Supporting Information

Petroleum hydrocarbons release behavior study in oil-sediment aggregates: turbulence intensity and chemical dispersion effect

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1. GC-FID and GC-MS parameters

GC-FID equipped with a DB-5MS column fused silica capillary column (30 m × 0.32 mm × 0.25 μm). The oven temperature kept constant for 5 min at 60℃, gradually increasing from 60 to 300℃ at the speed of 6℃ per minute, and then held constant for 45 min at 300℃. Helium was used as flowing gas at a flow rate of 1.0 mL min^{-1}. The inlet temperature was 290℃ and the ion source temperature was 230℃. GC-MS analyses were conducted on an automated GC-MS Shimadzu (Kyoto, Japan) equipment model GC-MS-QP2010 using a DB-5MS capillary column (30 m × 0.25 mm × 0.25μm, Agilent) with helium as the carrier gas, at a constant flow velocity of 1.0 mL min^{-1}. Sample aliquots of 1.0 μL were injected in splitless mode. Analyses were performed under the following conditions: the column was started at 50℃ for 2 min and then heated to 300℃ at 6℃/min, and then kept constant for 16 min. The mass chromatograms were analyzed in the selected ion-monitoring (SIM) mode (m/z 256) with sampling interval of 550 msec from 6.000 min to 69.983 min (6981 points). For SIM, the visual observation spectrogram, there is a greater difference in C2 chrysenes mass chromatograms between certain fuels and crude oils. Thus, the m/z 256 mass chromatogram, which mainly reflects C2 chrysenes, was selected to find a quick and effective identification method for oil types. System control and data acquisition were achieved with GC-MS solution software.[1-3]

2. Crude oil information

2.1 The four-component list of crude oil

Saturates (wt. %)	Aromatics (wt. %)	Resins (wt. %)	Asphaltenes (wt. %)	Others (wt. %)
62.3	22.7	9.5	0.9	4.6

Table S1 Compound-grouped fractions (wt. %) of the crude oil.

2.2 The *n*-alkanes and aromatic components of crude oil

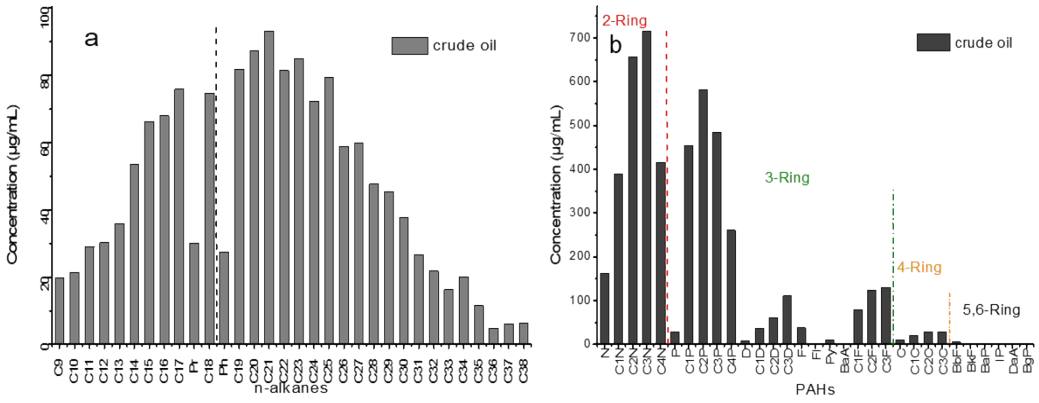

Fig. S1 The components of *n*-alkanes (a) and PAHs (b) of the crude oil in this paper.

3. Standard curve of oil

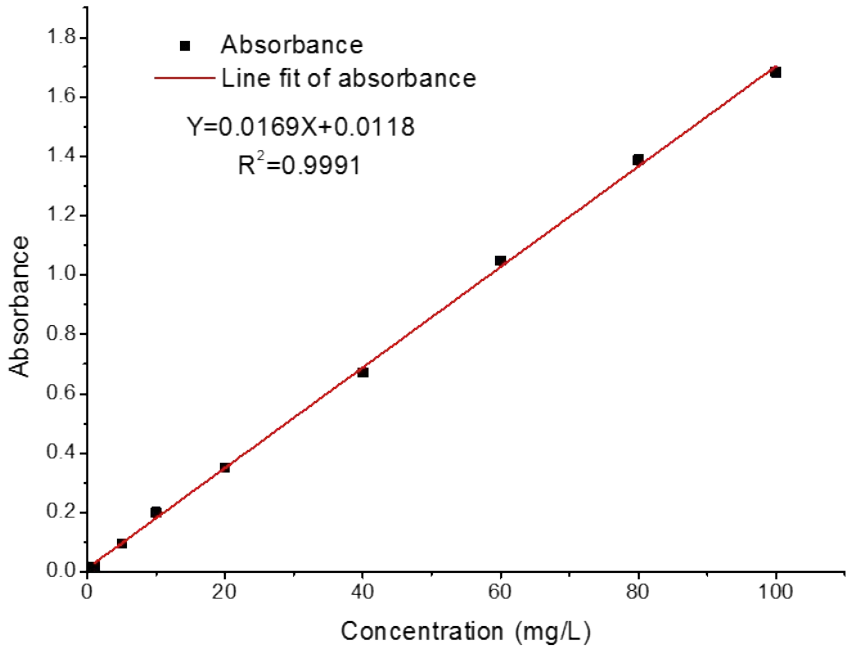

Fig. S2 The positive correlation between oil concentration and its absorbance (225 nm).

As showed in Fig. S2, the function of standard curve of petroleum hydrocarbons concentration was: $Y = 0.0169X + 0.0118$ ($R^2 = 0.9991$).

Where X-oil concentration (mg/L); Y-absorbance values. Based on this formula, the oil concentration in this experiment was calculated by measuring the absorbance. All tests were done in duplicates.

4. Petroleum hydrocarbons compounds studies in this paper

Table S2 Petroleum hydrocarbons compounds studies in this paper

***n*-Alkanes**	**abbrev**	**PAHs**	**abbrev**
n-Heptane	C9	Naphthalene	N
n-Octane	C10	C1-naphthalenes	C1N
n-Undecane	C11	C2-naphthalenes	C 2N
n-Dodecane	C12	C3-naphthalenes	C3N
n-Tridecane	C13	C4-naphthalenes	C4N
n-Tetradecane	C14	Phenanthrene	P
n-Pentdecne	C15	C1-phenanthrenes	C1P
n-Hexadecane	C16	C2-phenanthrenes	C2P
n-Heptadecane	C17	C3-phenanthrenes	C3P
Pristane	Pr	C4-phenanthrenes	C4P
n-Octadecane	C18	Dibenzothiophene	D
Phytane	Ph	C1-dibenzothiophenes	C1D
n-Nonadecane	C19	C2-dibenzothiophenes	C2D
n-Eicosane	C20	C3-dibenzothiophenes	C3D
n-Heneicosane	C21	Fluorene	F
n-Docosane	C22	C1-fluorenes	C1F
n-Tricosane	C23	C2-fluorenes	C2F
n-Tetracosane	C24	C3-fluorenes	C3F
n-Pentaccosane	C25	Chrysene	C
n-Hexacosane	C26	C1-chrysenes	C1C
n-Heptacosane	C27	C1-chrysenes	C2C
n-Octacosane	C28	C1-chrysenes	C3C
n-Nonacosane	C29	Benzofluoranthene	BbF
n-Triacontane	C30	Benzofluoranthene	BkF
n-Hentriacontane	C31	Benzofluoranthene	BaP
n-Dotriacontane	C32	Dibenzanthracene	DaA
n-Tritriacontane	C33	Benzo[ghi]perylene	BgP
n-Tetratriacontane	C34	Indeno(1,2,3-cd)pyrene	IP
n-Pentatriacontane	C35		
n-Hexatriacontane	C36		
n-Heptatriacontane	C37		
n-Octatriacontane	C38		

5. Gas chromatograms

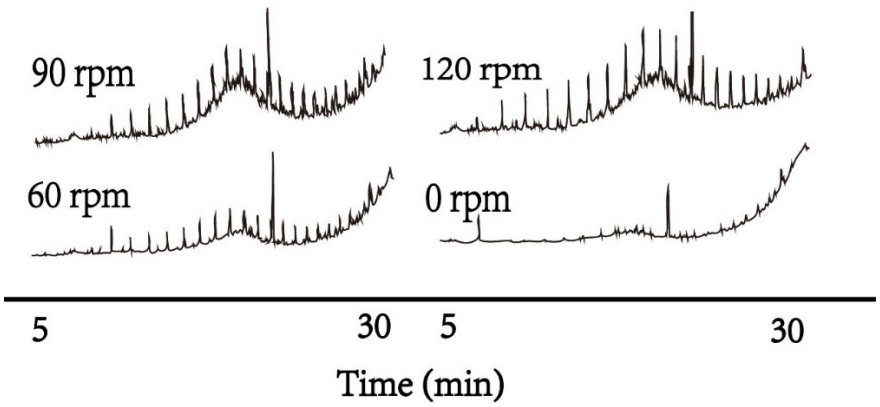

Fig. S3 Comparison of chromatograms for oil from seawater extracts, where the turbulence has been applied.

6. Zeta potential

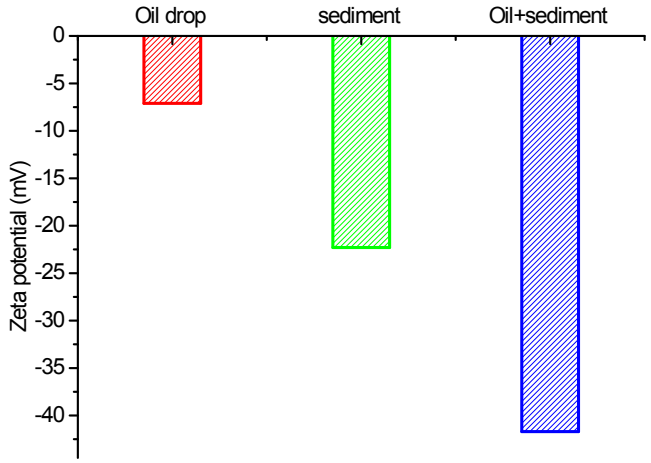

Fig. S4 Zeta potential under various experimental conditions**.**

7. Effect of dispersants on concentration of *n*-alkanes in three groups

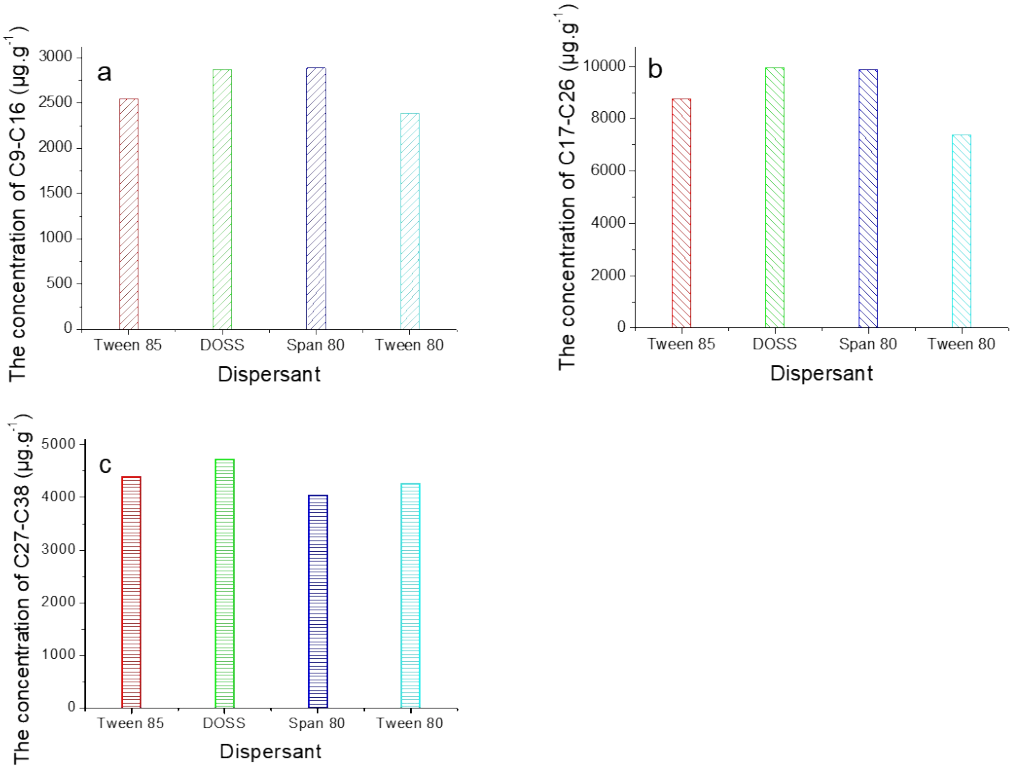

Fig. S5 The *n*-alkanes components in sediment after release equilibriumin. Concentration of *n*-alkanes in three groups, C_9-C_{16} (a), C_{17}-C_{26} (b) and C_{27}-C_{38} (c), respectively, at a fixed DOR of 1:20.

8. The effect of turbulence on concentration of *n*-alkanes in three groups

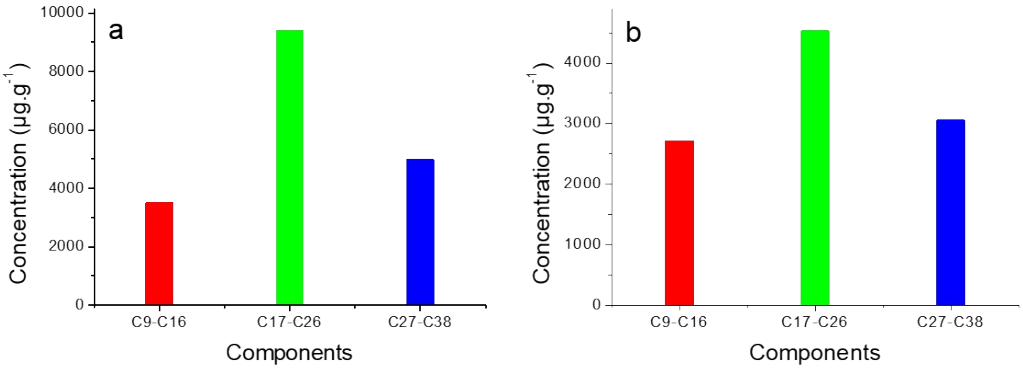

Fig. S6 The *n*-alkanes components in sediment after release equilibriumin. Concentration of *n*-alkanes in three groups, C9-C16, C17-C26 and C27-C38 with (a) and without (b) turbulence at 120 rpm.

9. Concentration of various groups of PAHs: 2 rings, 3 rings and 4 rings

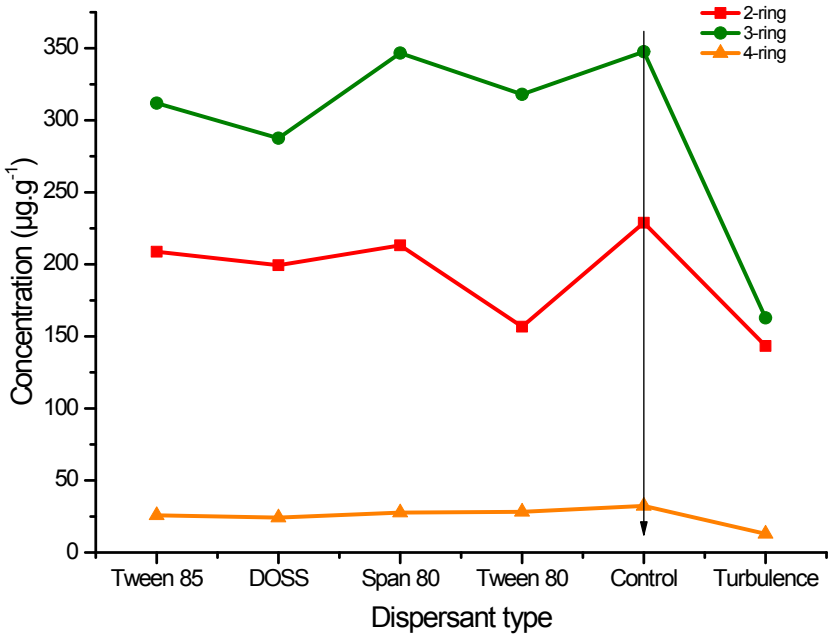

Fig. S7 The PAHs components in sediment after release equilibriumin. Concentration of various groups of PAHs: 2 rings, 3 rings and 4 rings.

Reference:

1. L. Yuan, L. Han, W. Bo, H. Chen, W. Gao and B. Chen, Marine Pollution Bulletin, 2017, 118, 79-84.

2. A. C. Bejarano and J. Michel, Environmental Pollution, 2010, 158, 1561-1569.

3. P. Sun, M. Bao, G. Li, X. Wang, Y. Zhao, Q. Zhou and L. Cao, Journal of Chromatography A, 2009, 1216, 830-836.