

DEPARTMENT OF BIOCHEMICAL ENGINEERING & BIOTECHNOLOGY

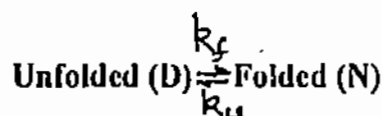
Major Test , Semester-II(2007-2008)
BEL411 (Food Science and Engineering)

Date: ~~30-4~~ 2008
Time: 8:00 – 10:00 AM
Venue: I -313
Marks: 50

Answer questions equivalent to 50 marks

- 1 a) A non Newtonian liquid food before entering in a sterilizer passes through a pipe line. A pipe line viscometer 2.5 cm, internal diameter and 50 cm long is used to characterise the liquid food. Assuming a laminar flow for one specific run the pressure drop was 500 N/m^2 at a flow rate of 100 l/min. Calculate the wall shear and apparent viscosity of the liquid food. (12)
- b) For the interest of a processed food industry it is required to estimate the total count of a bacterium at an effective product temperature of 80°F which was exposed for 210 minutes. If the exposure temperature and time were reduced to 69°F and 120 minutes respectively what would have been the new total bacterial count at this new condition? (Assume initial count = 15,000 and doubling time at 80°F = 35 mins and at 69°F = 60 mins respectively) (8)
- 2 i) Write notes on (any two) (2.5x2=5)
- a) Food sols and food gels.
 - b) Traditional Indian fermented foods
 - c) Feed protein
 - d) Deep fat frying
- ii) Explain how the quality of a single cell protein is evaluated. (5)

3. *Staphylococcus aureus* is a pathogen in food and environment. It has B domain of protein A (BdpA) which is said to be a factor responsible for its pathogenesis. Its native (N) and denatured (D) forms were examined. Consider equilibrium condition, proteins are distributed between (N) or folded and denatured D (or unfolded) forms.



For two-state folding proteins like BdpA from *Staphylococcus aureus*, only N and D states are significantly populated under all experimental conditions. For BdpA, the equilibrium constant for folding ($K_{eq,f}$) can be as high as 3000 under native conditions. Urea is a naturally occurring osmolyte and can denature proteins by stabilizing the D state relative to N state. The process of denaturation occurs by perturbing the folding (k_f) and unfolding (k_u) rate constants. Protein denaturation in the presence of urea lowers $K_{eq,f}$ to a value that is proportional to the concentration of the osmolyte under the conditions of experiment. Calculate the following for BdpA under native ($K_{eq,f} = 3000$ in OM urea) and denaturing conditions ($K_{eq,f} = 26$ in the presence of 2 M urea).

- Concentration of N and D if starting protein concentration is 1 mM (5)
- Free energies of folding and unfolding (37°C) (5)
- Unfolding rate constants if folding rate constants (5)
 - . in OM urea $k_f = 160000 \text{ sec}^{-1}$
 - . in 2 M urea $k_f = 22000 \text{ sec}^{-1}$
- Unfolding and folding rates (5)
- Time required to unfold and fold the protein (5)

(Value of $R = 1.987 \text{ Cal } ^\circ\text{K}^{-1} \text{ mol}^{-1}$)

4. Distinguish between (5x2=10)
- Proximate principles and ultimate principles of food.
 - Roll crusher and ball mill in cereal food milling.
 - Processing and preservation of food.
 - Damping oscillation and overshoot.
 - Saliva and pancreatic juice.