ROLE OF ASPHALTENES IN THE CRUDE OIL EMULSION STABILITY

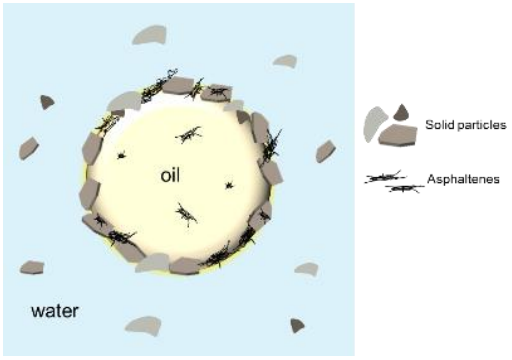
Tibor István Ördög [1], Lilla Balassa [2], Sándor Puskás [1], Imre Dékány [2]

[1]*Group Oilfield Development and Solutions MOL PLC. H-1117 Budapest, Dombóvári str. 28.*
[2] *Physical Chemistry and Material Science Department, University of Szeged, H-6720 Szeged, Rerrich Béla sqr.1.*
email:tordog5@gmail.com

Abstract
In the terciery crude production technologies the applied surfactant adsorption processes has to be clearly idetified. In this complex environment the asphaltenes has special role in the emulsion stabilisation. Asphaltenes covered solid mineral particles could stabilize the o/w emulsion in the crude oil/ brine environment.

Introduction
In naturally occurring crude oil, there are high molecular weight organic compounds in the crude oil phase, while the other phase of crude oil is an aqueous medium in which electrolytes (calcium, magnesium salts, water-soluble organic substances) are found. Depending on the oil-water ratio, there are o/w (oil in water) and w/o (water in oil) dispersions. In this work, we report on the role of asphaltenes occurring in o/w type emulsions and dissolved in the oil phase, with the aim of obtaining information on the stabilizing effect of asphaltene dissolved in the organic phase. It should be noted that, in addition to electrolytes, the brine phase used as a dispersion medium also contains sand and clay particles from the reservoir rock - washed out by brine migration flows - which also affect the stability of the crude emulsion.

Experimental
The stability test is important because the crude oil emulsion that has come to the surface must be separated into an oil and water phase before being sent to the oil refinery. In this separation technology, the stabilizing layer created at the o/w interface, which consists of asphaltene, mineral particles modified by asphaltene, plays an important role [1]. The schematic diagram 1 presented below shows the assumed so-called the structure of the interfacial layer of a Pickering-type emulsion droplet.



Schematic Diagram 1.

Results and discussion
In this work, we want to provide information on the extent to which the amount of asphaltene adsorbed on the mineral components affects the stability of the emulsion, or concentration of surfactants - which are essential in petroleum production technologies - how does it affect the

mineral or the adsorption of surfactants on asphaltene-modified minerals. It is important to know this because in the case of crude oil displacement technologies with surfactants, it is necessary to know the adsorption processes from injected surfactant solutions in the rock pores of the reservoir layer. This means that we are studying surfactant adsorption processes occurring at the solid-liquid interface, and in order to study it quantitatively, surfactant adsorption isotherms were determined using sodium dodecylbenzene sulfonate (NaDBS) anionic surfactant. Figure 1. represents an example of Langmuir adsorption isotherm of untreated and partially treated reservoir layer rock sample. Figure 2. shows the adsorption isotherm and ce/ns representation of the 1.rock sample.

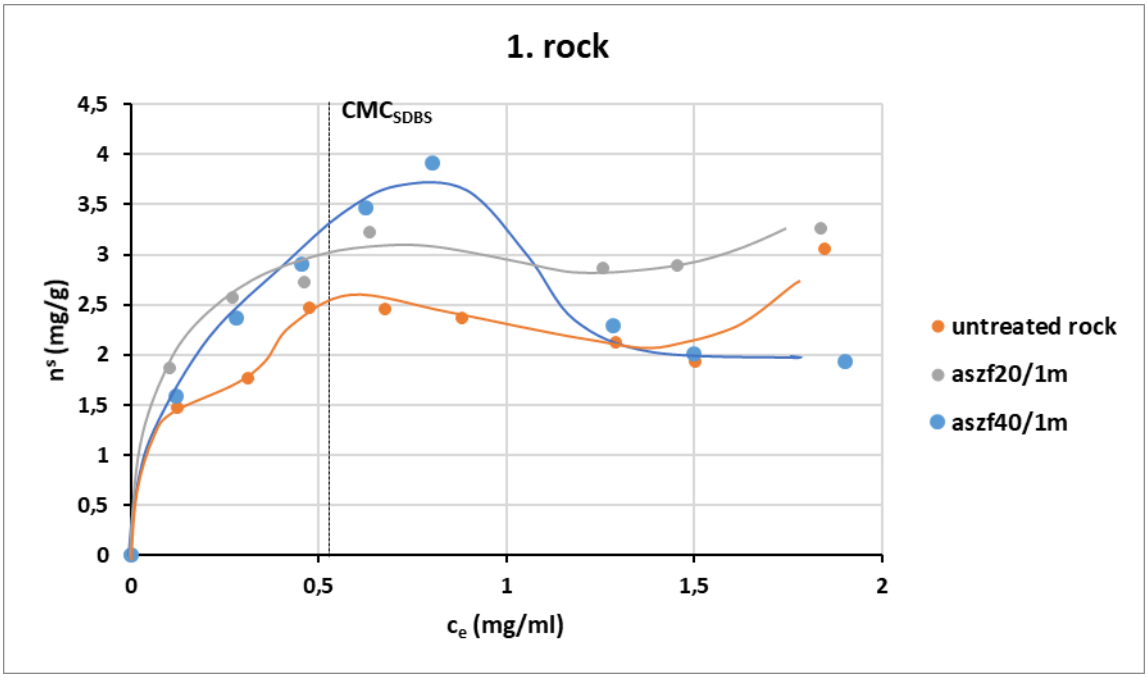


Figure 1. Adsorption isotherm of 1.rock sample

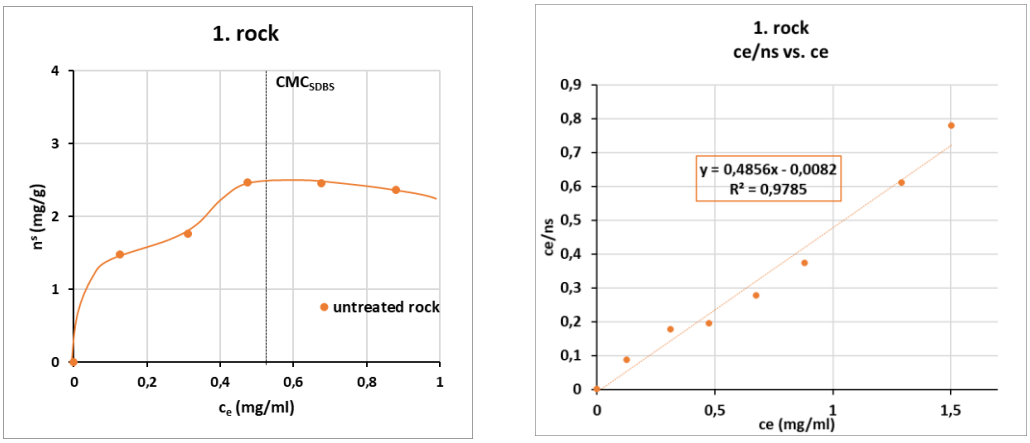


Figure 2. Adsorption isotherm and ce/ns representation of 1.rock sample

We will provide quantitative information about the adsorption capacity and the adsorption mechanism of the reservoir rock or from the surface of the emulsion stabilizing particles. Figure 3. represents the maximum adsorption capacity of NaDBS on the 1.rock sample.

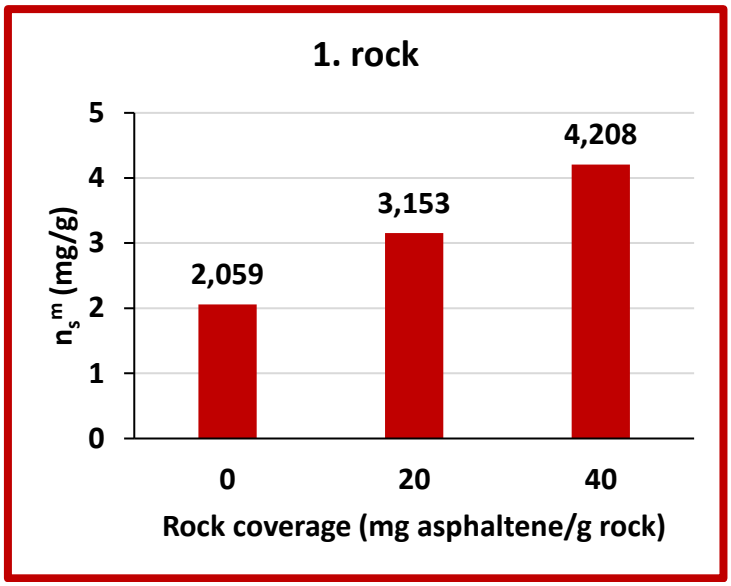


Figure 3. Maximum adsorption capacity of NaDBS on the 1.rock sample

Conclusion

We found that asphaltene adsorbed on the surface of the mineral particles in advance and in increasing amounts increases the amount of surfactant needed to displace crude oil. Knowledge of surfactant adsorption during practical application is important because it affects the costs of crude oil production.

Acknowledgements

Authors thank for the management of the Department of Physical Chemistry and Material Science of Szeged University for the resources applied in this project work and for MOL Group Oilfield Development and Solutions management for the support of this paper preparation.

References

[1] Á. Patzkó, I. Dékány: Colloids and Surfaces, 1993 (71), 299-307