

Application Note

Concentration dependence of viscosity of protein solutions

Industry	:	Pharmaceutical, Food & beverage
Instrument	:	EMS Viscometer
Measurement method	:	Electro Magnetically Spinning Method
Standards	:	-

1. Overview

Albumin is one of the most widely used proteins in the pharmaceutical industry. Bovine Serum Albumin (BSA) is an essential ingredient in the production of therapeutic drugs and extracorporeal diagnostic agents such as enzyme stabilizers. This note contains an example application for the non-contact, airtight, and sterile measurement of the concentration dependency of the dynamic viscosity of BSA and ovalbumin using an EMS viscometer.

2. Precautions

None.

3. Post-measurement procedure

All sample tubes and samples are discarded according to proper waste disposal procedures.

4. Apparatus

- EMS Viscometer
- Control Laptop PC

5. Reagents

- Sample: Bovine serum albumin, ovalbumin,
- Phosphate Buffered Saline (PBS(-)) solution

6. Procedure

- 1) Set the following measurement parameters in the EMSVisco software:

◇ Temperature	:25°C
◇ Motor rotation speed	:1,000 rpm
◇ Meas. time	:1 (1 second)
◇ Repeat times	:5 times
◇ Meas. interval	:5 seconds
◇ Hold time	:5 minutes/300 sec
- 2) Transfer a 2mm diameter aluminum probe (ϕ 2mm) and 300 μ L of sample into a sample tube, seal it with its tube cap and packing, set the sample tube into the EMS Viscometer, and then click the measurement button.
- 3) After the first measurement is taken, dilute the sample with PBS, mix, and measure using the same settings as outlined above. Repeat across an entire dilution series using the same sample tube.

7. Results & Discussion

The concentration dependence of viscosity of both bovine serum albumin and ovalbumin was able to be confirmed. The measurement results are shown in Figure 1 and Tables 1 and 2. At concentrations of 250 mg/mL or more, the viscosities of bovine serum albumin solutions were higher than ovalbumin solutions. No significant differences in the viscosities of the 2 protein sample types were observed at low concentrations.

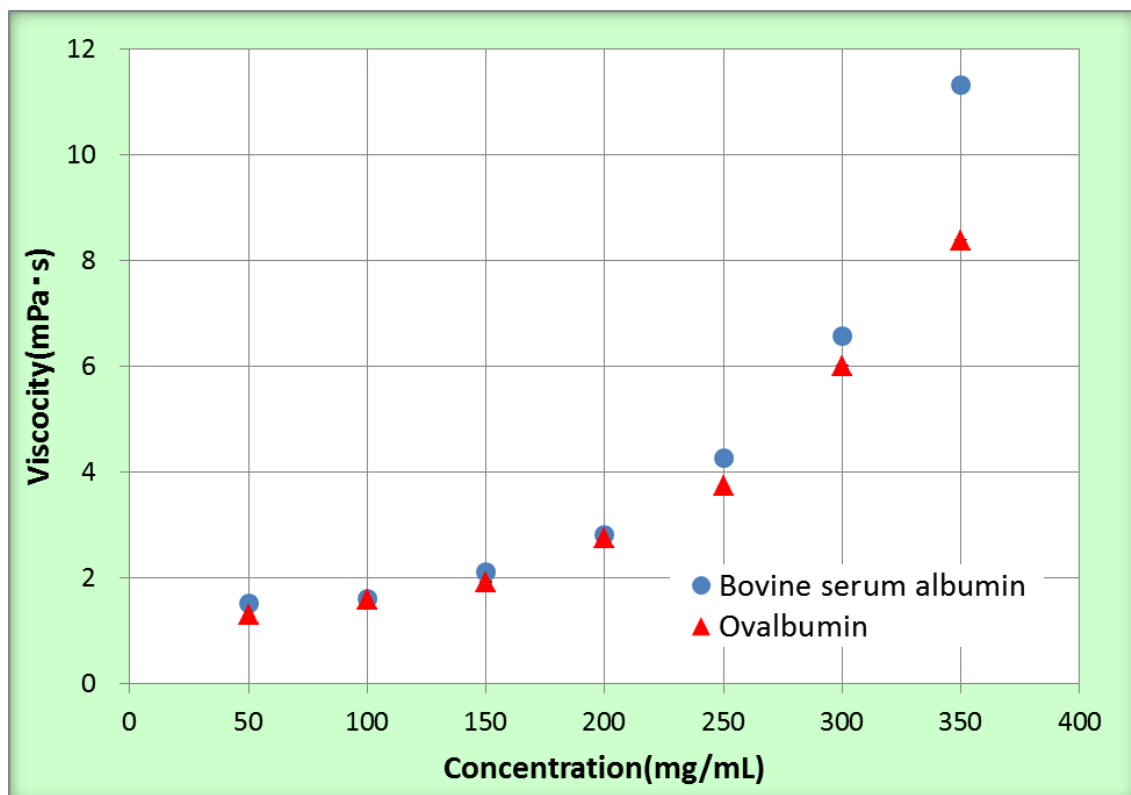


Figure 1. Concentration versus the viscosity of BSA and Ovalbumin

Table 1. Concentration dependence of viscosity of bovine serum albumin

(mPa·s)

	Concentration (mg/mL)						
	50	100	150	200	250	300	350
1st (viscosity reading)	1.53	1.61	2.31	2.82	4.27	6.56	11.30
2nd	1.53	1.61	2.31	2.82	4.26	6.55	11.40
3rd	1.53	1.61	2.31	2.81	4.26	6.57	11.30
4th	1.54	1.62	2.29	2.82	4.27	6.63	11.30
5th	1.53	1.62	2.33	2.82	4.27	6.57	11.30
Average	1.53	1.61	2.31	2.82	4.27	6.58	11.32
Standard deviation	0.00	0.01	0.01	0.00	0.01	0.03	0.04
RSD	0.3%	0.3%	0.6%	0.2%	0.1%	0.5%	0.4%

Table 2. Concentration dependence of viscosity of ovalbumin

(mPa·s)

	Concentration (mg/mL)						
	50	100	150	200	250	300	350
1st (viscosity reading)	1.30	1.60	1.94	2.79	3.72	5.96	8.35
2nd	1.29	1.60	1.92	2.73	3.73	5.98	8.34
3rd	1.29	1.60	1.92	2.73	3.73	6.04	8.38
4th	1.30	1.60	1.92	2.75	3.73	5.98	8.42
5th	1.29	1.59	1.92	2.75	3.73	5.99	8.32
Average	1.29	1.60	1.92	2.75	3.73	5.99	8.36
Standard deviation	0.01	0.00	0.01	0.03	0.00	0.03	0.04
RSD	0.4%	0.3%	0.5%	1.0%	0.1%	0.5%	0.5%

8. Summary

The EMS Viscometer provides a money-saving way to perform concentration dependence of viscosity studies on expensive and/or scarce samples as a single sample tube can be used to perform serial dilutions and repeat measurements.

9. References

None.