INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
Department of Biosciences and Bioengineering

SUBJECT: Bioseparation Engineering **24 February 2023**

COURSE # BT 306

LABORATORY EXPERIMENT ASSIGNMENT - III

Experiment Title: Measurement of Solution Flux as a Function of Solute Concentration in Membrane Filtration

Problem 1. A bench-top membrane microfiltration filtration unit was in used batch mode to filter BSA solution of varying concentration (1.0%, 2.0%, 3.0%, 4.0% and 5.0%). The membrane filter used for the filtration process was a PES membrane having a pore size of 0.22 μm and a diameter of 4.7 mm. In separate sets, 50 mL of BSA solution of the specified concentration was filtered by applying a vacuum pressure in the order of 7.5 mm Hg. The average time taken (rounded-off value) for filtration of 50 mL of BSA solution of varying concentration is indicated in the table shown below:

Concentration of BSA Solution (%)	Volume of BSA Solution Filtered (mL)	Operating Pressure (mm Hg)	Average Filtration Time (Seconds)
0%	50	7.5	30
1.0%	50	7.5	31
2.0%	50	7.5	33
3.0%	50	7.5	35
4.0%	50	7.5	40
5.0%	50	7.5	41

(a) Draw a plot indicating the decrease in solution flux **(mL/min.mm^2)** as a function of the concentration of BSA solution as shown in the table. Provide a plausible explanation for the decrease in solution flux with increase in the concentration of BSA.

(b) From the constructed plot in (a), predict the solution flux **(mL/min.mm^2)** for 1.8% and 3.5% BSA solution (50 mL each) filtered in separate sets in the same membrane filtration unit operated under an operating pressure of 7.5 mm Hg.

$$\frac{50}{\frac{30}{60} \times \frac{\pi D^2}{4}}$$

Problem 2. A bench-top membrane microfiltration filtration unit was in used batch mode to filter BSA solution of varying concentration (0.2%, 0.5% and 1.0%). The membrane filter used for the filtration process was a PES membrane having a pore size of 0.22 μm and a diameter of 4.7 mm. In separate sets, 50 mL of BSA solution of a particular concentration was filtered by applying a vacuum pressure varying from 2.5 - 20 mm Hg. The average flux **(mL/min.mm^2)** for filtration of 50 mL of BSA solution of varying concentration at various operating pressure is indicated in the table shown below:

Operating Pressure (mm Hg)	Average Flux (mL/min.mm^2)		
	BSA Solution (0.2%)	BSA Solution (0.5%)	BSA Solution (1.0%)
0	0	0	0
2.5	2.24	1.58	1.31
5	5.17	3.64	3.03
7.5	9.13	6.43	5.35
10	10.93	7.70	6.41
12.5	11.44	8.06	6.71
15	11.57	8.15	6.79
20	11.59	8.16	6.80

Draw a plot indicating the flux **(mL/min.mm^2)** for BSA solution of various concentration as a function of the operating pressure **(mm Hg)**. Provide an explanation for the trend of solution flux observed in the plot at various operating pressures.

********** **END OF ASSIGNMENT SHEET** **********