

Experimental Study on Emulsion Breaking of Water in Oil Emulsion and its Application to Viscous Oil Offloading

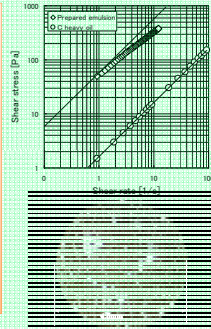


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I. Background & Research scopes

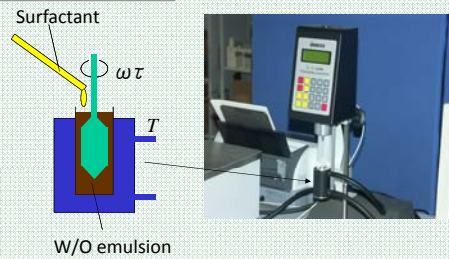
W/O emulsification causes :

- Viscosity increase, sometime up to 1,000,000mPa.s.
 - Volume inflation, 2 or 3 times compared to oil itself.
- Both poses much difficulties in oil spill response missions.



II. Chemical lab. Test to know governing parameters for emulsion breaking.

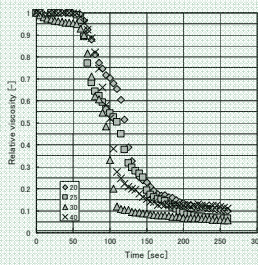
Experimental setup



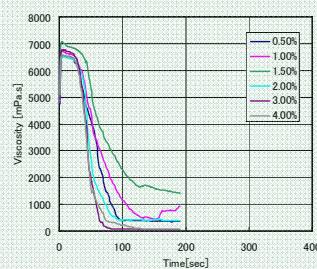
What physical property or condition is the most important for the emulsion breaking?

- Type of chemical agent
- Concentration
- Temperature
- Shear strain/rate

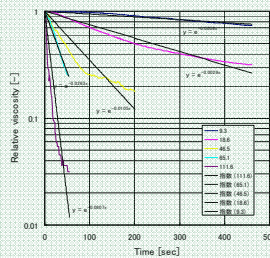
Temperature dependency



Concentration dependency

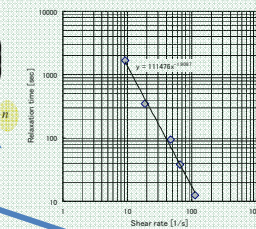


Shear rate dependency



$$\mu = \mu_0 \exp\left(-\frac{t}{t_0}\right)$$

$$t_0 = t_0(\dot{\epsilon}) = c \dot{\epsilon}^{-n}$$

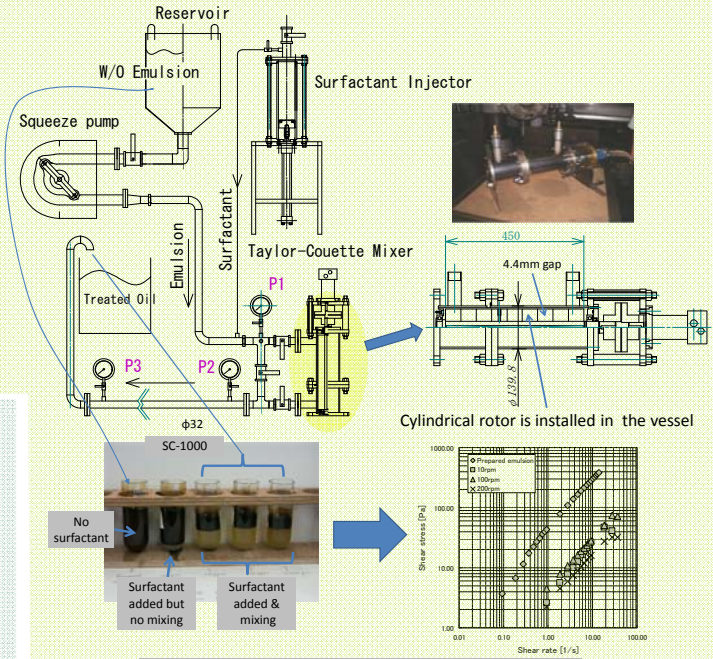


In the Couette flow, dissipation energy is

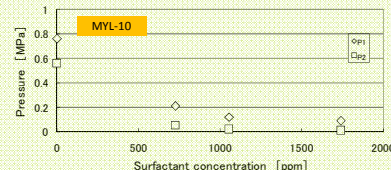
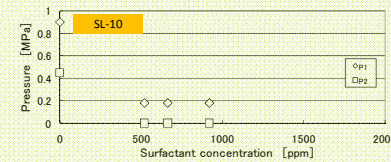
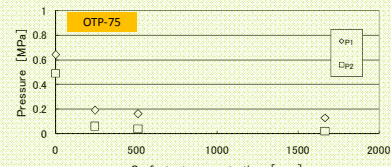
$$E = \tau \cdot V = \mu \frac{V^2}{d} = \mu d \dot{\epsilon}^2$$

- Shear rate is the most important factor for promoting emulsion breaking !!!
- The breaking speed is nearly proportional to the shear rate squared!!!

III. Inline emulsion breaking test with a Taylor-Couette reactor



Pressure loss reduction by a Taylor-Couette mixer

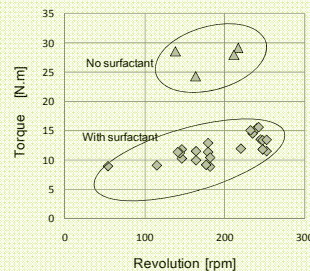


-Quick emulsion breaking is possible by combination of surfactant and strong mixing power.

-Pressure loss reduction in the pipe line flow of W/O emulsion was observed .

-It may be another option for water injecting lubrication.

Required torque for driving the mixer



IV. Conclusions

In this study, emulsion breaking of W/O heavy oil emulsion was experimentally studied.

Injection of small amount of surfactant and strong mixing power promote very quick emulsion breaking, which is applicable to pressure loss reduction technique for high viscosity heavy oil offloading.

#	Agents	Index n
1	MYL-10	2.004
3	OTP-75	2.039
4	DRIMAX 1235	2.183
6	SC-1000	1.908