Meet Honeybun: The most rapid viscometer out there

Introduction

Keeping viscosity data flowing is critical for biologics up and down the development pipeline. In the very first steps of antibody and formulation screening, high viscosity raises the alarm that sticky self-interactions are present. At the end of development, high viscosity causes havoc with filtration or fill/finish or can derail everything if it stops a drug from being injected.

For such a useful measurement, getting to the data sucks up so much sample and time that no one is getting as much viscosity data as they need. High-volume, classic techniques require hours of hands-on time in super slow, one-sample-at-a-time instruments. Even modern tech that just needs micro-liters of sample is often paired with an expensive chip that creates a one-by-one bottleneck and needs lots of hands on clogging, cleaning, and calibration.

Honeybun (Figure 1A) is the only rapid microvolume viscometer that combines low sample volume requirements with the ability to run up to 10 samples within six minutes. Samples are run on its Bun consumable (Figure 1B). Simply pipette 35 µL of sample into a Bun, insert it into Honeybun and you are just a few mouse clicks away (Figure 2) from your data. Measurements are free from complicated consumables or the hassle of cleaning expensive chips that are prone to clogging between runs.

Methods

Bovine serum albumin (BSA; Sigma-Aldrich; 05470) and γ-Globulins from bovine blood (IgG; Sigma-Aldrich; G5009) were diluted in 1x phosphate buffered saline (PBS; Life technologies; 10010-015) and centrifuged at 8,500 rcf for 30 min. Supernatants were collected and stock solutions were stored at 4 °C. Working solutions were prepared from stock solutions by diluting in 1x PBS and stored at -20 °C. Concentrations were confirmed by UV/Vis measurement on Stunner using Protein (Turbidity) application. Medical Grade Viscosity Standard (MGVS) of 2 cP (Paragon Scientific; MGVS20-100)

A

B

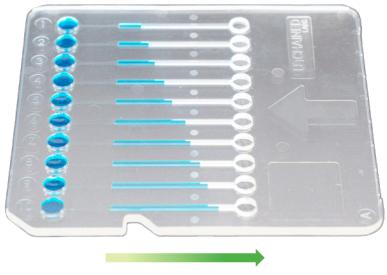

Figure 1: Honeybun (**A**) is the only rapid microvolume viscometer for proteins, vaccines, viral vectors and injectables. Honeybun and its consumable Bun (**B**) read up to ten samples in minutes with just 35 µL of sample.

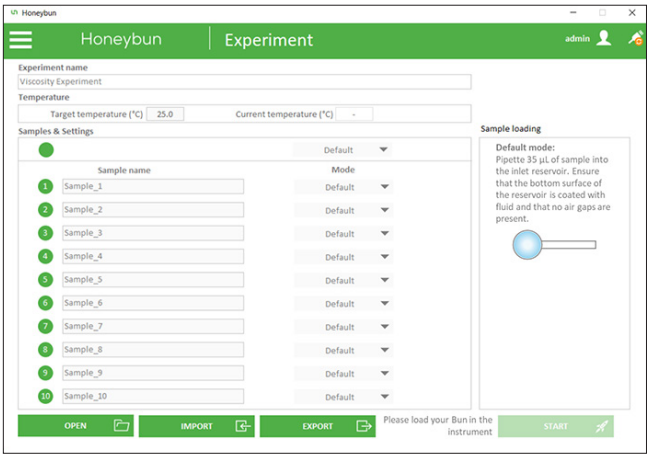

Figure 2: Honeybun software is designed to get you to your sweet viscosity data fast. Fill in all the details about your samples or take the automated fast track – Honeybun's software will auto-fill everything so you can just start your run. Just a few clicks gets you through experimental setup and straight to collecting data.

was stored at 4 °C and used directly. Outliers were identified and removed via interquartile range (1.5 X IQR) method.

Results

Satisfy your craving for data

If you're dealing with a high-concentration biologic – like a monoclonal antibody - that's destined to be injected, you know viscosity will be the key to good syringeability and injectability. Keeping the viscosity of those formulations low means any formulation development will need to measure a ton of viscosity data[1–3].

In (Figure 3), bovine serum albumin (BSA) and bovine gamma globulin (IgG) were used as model proteins and diluted in phosphate buffered saline (PBS) from 300 and 75 mg/mL, respectively. Pure PBS was used as a control. Viscosity was measured with Honeybun at 25 °C.

Honeybun delivers viscosity data across the wide range of concentrations. The viscosities uniformly rise from approximately 1.37 to 17.3 cP for BSA and from 0.91 to 2.0 cP for IgG (Figure 3A and C) in conjunction with the increasing concentrations. Moreover, BSA and IgG were tested at different shear rates from approximately 2,000 to 35,000 1/s and from 2,000 to 37,000 1/s, respectively (Figure 3B and D). The viscosities of analyzed proteins are

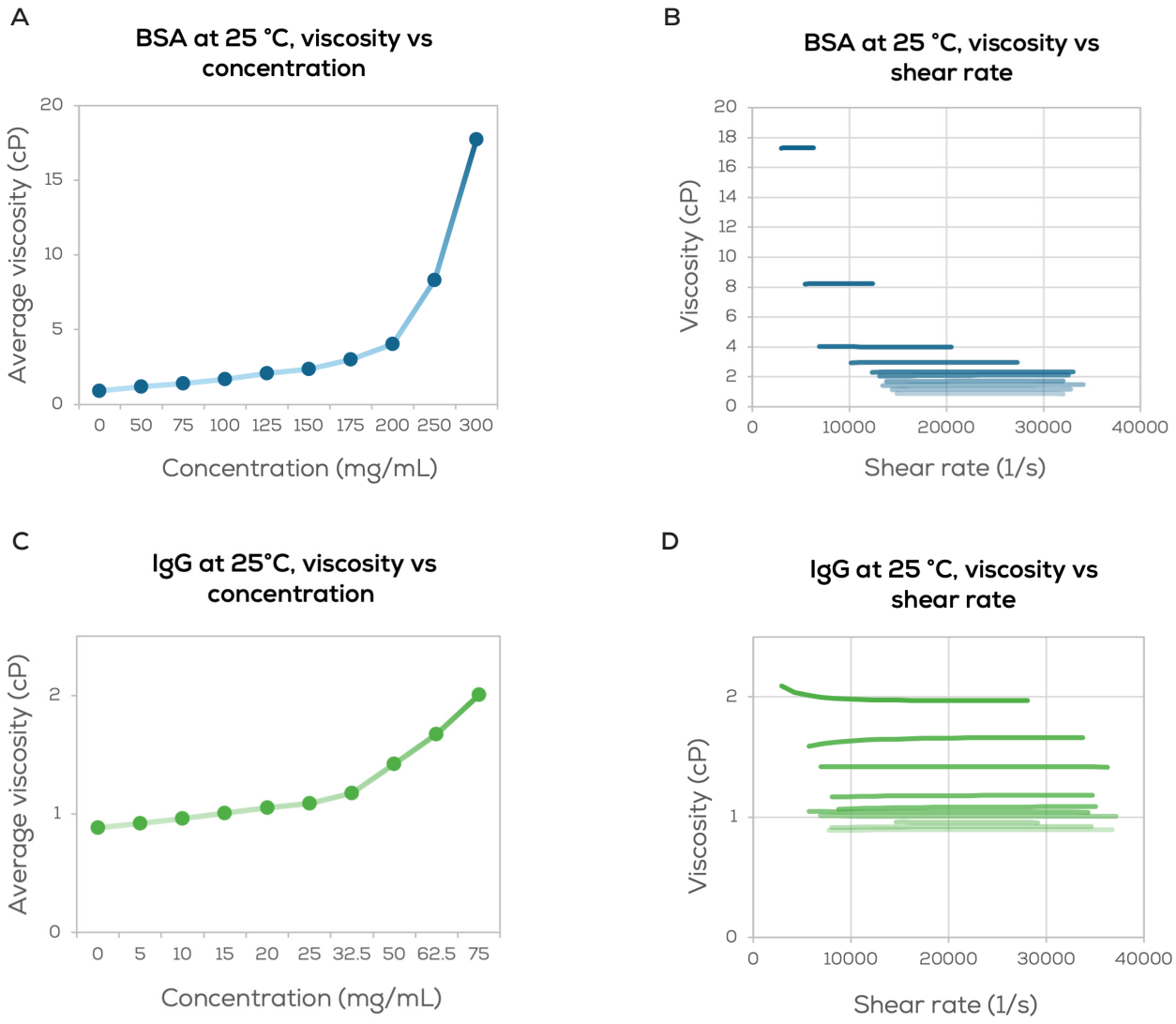

Figure 3: BSA and IgG were measured at various concentrations at 25 °C in three replicates. For both proteins, viscosity increases along with concentration (**A, C**). Both proteins exhibit Newtonian behavior as viscosity is constant across the range of shear rates tested (**B, D**).

independent of shear rate indicating Newtonian behavior, irrespective of their concentration.

Honeybun can easily handle measurements of proteins across a wide range of common concentrations, including highly concentrated ones. Gathering viscosity data at multiple concentrations provides more thorough insight into the behavior of protein formulations.

Tasty at any temperature

Injectable samples need to be measured at room temp and at temps that show what happens when they're fresh out of the fridge. Honeybun is equipped with temperature control, allowing viscosity measurements at temperatures down to 10 °C.

BSA and IgG viscosities were measured in triplicate at 10, 15, 20 and 25 °C and various concentrations ranging from 0 (pure PBS) to 300 and 75 mg/mL, respectively.

Honeybun reports viscosities from 1.35 to 30.6 cP for BSA (Figure 4A) and from 0.88 to 3.0 cP for IgG (Figure 4C). For both proteins, viscosities drop as temperature increases (Figure 4B and D).

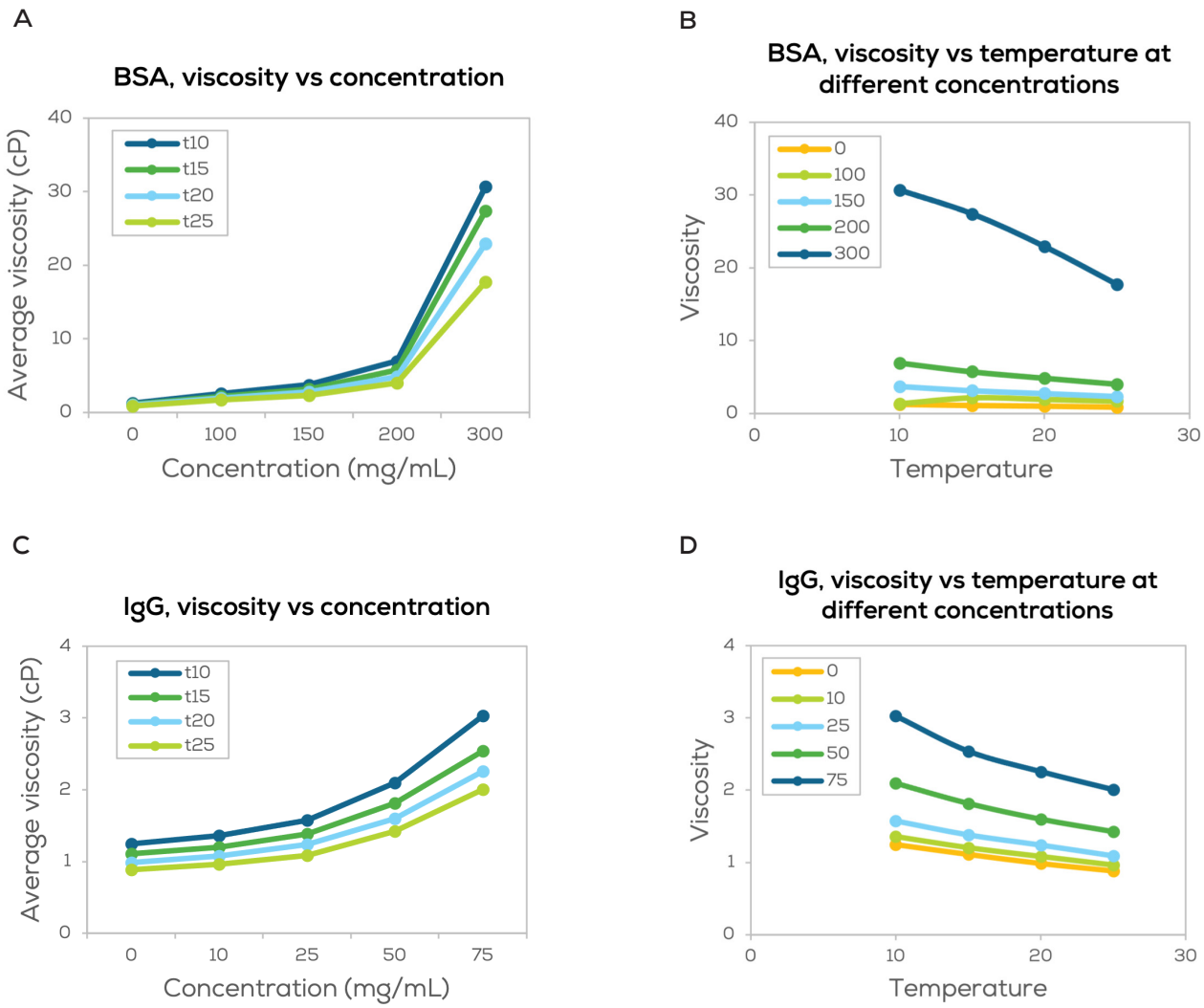

Figure 4: BSA and IgG were measured at various concentrations at four different temperatures in three replicates. Viscosity for both proteins decreases with rising temperatures (**A, C**). For both proteins as protein concentration increases viscosity also increases at any given temperature (**B, D**). Insets represent temperatures in °C (**A, C**) or protein concentration in mg/mL (**B, D**). Concentration 0 mg/mL is pure PBS.

Conclusion

Honeybun is fully equipped to deliver tons of simple, fast, and low volume viscosity measurements. It can process up to 10 samples simultaneously while using only 35 µL per sample. In just a few minutes you can get viscosity data across a range of temperatures and sample concentrations. Fast to set-up and run, low volume, hands-free, cleaning-free, and hassle-free – that's how Honeybun does viscosity measurements.

References

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Rev B