Supporting Information for
Surfactant-Enhanced Desorption and Biodegradation of Polycyclic Aromatic Hydrocarbons from Contaminated Soil

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Number of pages: 4

Number of Figures: 3

Number of Tables: 2

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PAH Concentrations in Soil Samples

Table S1. Concentrations of PAHs in the feed soil or slurry samples from the bioreactor that were used in this study.

	Concentration (mg/kg dry soil)			
PAH[a]	**Feed soil**	**Slurry 1**[b]	**Slurry 2**[c]	**Slurry 3**[d]
NAP	20.0 ± 1.4	17.1 ± 2.2	20.2 ± 1.8	19.2 ± 1.6
FLU	2.9 ± 0.2	2.1 ± 0.2	2.3 ± 0.2	2.5 ± 0.3
PHE	26.0 ± 2.0	19.6 ± 3.3	20.7 ± 1.3	23.1 ± 1.9
ANT	4.3 ± 0.7	4.0 ± 0.5	4.0 ± 0.6	5.7 ± 0.7
FLA	40.6 ± 2.7	34.2 ± 4.6	33.3 ± 2.0	35.0 ± 2.1
PYR	45.8 ± 2.9	41.3 ± 1.8	39.0 ± 2.3	41.9 ± 2.2
B*a*A	24.0 ± 1.6	19.0 ± 2.5	20.6 ± 1.1	18.9 ± 1.0
CHR	33.4 ± 2.1	23.5 ± 2.9	26.0 ± 1.7	22.0 ± 1.2
B*b*F	23.6 ± 1.5	22.8 ± 2.8	22.5 ± 2.4	17.7 ± 0.8
B*k*F	13.4 ± 0.8	12.8 ± 0.9	12.5 ± 0.9	10.3 ± 0.3
B*a*P	38.3 ± 2.2	41.4 ± 4.9	36.9 ± 3.3	31.7 ± 1.5
D*a*A	3.0 ± 0.7	3.9 ± 0.3	2.9 ± 0.3	2.4 ± 0.2
B*g*P	32.8 ± 1.5	37.8 ± 5.0	31.6 ± 2.9	20.2 ± 9.4

[a] NAP, naphthalene; ACE, acenaphthene; FLU, fluorene; PHN, phenanthrene; ANT, anthracene; FLA, fluoranthene; PYR, pyrene; BaA, benz[*a*]anthracene; CHR, chrysene; B*b*F, benzo[*b*]fluoranthene; B*k*F, benzo[*k*]fluoranthene; B*a*P, benzo[*a*]pyrene; D*a*A dibenz[*a,h*]anthracene; B*g*P, benzo[*g,h,i*]perylene. Concentrations are means and standard deviations of four samples for feed soil.

[b] The reactor slurry sample used to evaluate the effects of Brij 30 on PAH biodegradation.

[c] The reactor slurry sample used to evaluate the effects of $C_{12}E_8$ on PAH biodegradation and the effects of Brij 30 at its lowest dose (5 mg/g) on PAH desorption.

[d] The reactor slurry sample used to evaluate the effects of $C_{12}E_8$ at its lowest dose (2 mg/g) on PAH desorption.

Sorption of Surfactants to Soil

Isotherms for sorption of each surfactant to the soil slurry removed from the bioreactor are shown in Figure S1. Data were fit by non-linear regression to the Langmuir equation using ProStat 4.02 (Poly Software International, Pearl River, NY):

$$S = \frac{S_{\text{max}} KC}{1 + KC}$$

where S is the concentration in the soil (mg/g)
S_{max} is the maximum sorbed concentration (mg/g)
K is an equilibrium coefficient (L/mg)
C is the concentration in the liquid phase (mg/L)

Best-fit values of the parameters for each surfactant and their 95% confidence intervals are summarized in Table S2.

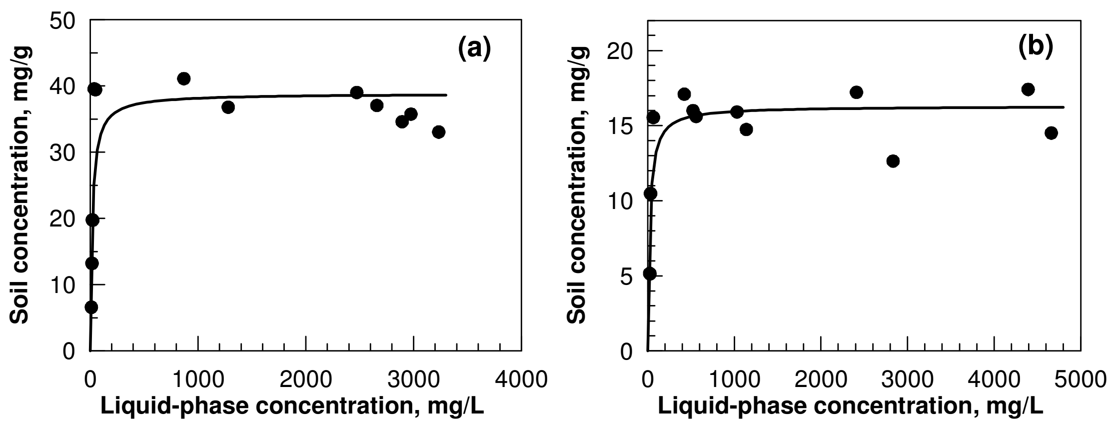

Figure S1. Isotherms for sorption of surfactant to reactor slurry (10% solids wt:wt) for **(a)** Brij 30 and **(b)** $C_{12}E_8$. The line is the best fit to the Langmuir equation.

Table S2. Best-fit values (with 95% confidence interval) of Langmuir parameters for each surfactant.

Surfactant	S_{max}**, mg/g**	K**, L/mg**
Brij 30	38.9 ± 5.6	0.054 ± 0.033
$C_{12}E_8$	16.3 ± 1.8	0.045 ± 0.029

PAH Biodegradation in the Presence of $C_{12}E_8$

Biodegradation of PAHs in the soil slurry removed from the bioreactor was evaluated for each of the three selected $C_{12}E_8$ doses. Results are shown in Figure S2.

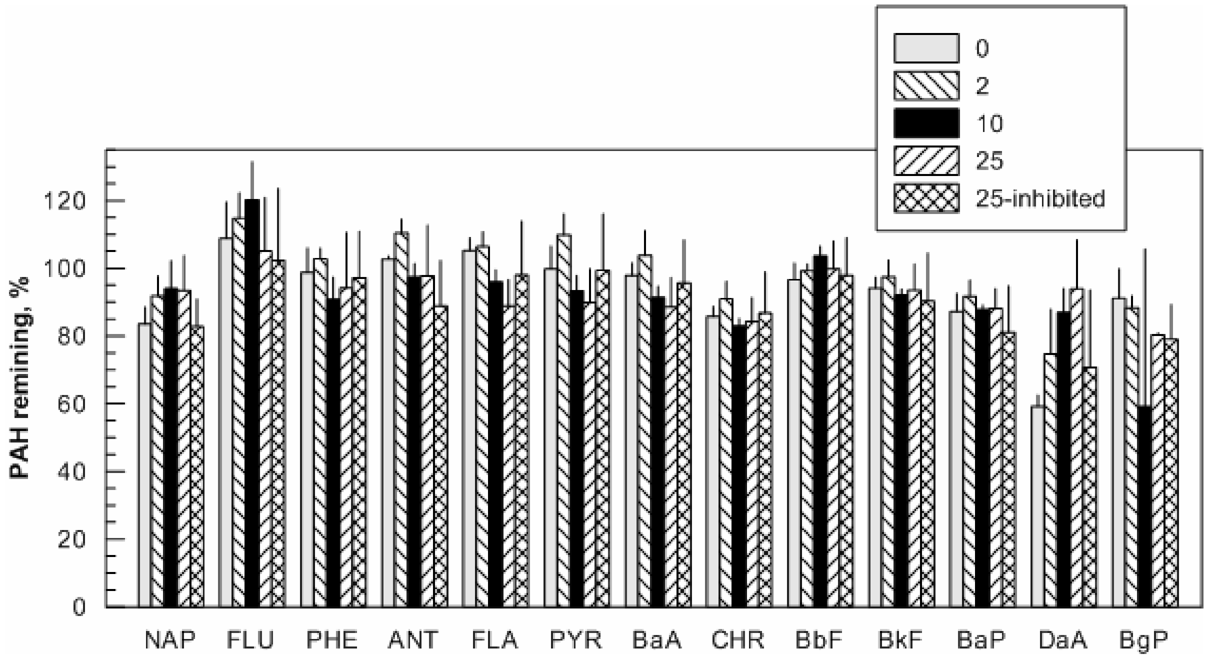

Figure S2. PAH remaining in the reactor slurry after 18 days of incubation with various concentrations of $C_{12}E_8$. The legend indicates surfactant dose in mg/g dry soil, and "inhibited" refers to controls to which sodium azide was added. The lowest surfactant dose tested (2 mg/g) corresponded to an aqueous-phase concentration of $C_{12}E_8$ below its CMC. The other two doses corresponded to $C_{12}E_8$ concentrations slightly above (10 mg/g) or well above (25 mg/g) the CMC. PAH remaining is relative to the initial concentration in the treated soil from the bioreactor.

Effect of Brij 30 on PAH Biodegradation in the Feed Soil

The effect of Brij 30 addition on the biodegradation of PAHs in the feed (untreated) soil was evaluated at the lowest Brij 30 dose (5 mg/g). Results are shown in Figure S3.

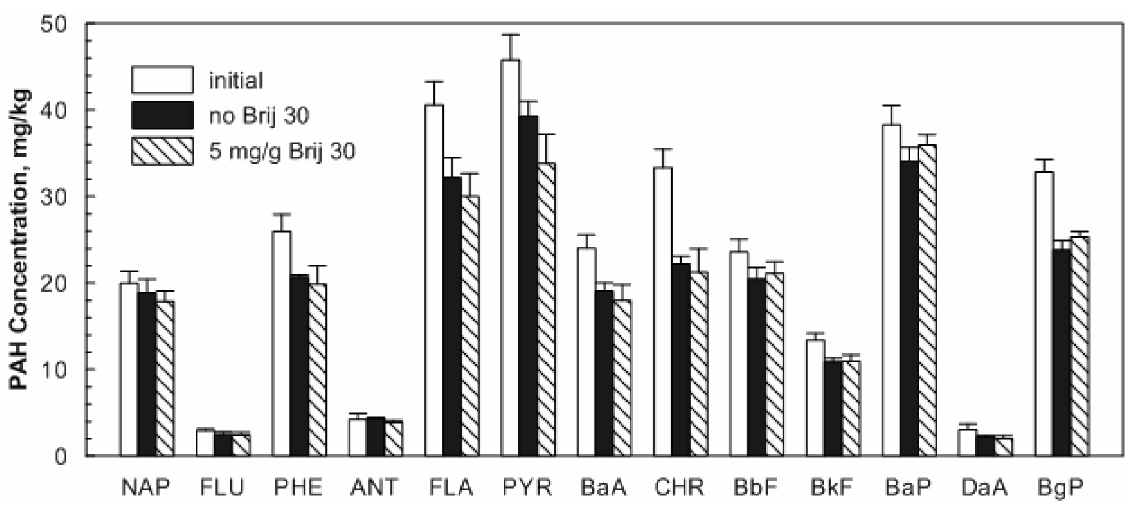

Figure S3. PAH concentrations in the feed soil initially and after incubation with or without Brij 30 (5 mg/g) for 18 d. Data are means and standard deviations of triplicate (day 0) or quadruplicate (day 18) samples.