

# EFFECTS OF DIFFERENT BACTERIAL SPECIES ON CRUDE OIL BIODEGRADATION BY TWO AEROBIC BACTERIA

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## Introduction

Biodegradation of crude oil are of concern in petroleum production and oil refining, organic geochemistry and geomicrobiology. Sequential and systematic variations in the chemical compositions of crude oils, such as the preferential removal of hydrocarbons and the relative preservation of nonhydrocarbons, are commonly observed in in-reservoir biodegradations and in laboratory simulations (Liao et al., 2012; Pan et al., 2017). It has been proposed that the general order of bioresistance of various biomarker compound classes mostly follows the sequence: n-alkanes (least resistant) < acyclic isoprenoids < steranes < hopanes < diasteranes < aromatic steroids (most resistant) (Volkman et al., 1984; Peters et al., 1993). Except for the bioresistance of compounds, another factor that affects the biodegradation of crude oil is essentially determined by microorganisms: metabolic pathways (aerobic or anaerobic), abundance (temperature, salinity, pH, and andelectron donors and acceptors) (Larter et al., 2003, 2006) and species. However, in previous studies, the effect of bacterial species on crude oil biodegradation has not been confirmed.

In this work, we compare the variations of saturated hydrocarbons and aromatic hydrocarbons during biodegradation simulation of two aerobic bacteria, by employing GC-MS analyses.

## Results

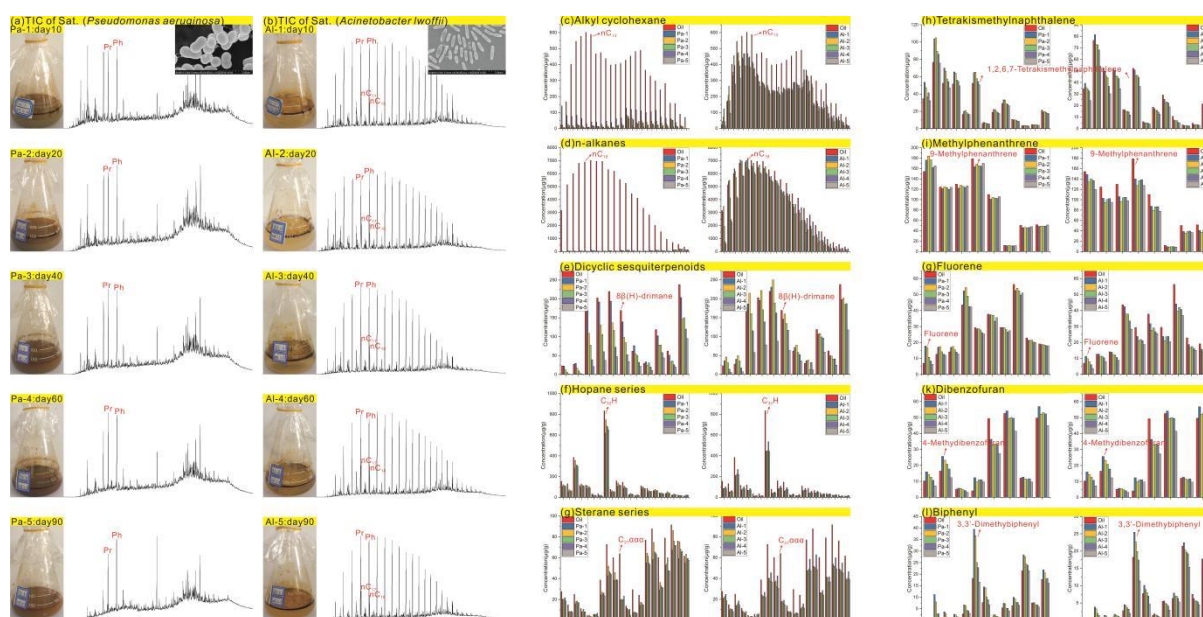
As seen from the TIC of saturated hydrocarbon, *Pa* (*Pseudomonas aeruginosa*) had biodegraded many compounds by the tenth day and the baseline uplift, indicating that the crude oils were biodegraded seriously (Fig. 1a). However, *Al* (*Acinetobacter lwoffii*) had not biodegraded much compounds even by the ninetieth day (Fig. 1b).

For *Pa*, the general order of bioresistance of various biomarker compound classes mostly follows the sequence (Figs. 1c,d,e,f,g): n-alkanes (least resistant) < alkyl cyclohexane < dicyclic sesquiterpenoids < sterane series < hopane series (most resistant). However, for *Al*, the general order follows the sequence (Figs. 1h,i,g,k,l): dicyclic sesquiterpenoids (least resistant) < sterane series < hopane series < alkyl cyclohexane < n-alkanes (most resistant).

For alkyl cyclohexane (Fig. 1c), n-alkanes (Fig. 1d) and dicyclic sesquiterpenoids (Fig. 1e), the biodegradability of *Pa* is higher than that of *Al*. However, for hopane series (Fig. 1f), sterane series (Fig. 1g), methylphenanthrene (Fig. 1i) and fluorene (Fig. 1g), the biodegradability of *Al* is higher than that of *Pa*. For tetrakismethylnaphthalene (Fig. 1h), dibenzofuran (Fig. 1k) and biphenyl (Fig. 1l), *Pa* and *Al* have the similar biodegradability.

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**Figure 1** TIC of saturated hydrocarbon of biodegradable oils from aerobic laboratory simulation of *Pseudomonas aeruginosa* (a) and *Acinetobacter lwoffii* (b); During the biodegradation process, the variations of concentration (  $\mu\text{g/g oil}$  ) of : (c)Alkyl cyclohexane, (d)n-alkanes, (e)Dicyclic sesquiterpenoids, (f)Hopane series, (g)Sterane series, (h)Tetrakisethylnaphthalene, (i)Methylphenanthrene, (j)Fluorene, (k)Dibenzofuran and (l)Biphenyl

## Conclusions

These two bacteria selectively biodegraded in different orders, and for the same biomarker compound classes, two bacteria have different biodegradability, which is the first time to prove that bacterial species have direct impact on the biodegradation results.

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