# International Internship Program at

# Mie University and Milbon Company

# From February 26 to March 26, 2011

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**2011**

## Objectives

1. To gain experiences in the specialties and atmosphere researches in famous Japanese University

2. To understand the manufacturings at MILBON company, how to settle the problems and challenges holding the job;

2.1. Have experience in producing experimentally, evaluating and performing our improved products.

2.2. Have experience in the emulsion shows entirely different physicality by only a small change of the manufacturing process, and students are to learn how MILBON work on those issues.

## Detail

1. Training at Prof. Ohta's lab (Graduate school of Engineering)
2. Internship at Milbon company (During March 7-18, 2011)

## Training at Prof. Ohta's lab

To study about analysis and environmental chemistry. I learned equipments analysis such as High-performance liquid chromatography (HPLC) and gas chromatography that equipped with FID and TCD. Moreover, I studied the environmental chemistry researches such as photocatalysis and electrochemistry.

## Internship at Milbon Company

The Milbon Company is manufacture of hair chemicals product such as shampoos, treatments, hair styling chemicals, hair coloring chemicals and perming appliances. There are two plants; Yumegaoka plant Aoyama plant.

1. Yumegaoka plant

   This plant produces shampoo, treatment, hair color, hair care, perm and styling.

2. Aoyama plant

   This plant produces shampoo and treatment.

**Training outline**

1. Process of hair products
2. Emulsion
3. Evaluation
4. Other training
5. experiment

**Training**

**1. Process of hair products**

All of hair products were produced follow by

1. Receiving materials

   - The raw materials were sent to Milbon Company. The raw materials were checked quality before keep in the warehouse.

2. Measurement

   - The raw material was weighed follow in composition of hair product for example shampoo, treatment and wax.

3. Dissolving

   - The raw material is hard such as wax. It was melted to liquid solution prior to send the next process.

4. Mixing

    - All of materials were mixed together step by step follow in process. The hair product was obtained from this step and was analyzed by checking pH, viscosity and creamy texture.

5. Storage

    - After mixing process, the product was weighed for checking the total weight and compare with before mixing step. After that, it was kept in container (approximately 2-3 days) for filling the package.

6. Filling

    - The product was contained in the package by using automatic system.

7. Packaging

    - After filling step, the package of hair product was baled in the box and transferred to the warehouse.

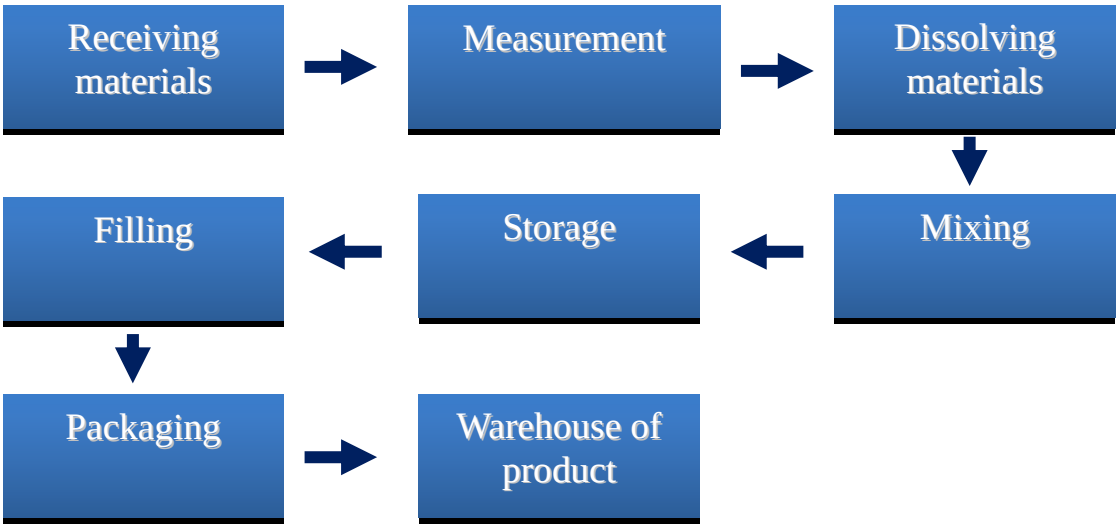


Figure 1.Process of hair product.

**2. Emulsion**

Emulsion is a mixture of two or more immiscible liquids for example the mixture of water and oil. An emulsifier (also known as an emergent or surface active substances, or surfactants) was used to mix immiscible liquid together.

Emulsification method

1. Agent in oil method

The emulsifying agent was added in oil. After that, water was added in the mixture solution. The water in oil emulsion was obtained. The scheme of process is shown in figure 2.

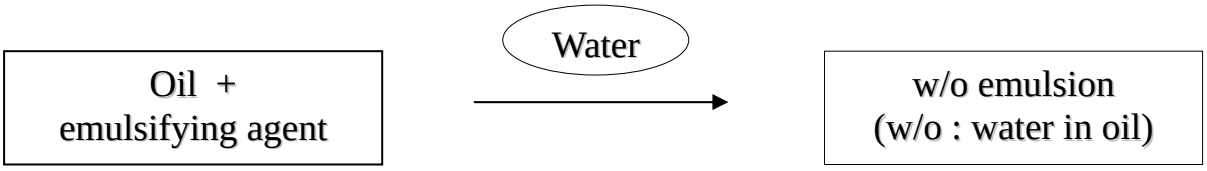


Figure 2.The scheme of agent in oil

2. Agent in water method

The emulsifying agent was added in water. After that, oil was added in the mixture solution. The oil in water emulsion was obtained. The scheme of process is shown in figure 3.

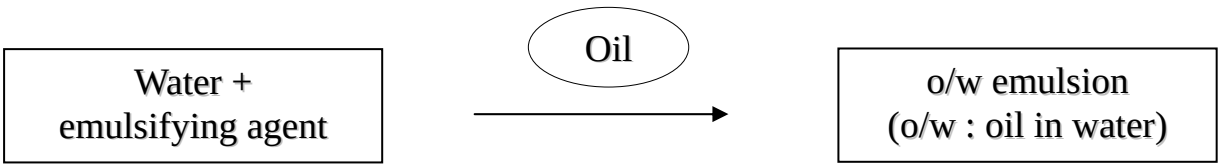


Figure 3.The scheme of agent in water

3. Soap emulsification method

The oil was mixed with fatty acid after that alkaline solution (ex. NaOH) was added in the mixture. The oil in water emulsion was obtained. The scheme of process is shown in figure 4.

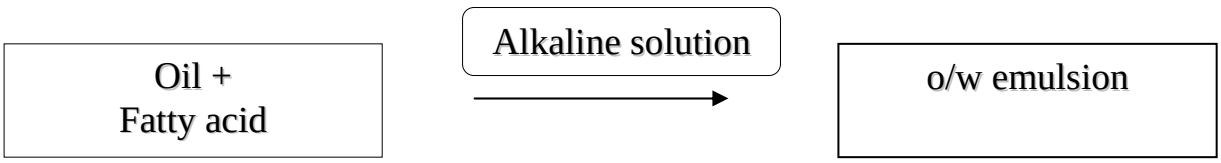


Figure 4.The scheme of soap emulsion method

4. Phase inversion emulsification method

The oil was mixed with emulsifying agent. After that, the water was added in the solution. When the temperature was decreased, the water in oil emulsion was changed to the oil in water solution. The scheme of process is shown in figure 5.

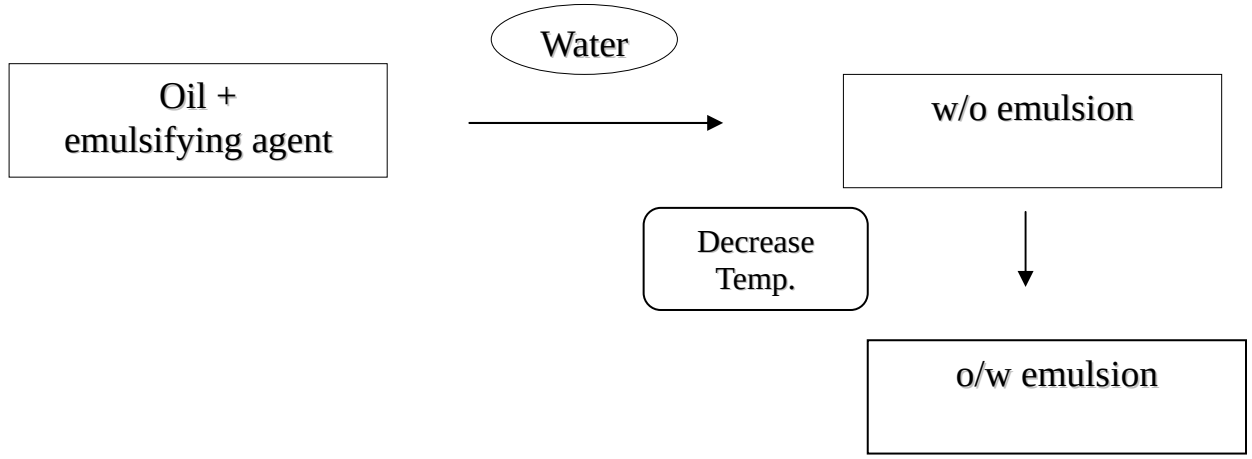


Figure 5.The scheme of phase inversion emulsification

5. Liquid crystal emulsification method

The oil was mixed with emulsifying agent after that water was added gradually. The solubilized solution was changed to liquid crystal, gel and oil in water, respectively. The scheme of process is shown in figure 6.

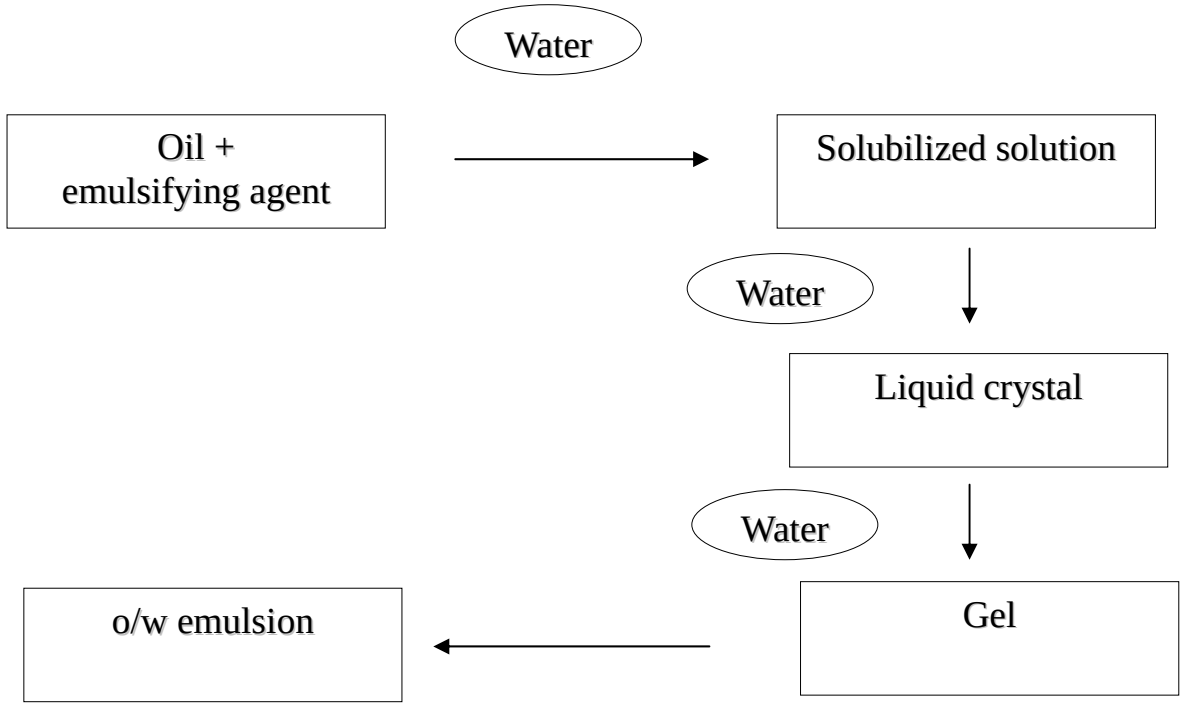


Figure 6.The scheme of liquid crystal emulsification

Factor of emulsion's viscosity change

1. The viscosity of cream composed of small emulsion particles is higher than that of large ones.
2. Emulsion with wide particle size distribution has lower viscosity than that with narrow one.
3. The viscosity of emulsion closely blocked is higher than that of not block.
4. The less surfactant emulsion made by, the lower viscosity it has.
5. The viscosity of the emulsion made by ionic surfactant is comparative high.

General method of the viscosity increase of the emulsion

1. Formation of gel network
2. Formation of the liquid crystal
3. Adding water soluble polymer

Effect of manufacturing method on viscosity of the emulsion

The viscosity of the emulsion may changed by the manufacturing method. Factors of change viscosity are described as follows;

The particles of the emulsion or the particle size distribution are variable on different manufacturing condition may lead to influence on the viscosity expect that factors are shown as

1. Amount of formation of the liquid crystal

Emulsion is made at high temperature. The liquid crystal is formed through the emulsion's cooling process. However, the liquid crystal is not formed when the emulsion instantaneously cooling because formation of the liquid crystal takes time. Oppositely, the high viscosity emulsion can be made with the result that a lot of liquid crystals can be formed when the emulsion slowly cooled.

2. Morphological change on the liquid crystal and gel network

The liquid crystal and the gel network surround oil droplet s and form the network structure. However, the network structure of emulsion is destroyed when the stir speed is too fast, hence it has low viscosity.

3. Structure of the surface active agent

When the surface active agent has complex structure, it takes time to the formation of the interfacial member and liquid crystal. It is necessary to slow the stir speed down to raise emulsion's viscosity. Moreover, it is necessary to cool slowly.

4. Migration of the surface active agent

In case of the emulsion with nonionic surface active agent, it is not the aqueous phase but in the oil phase. Nonionic surface active agent dissolves to the oil phase immediately after emulsification (high temperature). At cool temperature, the surface active agent gets hydrophilic. Therefore, it migrates from the oil phase to the aqueous phase, and it is gradually taken into the liquid crystal lead to raise viscosity.

**3. Evaluation**

1. Viscometer

   It used to analyzed the viscosity of emulsion

2. Rheometer

   It used to analyzed the recoverable elastic portion of solution

**4. Other training**

1. Rheometry principle
2. Oil in water emulsion unstabilization process
   a. Coalescences
   b. Aggregation

**5. Experiment**

1. Wax

Wax was made with different preparation techniques of polymer solution

1. Ribbon agitator 

2. Disperse agitator 

The speed of ribbon agitator has lower than disperse agitator.

Result

1. Ribbon agitator

   When it used to make wax, wax texture has soft but sticky. As a result, the polymer solution has high viscosity.

2. Disperse agitator

   When it used to make wax, wax texture has hard. As a result, the polymer solution has high viscosity.

2. Cream

Cream was made with different mixing processes

1. Using stirring rod 
2. Using homogenizer mixer 

Result

Cream making by using stirring rod has lower viscosity than using homogenizer mixer.

3. Treatment

Treatment was made with different surface-active agent

1. Cetyl trimethyl ammonium bromind (C16)
2. Stearyl trimethyl ammonium bromind (C18)
3. Behenyl trimethyl ammonium chloride (C22)

Result

From experiment, all treatments have same viscosity. (By touching)

4. Hair product (Tank scale)

   Hair product was made with different process

   1. Adding silicon slowly
   2. Adding silicon fast

      Result

      When silicon was added slowly, the final solution was uniformed and homogeneous. On the other hand, silicon was added fast, the solution was phase-separated solution.

5. Shampoo
6. Watergel

**Activities**

1. Strawberry hunting (March 12, 2011)

2. Sight-seeing at Ueno Castle and Ninja museum at Iga city (March 13, 2011)

3. Sight-seeing Todaji temple and Kofukuji  temple at Nara ( afternoon, March 17, 2011)

**Benefits from internship**

1. Learnt Japanese culture and life-style
2. Leant how to work in Japanese company
3. Gain a new knowledge in process and manufacture of hair products