

科学英語講座

科学技術分野では、国境の壁がありません。世界各国の人々と交流し、お互いの知識を交換し合い、研究や技術を発展させていくことになります。そのためのコミュニケーションツールとして英語は必要不可欠な言語です。特に理系分野ではテクニカルタームが多く、英語が得意な者であってもコミュニケーションに支障をきたすことがあります。今回の取り組みは、実験授業から細かな実験指導まで全てを英語で行い、生徒達の英語でのコミュニケーション能力を高め、さらに、科学的な分野への興味・関心を喚起する事を目的として実施しました。



平成24年6月13日(水)・15日(金)の2日間に、1年生全クラスで「科学英語講座」が実施されました。

宇都宮大学農学部大学院博士課程に留学されているバングラディッシュ出身のシディキ (Mohammad Shohe1 Rana Shiddiki) 先生を講師として、牛乳と豆乳のそれぞれのタンパク質成分を塩析させて、カッテージチーズと豆腐を作り出す実験を行いました。もちろん、授業はすべて英語で、お互いのコミュニケーションにも英語以外は使用しないルールで授業が進行しました。



ウォーターバスで牛乳を50℃に、豆乳は70℃に暖めながら攪拌します。その後、牛乳には酢を豆乳にはにがり(MgCl₂)を加えると牛乳と豆乳にかたまりが生じます。それをフィルターでろ過するとカッテージチーズ(牛乳)と豆腐(豆乳)のできあがりです。カッテージチーズは、牛乳を加熱し酸を加えてpHを変化させたことでタンパク質の構造が変化を起こして活性を失い不溶性になった結果です。これをタンパク質の変性といいます。豆腐は、タンパク質のコロイド粒子(親水コロイド)が、電解質(MgCl₂)を加えたことで反発力を失い、分子間力によって引き合い沈殿が起きた結果です。このような現象を塩析といいます。

13 (Wednesday), 15 (Friday) June 2012
at Sakushin Gakuin high school

Super Science High School (SSH) program

Science communication using English conversation

Mohammad Shohel Rana Siddiki
(from Bangladesh)



(A) Introduction

Proteins are high-molecular-weight compounds and have specific biological functions such as those of enzyme and hormone. Several hundreds of L-amino acids are connected in an order and, then, a protein is formed. Protein is one of the important ingredients for living things, and it is counted in the three major nutrients together with carbohydrate and lipid. Protein plays a role to build up the body of creatures. Many foods contain various kinds of protein. Protein participates in deciding taste and physical properties of food and maintaining their shapes and colors.

(B) Purpose of the experiments



Milk is an important food. It has many nutrients including proteins. **Cow's milk** has a pH ranging from 6.4 to 6.8, making it slightly acidic. Normal cow's milk contains 30–35 grams of protein per liter, of which about 80% is arranged in **casein** micelles. **An increase in acidity of milk** makes it turn into **curd**. Milk protein casein is mainly responsible for this feature because it is denatured and starts to aggregate each other in the acidic pH range. **Cottage cheese** is made according to this feature of casein in milk. **Soy milk** also contain abundant proteins of which about 50% is occupied with **glycinin**. One of the processed-soybean products is a Japanese traditional food, **tofu**. A coagulant, so-called Nigari (mainly made of **magnesium chloride**), is added into warmed soy milk to form a gel of proteins including glycinin. The gel can maintain much water in its mesh structure. This gel is poured into a mold to make a form of tofu. In this experiment, we learn functions of protein in foods through making cottage cheese and tofu.

(C) Materials

• Cottage cheese

Cow's milk	50 ml
Vinegar	5 ml
100 ml Beaker	2
Funnel	1
Filter paper	1

• Tofu

Soy milk	50 ml
Magnesium chloride solution	5 ml
100 ml Beaker	2
Funnel	1
Filter paper	1

(D) Experiments

• Cottage cheese

1. Pour cow's milk into a 100 ml beaker, and warm up it at 50°C-60°C.
2. Add 5 ml vinegar and stir it slightly.
3. Stand the beaker for about 5 minutes to form curd.
4. Filter the milk including curd with a set of funnel, filter paper, and another 100 ml beaker at bottom.
5. Collect cottage cheese on the filter and whey (milk serum) in the bottom beaker.
6. Observe the hardness and volume of cottage cheese and the color of whey.
7. Wash the two beakers and a funnel and use these for the next experiment.

• Tofu

1. Pour soy milk into a 100 ml beaker, and warm up it at 70°C-75°C.
2. Add 5 ml magnesium chloride solution and stir it slightly.
3. Stand the beaker for about 5 minutes to form gel.
4. Filter the milk including gel with a set of funnel, filter paper, and another 100 ml beaker at bottom.
5. Collect tofu on the filter and milk serum in the bottom beaker.
6. Observe the hardness and volume of tofu and the color of milk serum.

(E) Discussion

Compare hardness and volume of cottage cheese with those of tofu. Observe how did the colors of milk changed after formation of milk serum. Discuss these differences between cottage cheese and tofu and between milks and milk serums.