DATE 30/01/25 | Exp: 6 Speed Viscometer (FANN-35S) | SHEET NO. 15

Aim: To determine the viscosity of a given fluid sample using 6 speed viscometer.

~~Procedure~~

~~1) Ensure that the bob~~

Theory: FANN-35S 6-Speed viscometer is used to determine the viscosity of a given fluid sample by measuring resistance to rotational motion at different speeds (RPM). Viscosity is a key property in fluid mechanics, Particularly in drilling fluid analysis, where it impacts flow behaviour and performance.

Working Principle

The roter rotates inside the fluid sample, and the torque on the ~~bobb~~ bob (attached to the bob shaft) is measured.

The dial readings at different speeds (600 RPM, 300 RPM, etc.) help determine viscosity characteristics using standard eqn^{s}.

→ Apparent viscosity (AV): 600 RPM Reading / 2

→ Plastic viscosity (PV): (600 RPM Reading) − (300 RPM Reading)

→ Yield Point (YP) = (300 RPM Reading) − (PV)

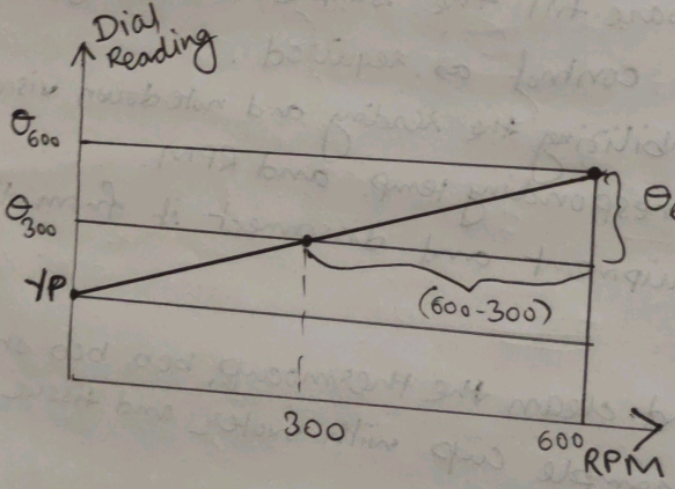
Procedure

1) Ensure the bob and sleeve is attached with the bob shaft and rotor.
2) Connect the instrument to a power source and turn it on.
3) Plug the FANN 35 motor to 110 volt voltage transformer
4) Fill the sample cup to 75% capacity (170ml)
5) If temp. control is required, used a thermocup and thermo-meter.
6) Put the sample cup in the base of the instrument and raise the base till the sample touch the given marker
7) Adjust RPM control as required.
8) Wait for stabilizing the reading and note down viscosity in Cp with corresponding temp. and RPM.
9) Turn off equipment and disconnect it from the power source.
10) Remove and clean the thermocup, bob, bob shaft, sleeve and sample cup with water and tissue paper.

Observation

@T = 26°C

$\dot{\gamma}$ (s^{-1})	RPM	Dial Reading	τ (Pa)	μ (Pa.s)
1021.8	600	98	50.078	0.05
510.9	300	71	36.281	0.07
340.6	200	60	30.66	0.09
170.3	100	45	22.995	0.135
10.218	6	19	9.709	0.95
5.109	3	17	8.687	1.7



Calculation and lab Exercise

→ Derive formular for Yield Point:

$YP\,(lb/100\,ft^2) = (300\text{-}RPM)_{DR} - \text{Plastic Viscosity}$

→ From the plot,

slope of the line $= m = \dfrac{\theta_{600} - \theta_{300}}{300} = PV\,(\text{in cP})$

eq^n of line: $\dfrac{y - \theta_{300}}{\theta_{600} - \theta_{300}} = \dfrac{x - 300}{600 - 300}$

$\therefore y - \theta_{300} = \dfrac{PV\,(x - 300)}{300}$

$\therefore YP = \theta_{300} = \dfrac{PV\,(0 - 300)}{300} = -PV$

$\therefore \boxed{YP = \theta_{300} - PV}$ (Proved)

→ $\tau\,(Pa) = D.R \times 0.511$ (↳ spring constant)

$\dot{\gamma}\,(sec^{-1}) = RPM \times 1.703$

$\mu\,(Pa.s) = \dfrac{\tau}{\dot{\gamma}}$

Sample Calculation for obs 1: RPM = 600, DR = 98

$\therefore \boxed{\tau = 50.078\ Pa}$

$\dot{\gamma} = 600 \times 1.703 = \boxed{1021.8\ sec^{-1}}$ $\mu = \dfrac{50.078}{1021.8} = \boxed{0.05\ Pa.s}$

$\boxed{AV = \frac{98}{2} = 49\ cP}$ $\boxed{PV = 98 - 71 = 27\ cP}$ $\boxed{YP = 44\ lb/100\,ft^2}$

Results

Apparent viscosity = 49 cP Yield Point = 44 lb/100 ft^2

Plastic viscosity = 27 cP

Precautions

1) Always ensure that the fluid temp. doesn't go beyond 180°F
2) Don't move "Gear Shift knob" if "viscometer Switch" is off.
3) Don't try to rotate the Thermo-cup knob beyond marked position.
4) The rotor, bob and splash guard should be cleansed and dried after each operation.

Conclusion

i) The Fann-35S viscometer accurately determines fluid viscosity at varying rates.

ii) Plastic viscosity indicates particle interaction and friction, while Yield Point reflects the fluid's ability to suspend solids

iii) This experiment highlights the importance of proper temp control, equipment calibration, and fluid sample Preparation to ensure accurate viscosity readings.

iv) Future improvements could include automated data logging for efficiency and minimizing manual reading error.

Assignment

1) Temp. 2) To Protect bob shaft 3) Rotor

4) $P.V. = (DR)_{600} - (DR)_{300} = 36 - 12 = 24\ Pa$

$YP = (DR)_{300} - PV = 12 - 24 = -12\ lb/100\ ft^2$