The DEMCON method, a new way forward for evaluating Demulsifier performance

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Principle of the method

- The method is based on the idea that the conductivity, as such of the emulsified water, is a constant and the same for the first, as well as for the last separated drop of water

- Measuring the resulting conductivity continuously as function of time and by using data logging, a suitable program and a personal computer or laptop, it is possible to register automatically the demulsification process

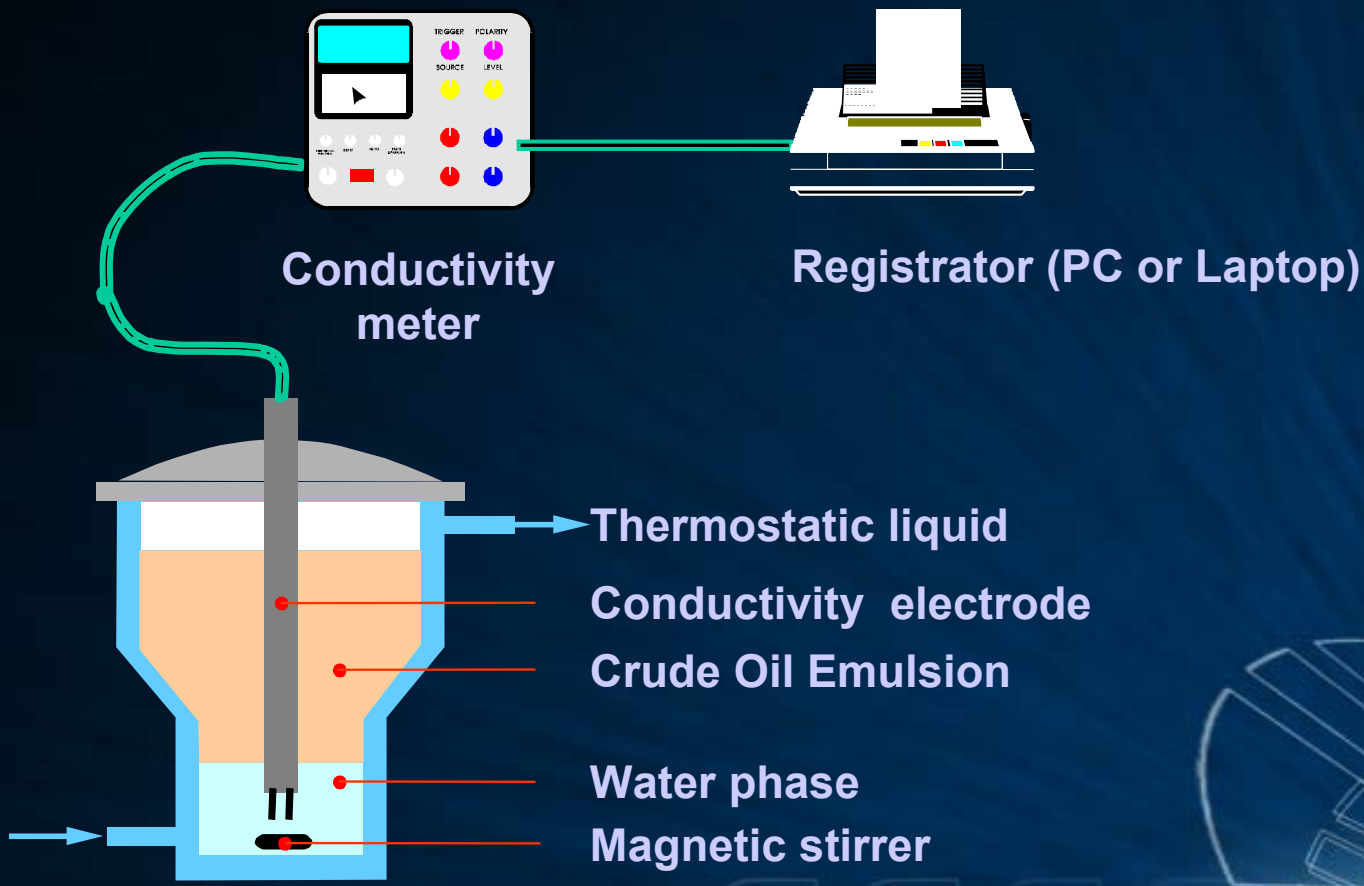
“**DEMCON** method”

DEMCON is an acronym of

“**DE**mulsification **M**onitoring by **CON**ductivity Measurement”

DEMCON - Method

DEmulsification Monitoring by CONductivity



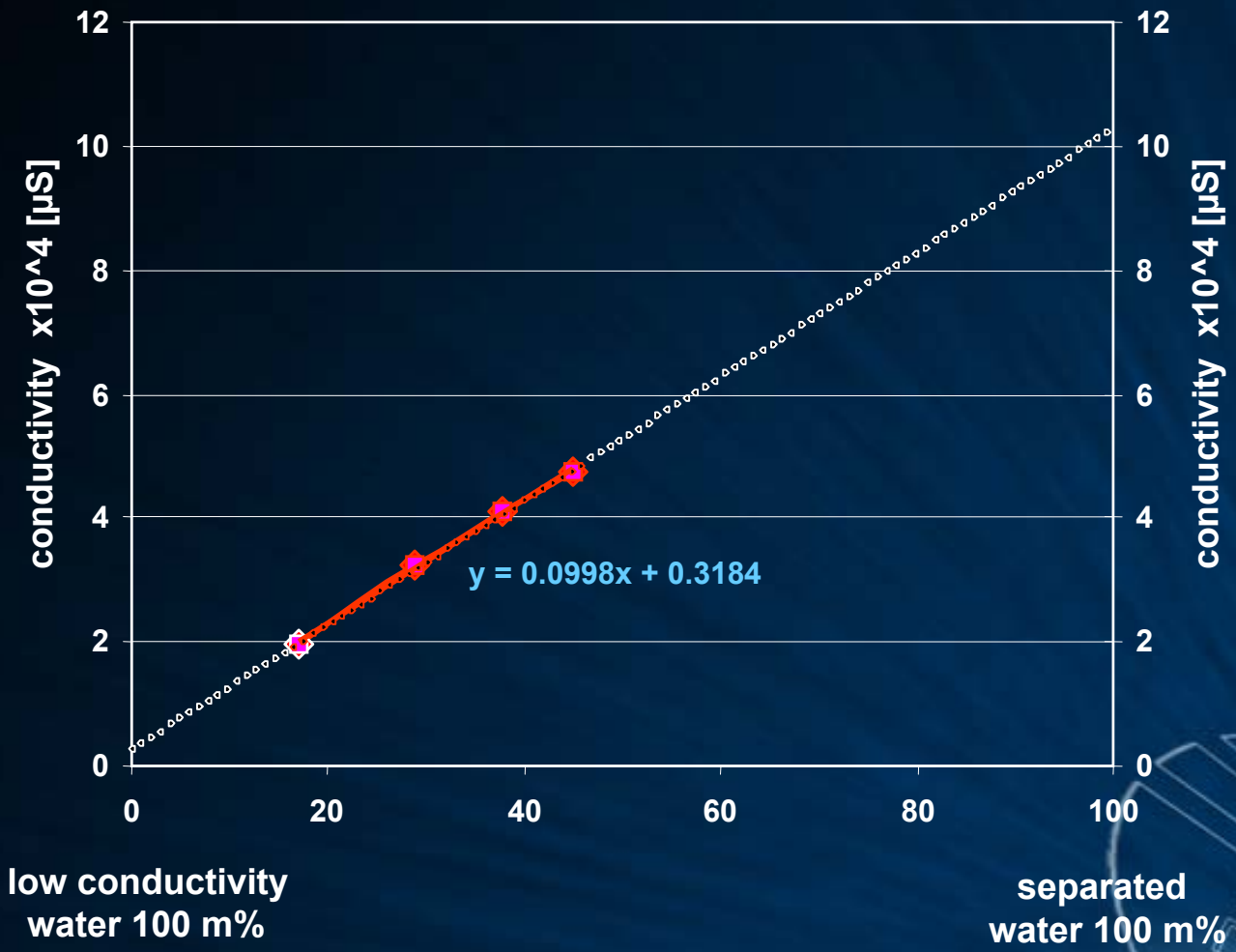
Test procedure (1):

- The conductivity of the water used for mixing also needs to be known
- A calibration curve for the conductivity as function of the ratios of both water qualities has to be made
- A crude sample is heated to the test temperature
- The demulsifier is dosed and mixed thoroughly
- The test cell is filled with a measured quantity of water for mixing and thermostated to the test temperature

Test procedure (2):

- The conductivity measuring electrode as well as a magnetic stirrer is placed in the water phase
- A measured quantity of the prepared crude emulsion sample is poured carefully on top of the water phase
- Start stirring moderately to obtain a fast and reliable signal response
- The measuring starts from time zero and will continue as long as the monitored and logged signal indicates that the separation is still in progress

Conductivity Calibration Curve for mixtures of separated water and low conductivity water



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Calculation of the amount of separated water based on conductivity measuring results

$$Y = \alpha * X + C \qquad Z = X * 100 / M \qquad X = (Y - C) / \alpha$$

Y = The measured conductivity of the actual mixture of both waters [$*10^4 \mu S$]

α = 0.106, the slope of the trend line of the calibration curve [$*10^4 \mu S$ / m%]

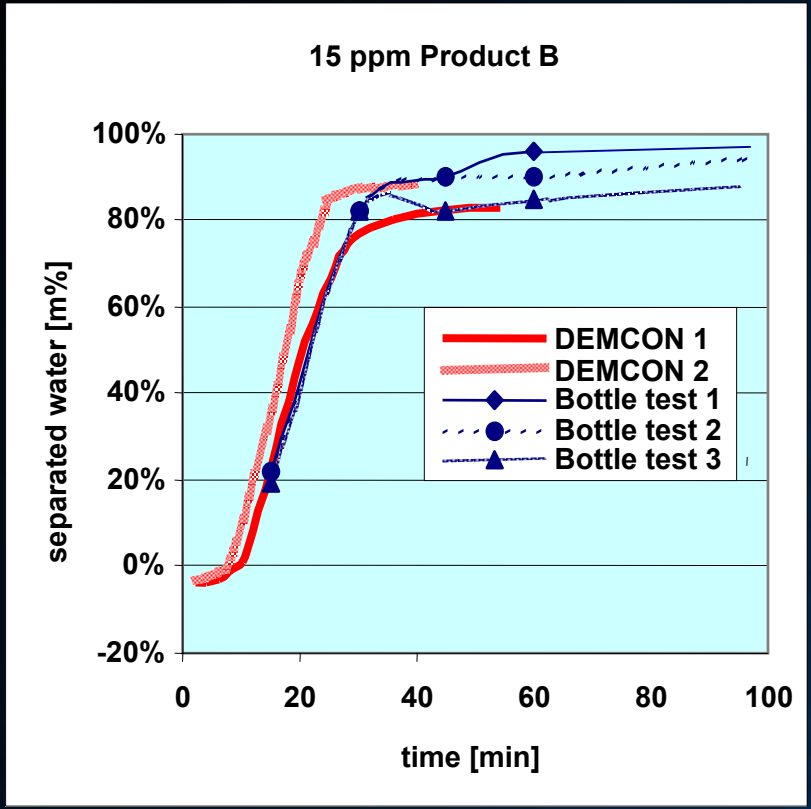
X = The fraction of the separated water in the water mixture [m%]

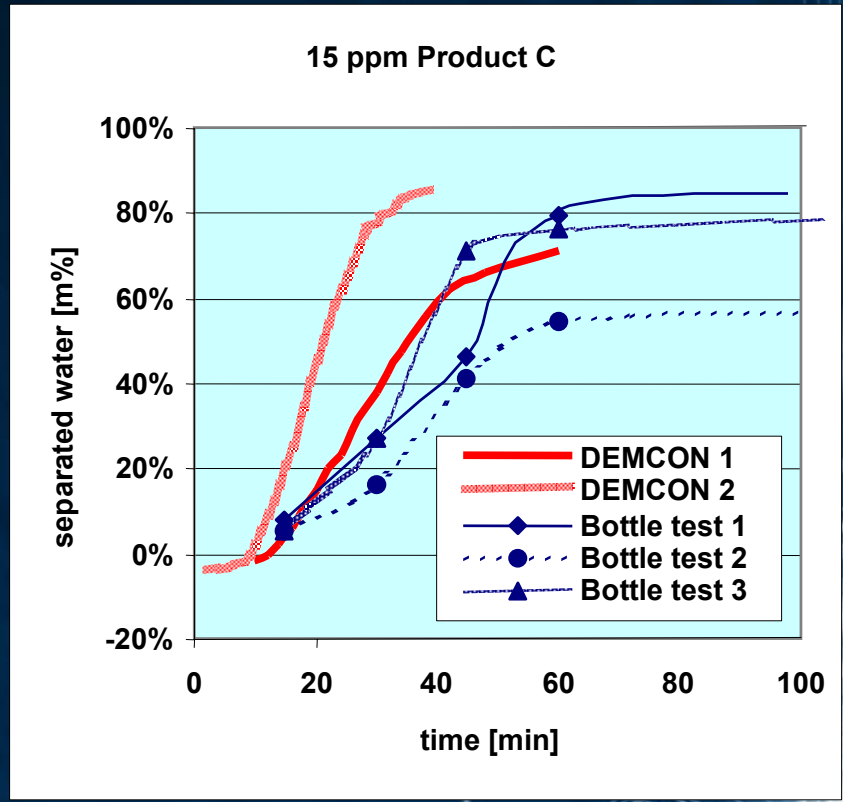
C = 0.232, is the intercept of the trend line at 0 m% of separated water [$*10^4 \mu S$]

M = Emulsified water weight fraction in the crude oil emulsion [m%]

Z = Fraction separated water of the total amount of emulsified water [m%]

Comparison results of the bottle test and the DEMCON method 15ppm Product B and C





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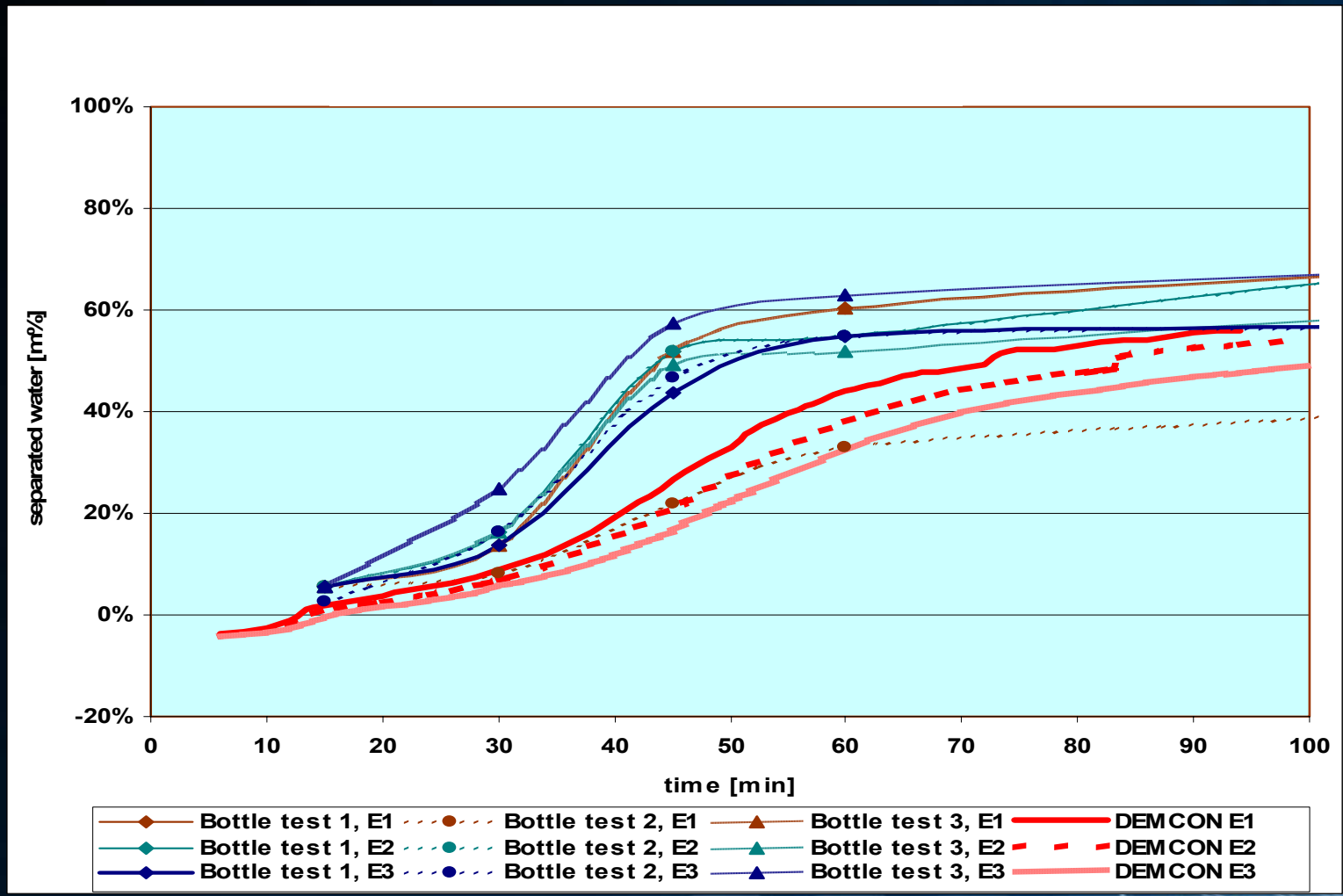
Comparison results of the Bottletest and the DEMCOM method 30ppm products E1, E2 and E3



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Comparison of “Bottle test” and DEMCON

Classic “Bottle test”

- Very traditional
- Well excepted by industry
- Relative simple to perform
- Great number of tests are possible
- Registering results is labour intensive

DEMCON method

- No human interferences in reading results
- Registering results is automatized
- Measuring conductivity has a high accuracy
- More details about the demulsification process
- Demulsifier characteristics fed into data files
- Comparing results easier from data files

Conclusions and Recommendations

- The calibration curves are easy to run and good reproducible
- For further experiments it is advised to add just a slight amount of salt to it in order to get a stable conductivity, which is easier to reproduce and should improve the accuracy of the constant “C”
- The DEMCON method is based on measuring conductivity, which is an easy and accurate to measure signal
- Results generated in the “DEMCON” method are comparable with the “Bottle Test” results
- The shape of the lines is representative of the demulsifying characteristic; this is the same in both tests
- The DEMCON method has only practical value if more cells are available

Acknowledgement

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Literature

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Thank you for you attention


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Determination of average conductivity per % separated water

product	formula for trend line	α [x10^4µS/m%]	C [m%]	x10^4µS at x=0% 0	x10^4µS at x=100% 100
	y = αx + C				
experiment 2	y = 0.0998x + 0.3184	0.0998	0.3184	0.318	10.298
experiment 3	y = 0.1021x + 0.2961	0.1021	0.2961	0.296	10.506
experiment 4	y = 0.1088x + 0.1667	0.1088	0.1667	0.167	11.047
experiment 5	y = 0.1077x + 0.1704	0.1077	0.1704	0.170	10.940
experiment 6	y = 0.1089x + 0.1832	0.1089	0.1832	0.183	11.073
experiment 7	y = 0.105x + 0.2265	0.1050	0.2265	0.227	10.727
experiment 8	y = 0.106x + 0.2458	0.1060	0.2458	0.246	10.846
experiment 9	y = 0.1077x + 0.2489	0.1077	0.2489	0.249	11.019
	average	**0.106**	**0.232**	**0.232**	**10.807**
	st.dev.	0.003	0.057	0.057	0.280