

### Supplementary Materials:

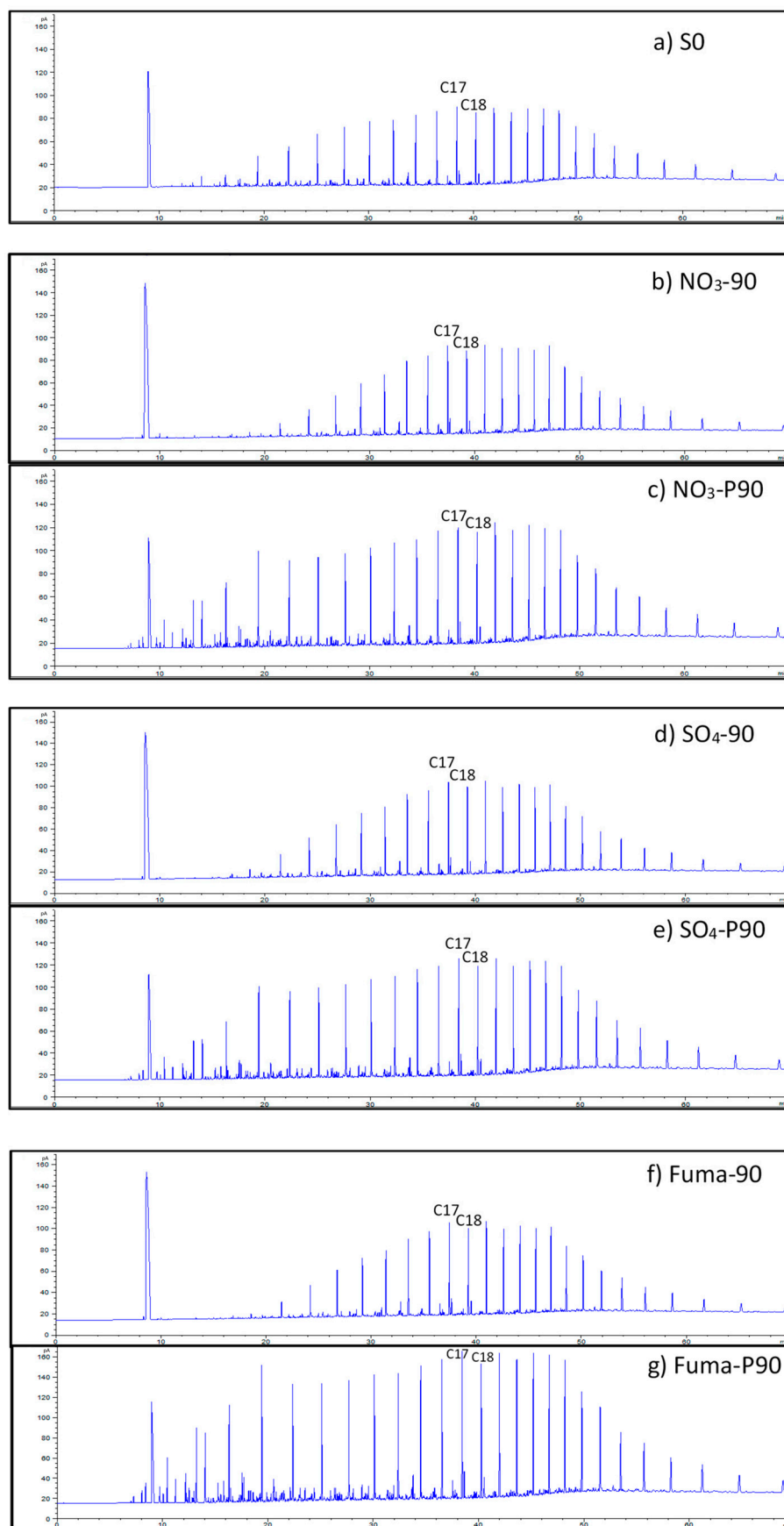
**Figure S1.** Gas chromatography of saturates before and after microbial degradation of crude oil. (a)S0, (b)NO<sub>3</sub>-90, (c)NO<sub>3</sub>-P90, (d)SO<sub>4</sub>-90, (e)SO<sub>4</sub>-P90, (f)Fuma-90, (g)Fuma-P90. (The culture starting point sample was labeled S0. After 90 days of incubation, the samples incubated under atmospheric pressure were labeled as “additive-90”, e.g., NO<sub>3</sub>-90, SO<sub>4</sub>-90 and Fuma-90, while the samples incubated under high pressure were labeled as “additive-P90”, e.g., NO<sub>3</sub>-P90, SO<sub>4</sub>-P90 and Fuma-P90.)

**Figure S2.** Relative abundance of *n*-alkanes from C8-C32 with NO<sub>3</sub><sup>-</sup> additive. (The culture starting point sample was labeled S0. After 90 days of incubation, the samples with NO<sub>3</sub><sup>-</sup> additive incubated under atmospheric and high pressure were labeled as NO<sub>3</sub>-90 and NO<sub>3</sub>-P90, respectively.)

**Figure S3.** Relative abundance of *n*-alkanes from C8-C32 with SO<sub>4</sub><sup>2-</sup> additive. (The culture starting point sample was labeled S0. After 90 days of incubation, the samples with SO<sub>4</sub><sup>2-</sup> additive incubated under atmospheric and high pressure were labeled as SO<sub>4</sub>-90 and SO<sub>4</sub>-P90, respectively.)

**Figure S4.** Relative abundance of *n*-alkanes from C8-C32 with fumarate additive. (The culture starting point sample was labeled S0. After 90 days of incubation, the samples with fumarate additive incubated under atmospheric and high pressure were labeled as Fuma-90 and Fuma-P90, respectively.)

**Figure S5.** Total Ion Chromatography Mass Spectrometry of aromatic hydrocarbon (retention time has been showed from 7 min to 60 min. (a)S0, (b)NO<sub>3</sub>-90, (c)NO<sub>3</sub>-P90, (d)SO<sub>4</sub>-90, (e)SO<sub>4</sub>-P90, (f)Fuma-90, (g)Fuma-P90. (The culture starting point sample was labeled S0. After 90 days of incubation, the samples incubated under atmospheric pressure were labeled as “additive-90”, e.g., NO<sub>3</sub>-90, SO<sub>4</sub>-90 and Fuma-90, while the samples incubated under high pressure were labeled as “additive-P90”, e.g., NO<sub>3</sub>-P90, SO<sub>4</sub>-P90 and Fuma-P90.)



**Figure S1**

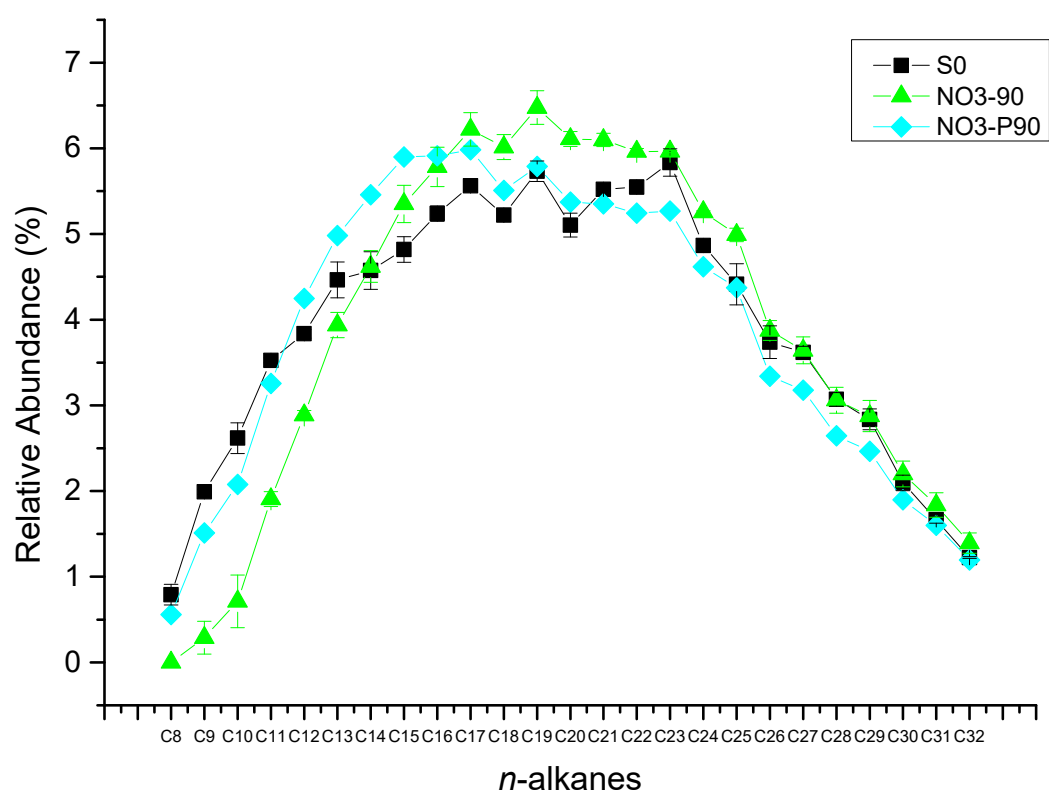


Figure S2

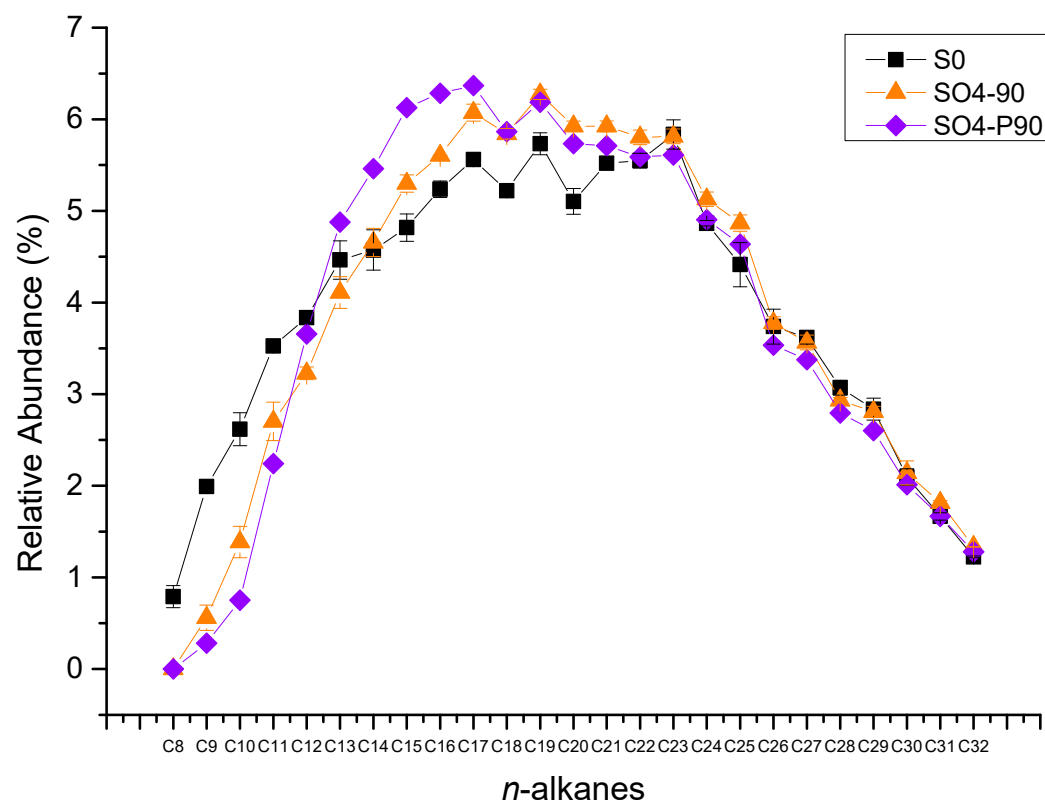


Figure S3

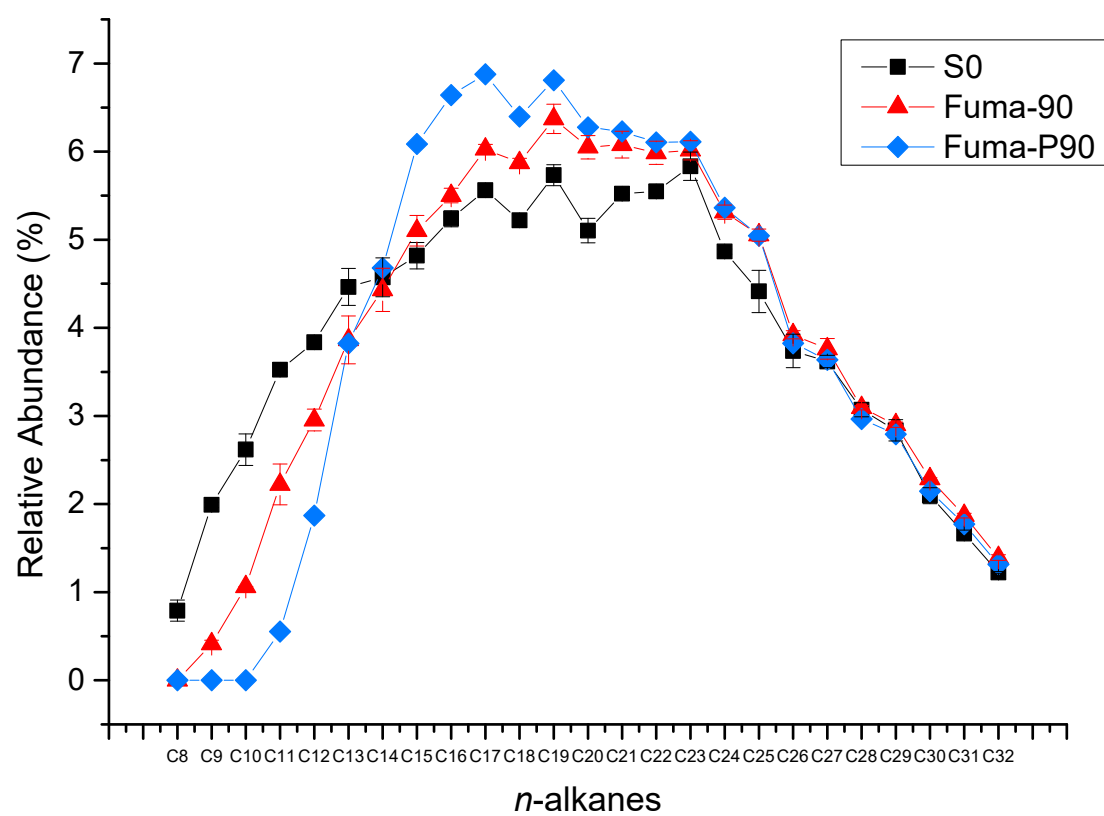


Figure S4

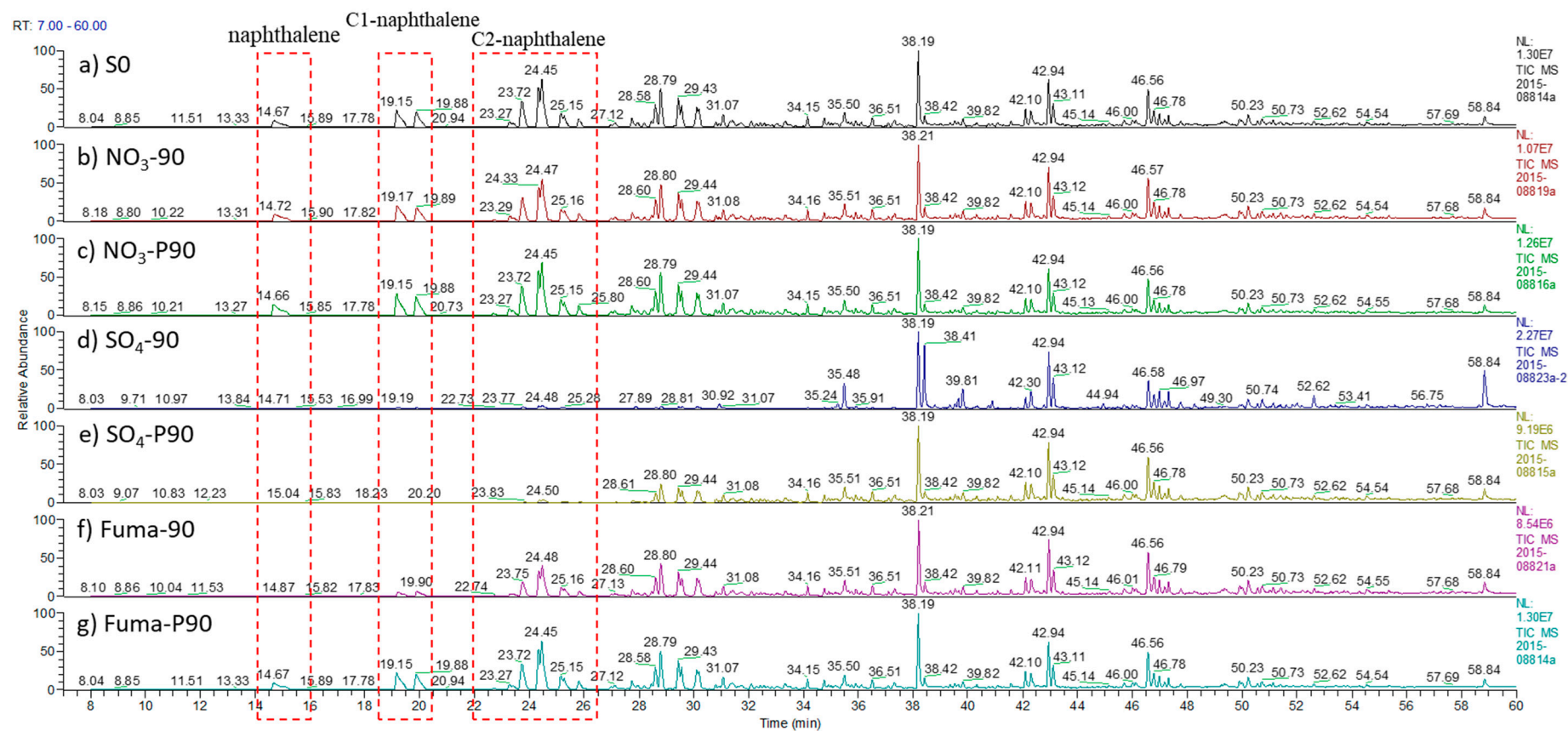


Figure S5