ASTM D5225 and ISO 1628: a *conceptual* comparison

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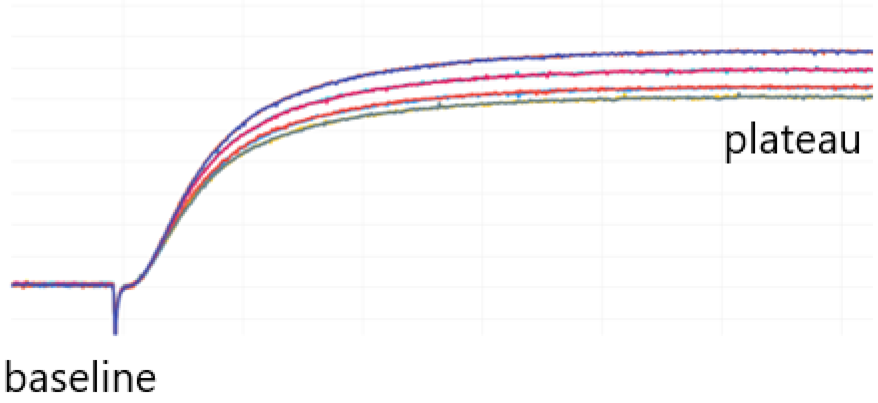
ASTM D5225: Differential Pressure

<u>Constants: Flow & Temperature</u>

Plateau / baseline ⇨ relative viscosity (RV)

Relative viscosity & concentration ⇨ **IV**

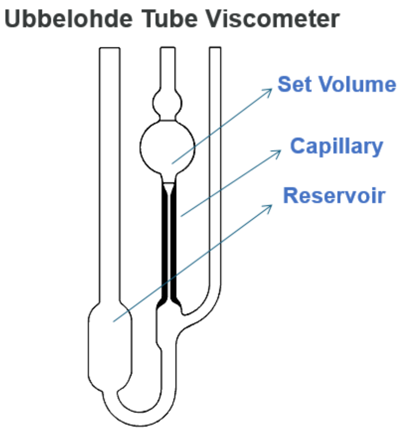


ISO 1628-1: Differential Time

<u>Constants: Temperature and Gravity</u>

t_s / t_0 ⇨ relative viscosity (RV)

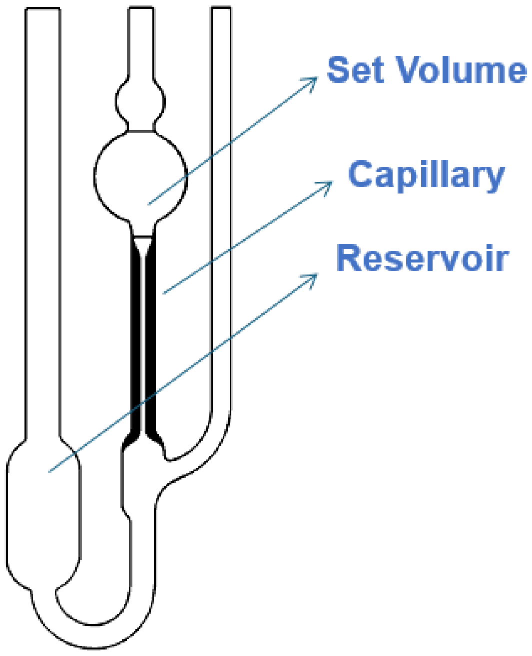
Relative viscosity & concentration ⇨ **IV**



Historical Measurements:
ISO 1628-1

“Viscosity of Polymers in dilute solution using capillary viscometers”

Ubbelohde Tube Viscometer



Measure the time for a set volume of liquid to traverse a capillary.

Divide the sample “drop time” by the solvent “drop time”.

Sample viscosity > solvent viscosity, leading to an RV > 1.

$$\eta_{rel} = \frac{\eta}{\eta_0} = \frac{t}{t_0}$$

t → Sample Drop Time

t_0 → Solvent Drop Time

Modern Measurements: ASTM D5225:22

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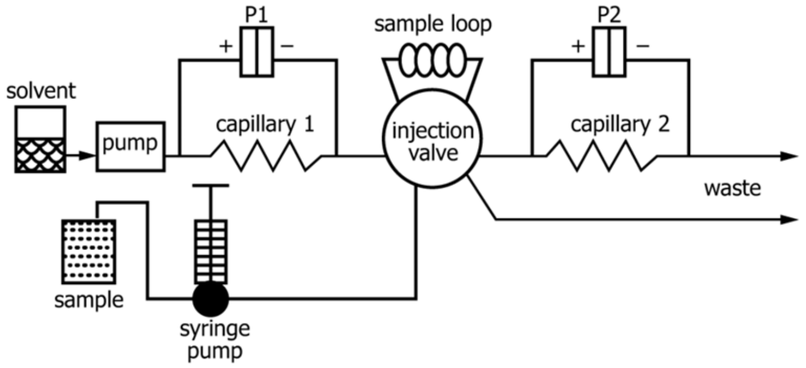
"Solution Viscosity of Polymers with a Differential Viscometer"



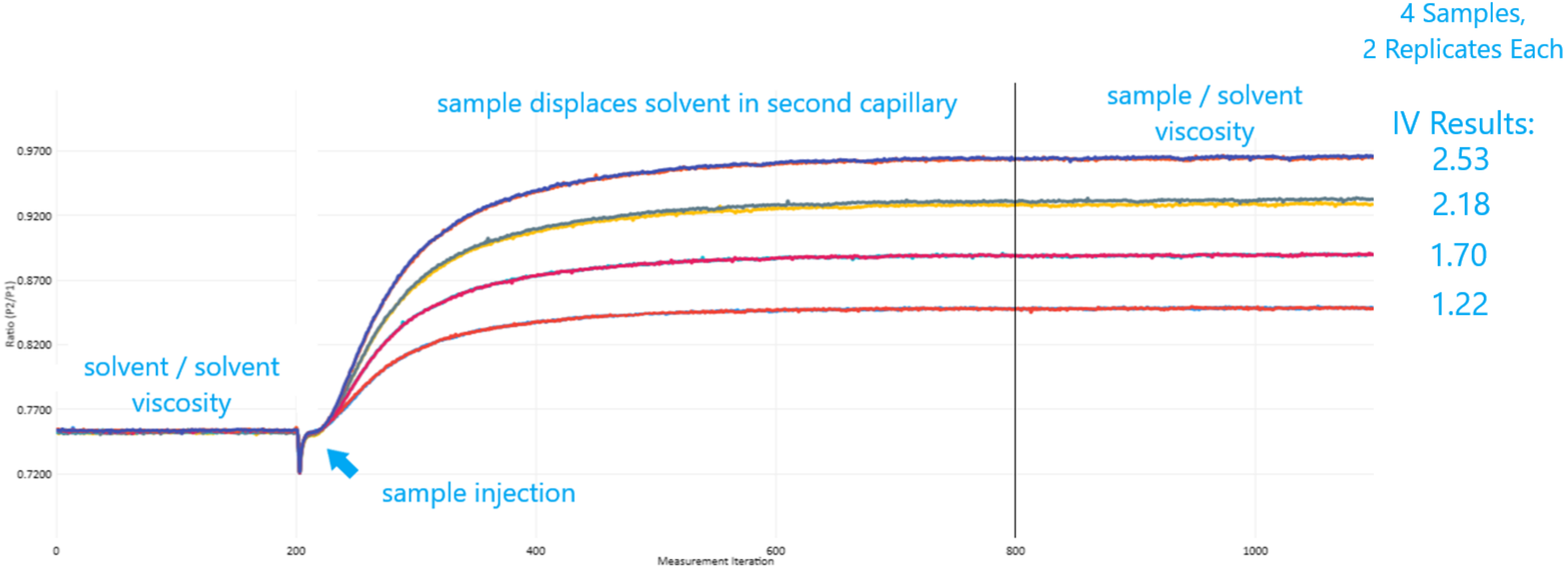
Measure the pressure ratio across a set of capillaries under constant flow:

First at "baseline" with solvent flowing through P1 and P2

Then at "plateau" with solvent flowing through P1, sample flowing through P2

Divide the plateau ratio by the baseline ratio, giving an RV > 1.

Dissecting ASTM D5225 Data:
interpreting the viscogram



ASTM D5225 vs. ISO 1628:
by the numbers

Parameter	ASTM D5225 Haiku Instruments Model 575	ISO 1628-1 Brands C, L or S Best-in-Class Offering
Total Solvent used per Sample	25 ml	50-75 mL
Analysis Time (1 sample, all replicates)	5 minutes	15 minutes
Replicates measured per sample	2	1
Operator Time per Sample	60 seconds	300 seconds
Precision (% RSD, including sample prep)	Better than 0.5%	N/A – single sample

1/3 the analysis time. 1/3 the solvent used. 1/5 the operator time required.

ASTM D5225 vs. ISO 1628:

beyond the numbers

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Parameter	ASTM D5225 Haiku Instruments Model 575	ISO 1628-1 Brands C, L or S Best-in-Class Offering
Solution Stability Confirmation?	Yes	N/A – single sample
Data Validation?	Yes	No
Inline Filtration?	Yes	No
User Interaction with Solvent?	No	Yes
LIMS / ERP integration	Yes	No

Graphical versus numerical data. Replicate results.
Inline Filtration. Operator Safety. Integration.

Haiku Instruments’ Journey

in just 4 years

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Our Launch Model in 2021:

Modular, Rough-cut, Robust

Our Finalized Product in 2024:

Modern, Compact, Serviceable

ISO 1628: Pro and Con

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Con

- Inline filtration of samples is not possible
- Throughput is limited by the method parameters
- Automation of sample loading is complex and costly
- Data quality must be assessed using external standards

Pro

- Low Cost of Entry for basic models
- Low Maintenance Needs for basic models
- Conceptually Simple

ASTM D5225: Pro and Con

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Con

- Higher purchase cost versus basic glass tube models
- Solvent and syringe pumps require annual maintenance

Pro

- Highest throughput IV measurements available
- No interaction with solvents
- Automation is simple by design
- Data is graphical and averaged
- Data quality assurance is self-contained within the measurement data

Haiku Instruments:
built on a legacy of polymer expertise

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- Founded in 2019, Haiku Instruments viscometers were designed leveraging a legacy of experience from giants in polymer analysis:
  - **Viscotek Corporation** Y501 series DSV
    - Our design team had a combined 30+ years with the Y501 systems
    - Application testing, repair service, diagnostics and maintenance
  - **Malvern Instruments** GPC/SEC
    - 3 GPC systems in our applications lab
    - Cross-referencing polymer IV data from multiple methods
    - GPC is found in the same labs as polymer solution viscometers

Polymer applications:

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- PVC Application Note H005
- Polystyrene Application Note H008
- Hyaluronic Acid / Hyaluronan Application Note H003
- Polycarbonate Application Note H007
- PET / rPET Application Note H004
- PBAT PLA PHA PBS PCL Biopolymers App Note H006
- PPO Application Note H009

Not seeing your polymer?

Send samples in for free-of-charge analysis and see what you are missing!