

Application Note

Concentration dependence of viscosity of protein solutions

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

1. Scope

Albumin is one of the most widely used proteins in the pharmaceutical industry. Bovine Serum Albumin (BSA) is an essential ingredient for the production of therapeutic drugs and extracorporeal diagnostic agents as enzyme stabilizers and the like. Examples of measuring the concentration dependency of the dynamic viscosity of protein solutions using an EMS viscometer that can be measured by sealing, sterilization and non-contact were shown below.

2. Precautions

None.

3. Post-measurement procedure

The sample container and the sample are discarded appropriately.

4. Apparatus

- EMS Viscometer
- Control Laptop PC

5. Reagents

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

6. Procedure

- 1) Enter the following conditions in measurement condition of the sequence mode of control software.

✧ Measurement mode	:Sequence mode
✧ Measurement temperature	:25°C
✧ Motor rotation speed	:1,000 rpm
✧ Measurement time	:1 (1 second)
✧ Repeat count	:5 times
✧ Measurement interval	:5 seconds
✧ Waiting time for temperature stability	:5 minutes
- 2) Place an aluminum spherical probe of ϕ 2 mm and a sample of 300 μ L in a container, cover with a cap and packing, set the sample container in the EMS Viscometer, and click the measurement button.
- 3) Add the dilution solvent after the first measurement is completed, and measure in sequence under the same condition.

7. Example

The concentration dependence of viscosity of bovine serum albumin and ovalbumin both can be confirmed. The measurement results are shown in Figure 1 and Table 1, 2. The viscosity of bovine serum albumin solutions is obtained higher value compared with that of ovalbumin solutions at high concentrations of 250 mg/mL or more, though a significant difference of viscosity between two kinds of protein solutions at low concentrations is not observed.

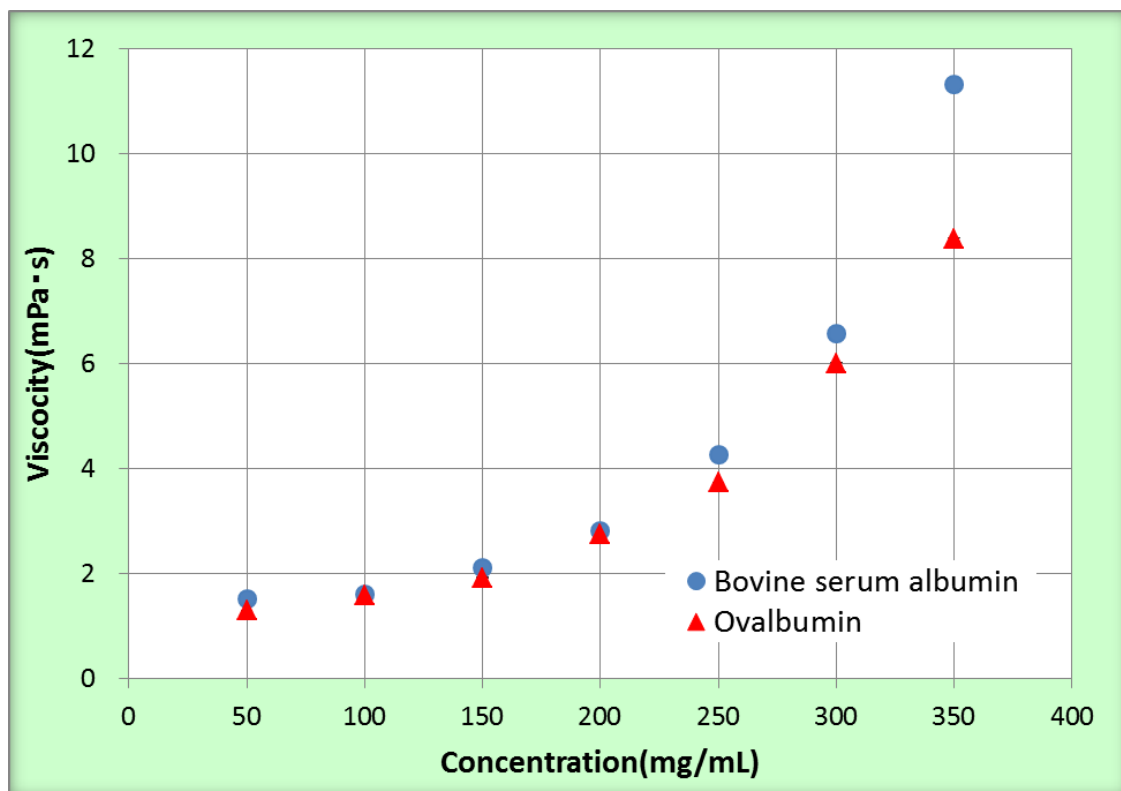


Figure 1. Measurement result about concentration dependence of viscosity of protein solutions

Table 1. Concentration dependence of viscosity of bovine serum albumin

(mPa·s)

	Concentration (mg/mL)						
	50	100	150	200	250	300	350
1st	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	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

Even if it is a rare sample (expensive sample) such as the protein, it is possible to evaluate the concentration dependence with a small amount of sample by measuring while adding the dilution solvent and diluting.

9. References

None.