

## Biochemical Thermodynamics

2 units (selection)

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**Target)** Thermodynamic treatments for molecular aggregates constructed by self-association of bio-related substances and effects of environmental variables such as temperature, pressure and additives on the aggregates are described.

**Outline)** The former part of this lecture reviews treatments for molecular aggregates such as monolayers, micelles and vesicles constructed by self-association of bio-related substances like surfactants, lipids and amphiphilic drugs from a thermodynamic viewpoint. The latter part describes various nature of these aggregates and structure changes of the aggregates by environmental variables such as temperature, pressure and additives. Further industrial application and utilization of molecular aggregates are also explained. This lecture deals with industrial subjects.

**Style)** Lecture

**Keyword)** *bio-related substance, molecular aggregate, thermodynamics, phase behavior, pressure*

**Fundamental Lecture)** “Physical Chemistry 2”(1.0), “Biophysical Chemistry 2”(1.0)

**Relational Lecture)** “Advanced Biophysical Chemistry”(0.5)

**Requirement)** Students are required to have a good understanding of undergraduate-level physical chemistry and biophysical chemistry and related subjects.

**Goal)**

1. To understand the thermodynamic treatments of molecular aggregates formed by bio-related substances.
2. To understand the nature for aggregates of bio-related substances and effects of environmental variables on the aggregates.

**Schedule)**

1. Thermodynamics of molecular aggregates (1) thermodynamics of adsorption at interfaces 1: surface and interfacial tension
2. Thermodynamics of molecular aggregates (2) thermodynamics of adsorption at interfaces 2: treatments of adsorbed film
3. Thermodynamics of molecular aggregates (3) phase transitions of monolayers 1: insoluble monolayers
4. Thermodynamics of molecular aggregates (4) phase transitions of monolayers 2: soluble monolayers

5. Thermodynamics of molecular aggregates (5) thermodynamics of self-association 1: phase separation model
6. Thermodynamics of molecular aggregates (6) thermodynamics of self-association 2: mass action model
7. Thermodynamics of molecular aggregates (7) micelle formation in dilute solutions 1: critical micelle concentration
8. Thermodynamics of molecular aggregates (8) micelle formation in dilute solutions 2: affecting factors
9. Structures and functions of molecular aggregates (1) solution behavior 1: Krafft point
10. Structures and functions of molecular aggregates (2) solution behavior 2: cloud point
11. Structures and functions of molecular aggregates (3) phase behavior of bilayers 1: saturated phospholipids
12. Structures and functions of molecular aggregates (4) phase behavior of bilayers 2: unsaturated phospholipids
13. Structures and functions of molecular aggregates (5) pressure effect on bilayers 1: volume change of transition
14. Structures and functions of molecular aggregates (6) pressure effect on bilayers 2: pressure-induced bilayer interdigitation
15. Structures and functions of molecular aggregates (7) phase behavior of bilayer mixtures: domain formation
16. Summary, inquiry and report preparations

**Evaluation Criteria)** More than 80% percentage of attendance and reports (100%).

**Textbook)** To be distributed materials adequately in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216731>

**Student)** Able to be taken by student of other department

**Contact)**

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(Office Hour: Friday 16:20-17:50)

**Note)**

◇ When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

◇ Goal 1 is related to schedules 1-8 and goal 2 is related to schedules 9-15.