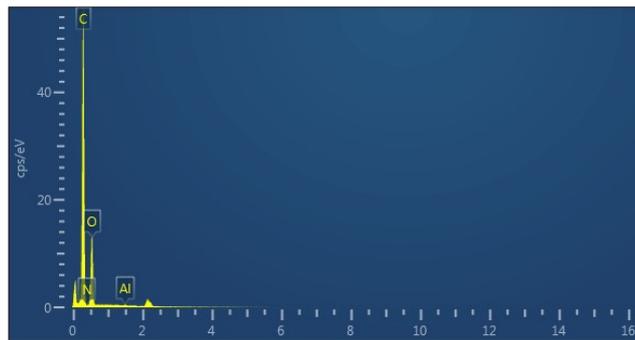
Eelement	Line style	Weight percentage	Wt % Sigma	Atomic percentage
C	K linear system	66.52	0.39	72.61
O	K linear system	33.35	0.39	27.33
N	K linear system	0.00	1.33	0.00
Al	K linear system	0.12	0.04	0.06

Spectrogram2

Eelement	Line style	Weight percentage	Wt % Sigma	Atomic percentage

C	K linear system	63.84	0.36	70.23
O	K linear system	35.97	0.36	29.71
N	K linear system	0.00	1.78	0.00
Ca	K linear system	0.19	0.04	0.06

Fig. S5. EDS of raw sawdust
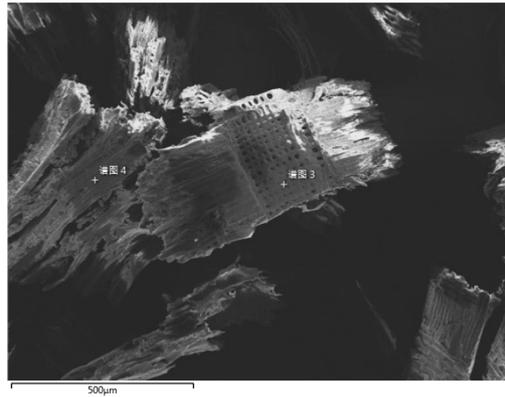
Spectrogram1
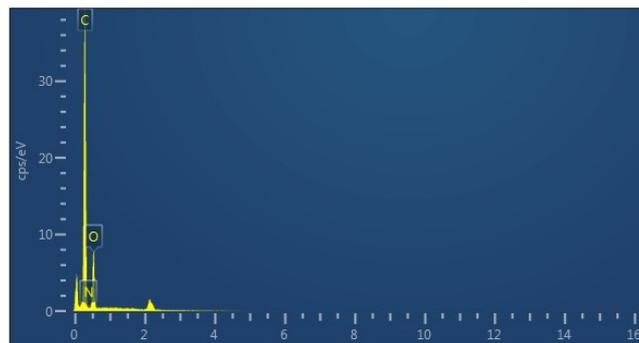
Eelement	Line style	Weight percentage	Wt % Sigma	Atomic percentage
C	K linear system	69.77	0.48	75.45
O	K linear system	30.23	0.48	24.55
N	K linear system	0.00	1.81	0.00

Spectrogram2
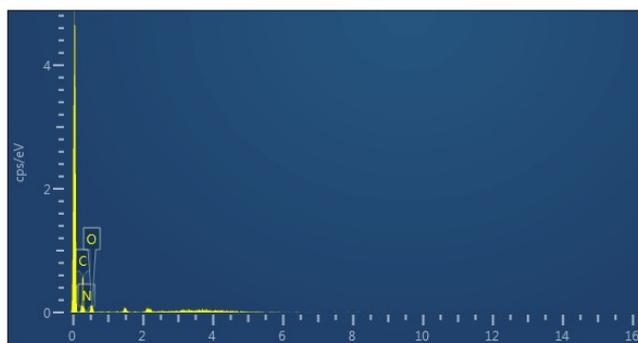
Eelement	Line style	Weight percentage	Wt % Sigma	Atomic percentage
C	K linear system	69.77	3.09	75.45
O	K linear system	31.93	3.09	26.04
N	K linear system	0.00	10.40	0.00

Fig. S6. EDS of MS

Videos S1. Dynamic water contact Angle of RS
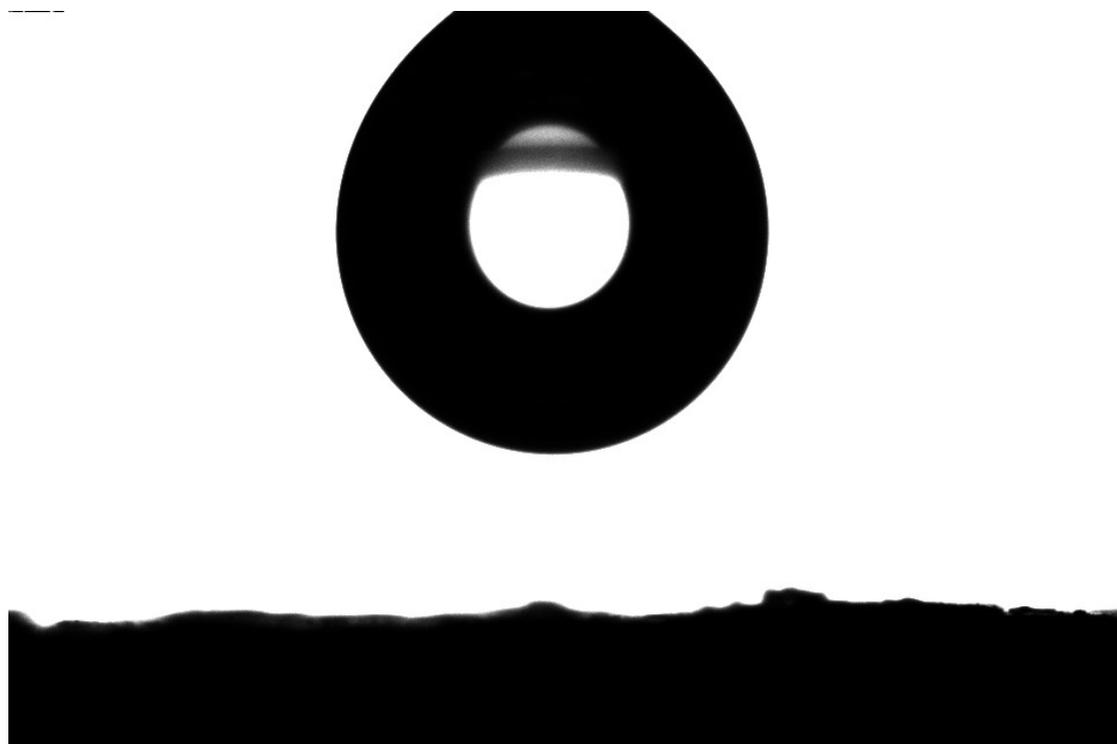
Videos S2. Dynamic water contact Angle of MS
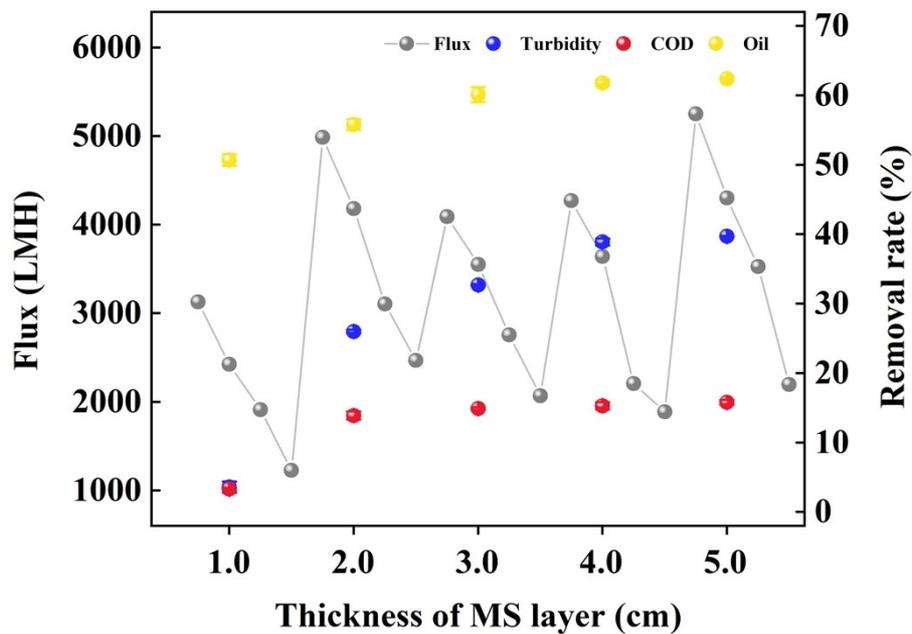
Fig. S7. Influence of MS layer thickness on flux, removal rates of turbidity, COD and oil.

Table S1

Main water quality parameters of wastewater from TD of an oil-contaminated soil in Tahe, Xinjiang, China

Parameters	Value	Parameters	Value
COD	9724 (mg/L)	As	92.1 (μg/L)
NH_3-N	252 (mg/L)	Hg	1.37 (μg/L)
Turbidity	596 (NTU)	Cu	0.02 (mg/L)
Oil content	1377 (mg/L)	Cr	0.06 (mg/L)
Petroleum hydrocarbons	818 (mg/L)	Mn	1.01 (mg/L)
pH	7.8	Se	2.5 (μg/L)
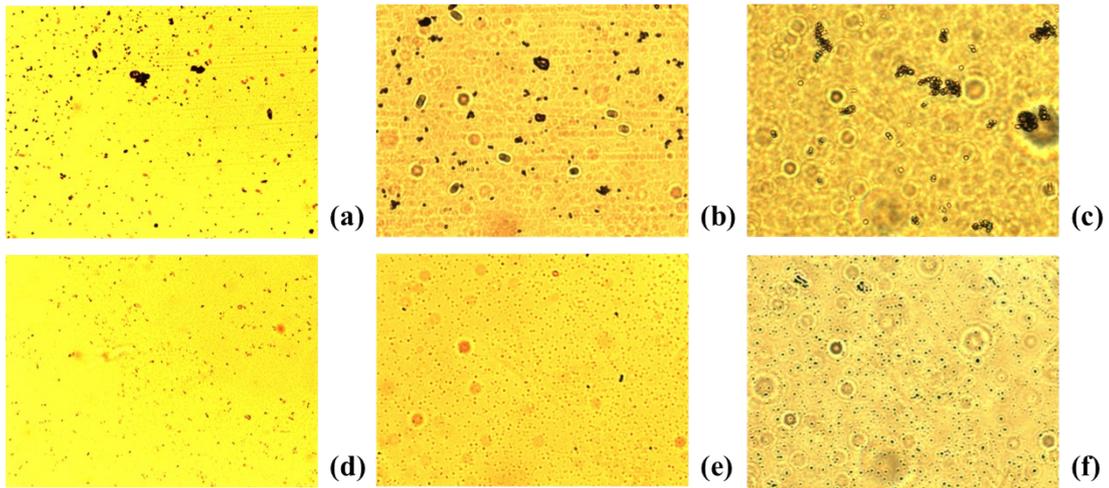
Fig. S8. Optical microscope photos of TDW before (a-c) and after (d-f) MS layer treatment. (a,d: Magnified 40 times; b,e: Magnified 100 times; c,f: Magnified 200 times)
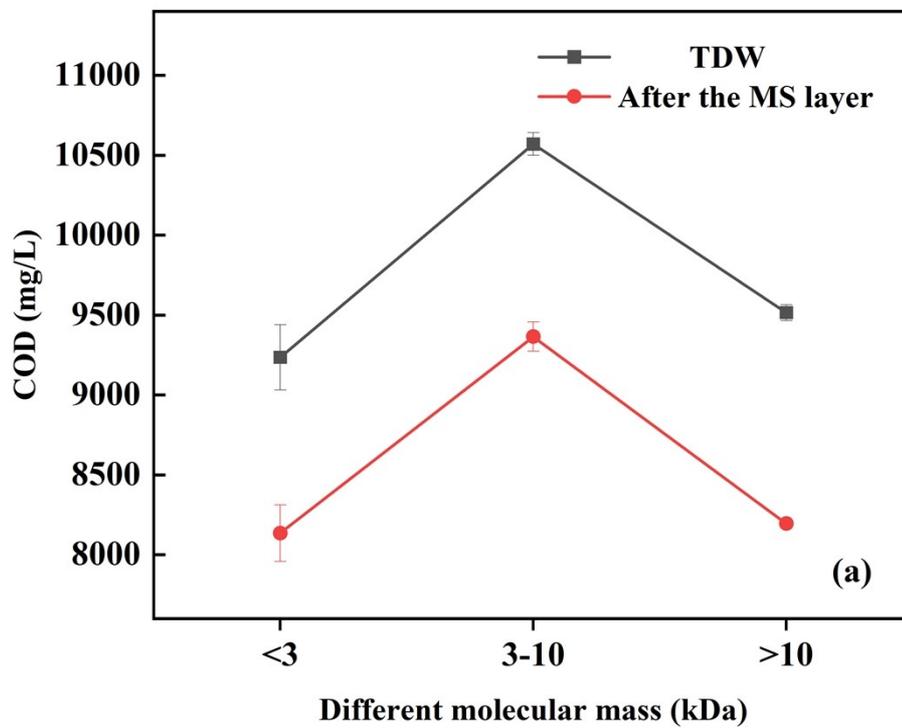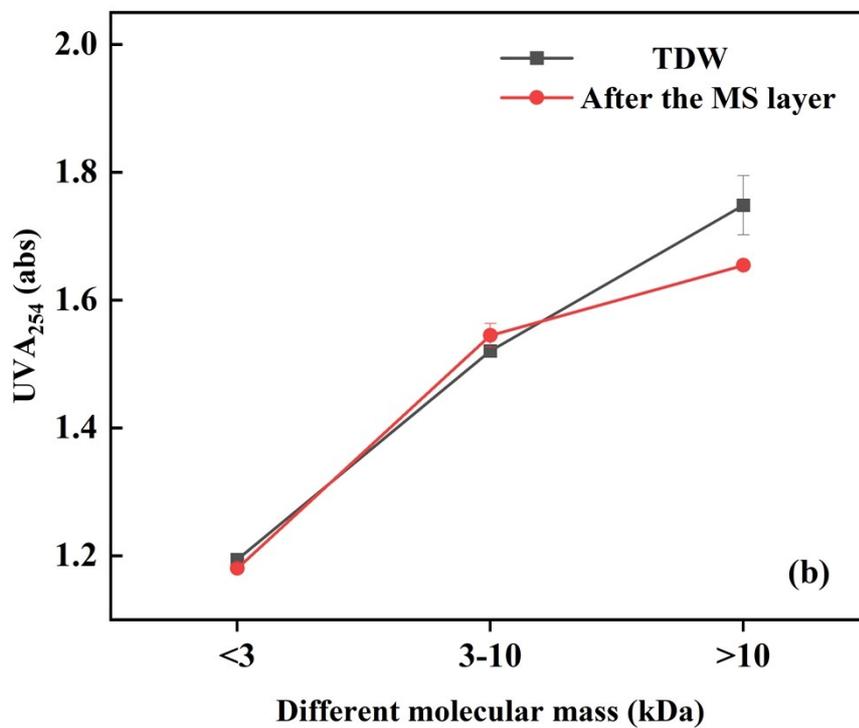
Fig. S9. Different molecular mass distributions of the (a) COD and (b) UV254

Table S2. The Zeta and size distribution of TDW before and after MS layer treatment

	Zeta (mV)	Conductivity (mS/cm)	Z-average Size (d.nm)	Pdl
TDW	-7.98	25.03	4187	0.686
After the MS layer	-6.89	32.73	1215	0.033

Fig. S10. Effect drawing of wastewater treatment in DF process (from left to right, NaClO, CaCl$_2$, PAC and PAM are added in order)

Table S3. Orthogonal experimental design table for the treatment effect of DF on COD, turbidity and oil concentration

Factors	NaClO (ml/L)	CaCl$_2$ (g/L)	PAC (g/L)	PAM (g/L)
A	20	2	2	1
B	30	4	4	2
C	40	6	6	3

NO.	NaClO (ml/L)	CaCl$_2$ (g/L)	PAC (g/L)	PAM (g/L)	COD (%)	Turbidity (%)	Oil concentration (%)
1	20	2	2	1	9.5	96.8	59.3
2	20	4	4	2	15.3	97.6	64.3
3	20	6	6	3	12.7	97.1	65.3
4	30	2	4	3	10.8	94.5	63.9
5	30	4	6	1	11.5	97.4	57.7
6	30	6	2	2	7.6	97.3	63.3
7	40	2	6	2	10.8	91.2	59.9
8	40	4	2	3	10.2	95.6	56.8
9	40	6	4	1	14.0	97.0	61.4
K1	37.5	31.2	27.4	35.0			
	291.6	282.6	289.7	291.3			

	188.8	183.1	179.4	178.4
	29.9	36.9	40.1	33.7
K2	289.3	290.6	289.1	286.1
	184.9	178.8	189.6	187.5
	35.0	34.4	35.0	33.7
K3	283.8	291.4	285.8	287.3
	178.1	189.9	182.9	186.0
	12.5	10.4	9.1	11.7
k1	97.2	94.2	96.6	97.1
	62.9	61.0	59.8	59.5
	10.0	12.3	13.4	11.2
k2	96.4	96.9	96.4	95.4
	61.6	59.6	63.2	62.5
	11.7	11.5	11.7	11.2
k3	94.6	97.1	95.6	95.8
	59.4	63.3	61.0	62.0
	2.5	1.9	4.2	0.4
R	2.6	3.0	1.3	1.7
	3.6	3.7	3.4	3.0
Significance order	2	3	1	4
	2	1	3	4
	2	1	3	4

DF experiment steps: DF experiments were performed using a jar test apparatus. Each sample to be coagulated was added with NaClO and placed under a state of rapid stirring (250 rpm). CaCl$_2$ was slowly added after stirring for 60 s. After adding PAC, the flocculant was stirred slowly for 5 min at a speed of 50 rpm. At the last stage, PAM was added to make the flocculant settle for 30 min. The supernatant obtain

Table S4 Comparison of treatment efficiencies between Demulsification and flocculation (DF) and Modified sawdust (MS).

Methods	Turbidity removal rate (%)	COD removal rate (%)	Oil removal rate (%)	Solid waste production (g/L)
Demulsification and flocculation (DF)	97.6	15.3	65.3	5.61
Modified sawdust (MS)	99.0	24.8	82.6	0.35