

UNRAVELLING INITIAL BIODEGRADATION OF CRUDE OIL USING PRINCIPAL COMPONENT ANALYSIS

Bent Barman SKAARE, Egil NODLAND, Hege OMMEDAL and Tanja Barth

1. *Department of chemistry, University of Bergen, Allégt 41, 5007 Bergen, Norway*
2. *UNIFOB, Center for Integrated Petroleum Research, Allégt 41, 5007 Bergen, Norway*

Biodegradation of crude oil is a complex process with molecular effects being highly dependent on the local microbial community. This is evident as the microorganisms capable of anaerobic degradation of hydrocarbons isolated up to date are highly specific with regard to the substrate they are able to utilize (Widdel *et al.*, 2006). Hence, the differences in the effects on crude oil on the molecular level seen in various field studies are not surprising.

In this study we have used Principal Component Analysis (PCA) to model the biodegradation in four datasets. One of the sets is from model reservoirs which have been actively biodegrading under anaerobic conditions for ten years. Two datasets are from incubation experiments in which crude oil have been biodegraded by sulphate-reducing bacteria for up to two years and the last dataset is based on seven oils from the reservoir surrounding Troll C in the Norwegian North Sea. The datasets are individually modelled in order to get information on specific local effects. A grand model featuring all data has also been analysed indicating overall processes to be dependent on the individual degradation rates of each compound in each dataset. The results indicate the current biodegradation model used to assess initial biodegradation of crude oil (Wenger *et al.*, 2001), to be too simplified.

The study also shows the power of using multivariate techniques for assessment of initial biodegradation as the molecular effects may vary to a large extent. The results from multivariate analysis of dataset based on the peak area data are compared to datasets based on ratios affected by biodegradation, indicating that the use of univariate ratios are dependent on a universal biodegradation process in order to function properly.

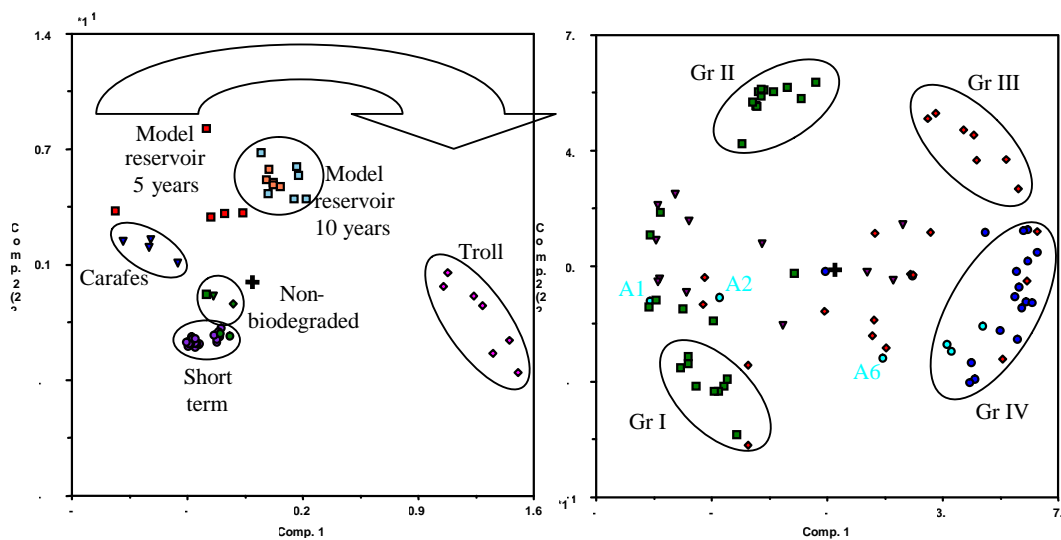


Figure 1. The PCA model based on all data available during this study. The different groups of oils are separated and explained in loadings plot on the right. Four groups of oil constituents explain most of the variance in the sample set.

REFERENCES

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