หอสมุดกลาง สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER I
INTRODUCTION

1.1 General

Even though all countries in the world try to control the annual birthrate of the world's population, the population is still increasing consistently. How to feed this growing population for them is being discussed everywhere. The world nutrition is mostly based on the agricultural products, rice, vegetables, fruits, or animal meat. The farmers who produce those things are always working hard. They have to take care of their agricultural plants with the expectation that they could sell all of their products with good prices. They make every effort for achievement of the best agricultural products before launching into the market.

In fact, there are many obstacles in every business sector with no exception whether or not it would be on a big or small scale. Such obstacles are problems which the farmers pass on, to dealers and at least to the customers in both directions. Some of those problems are **product waste**, lower price and lower profit than anticipated.

In a tropical country, such as Thailand, there are many kinds of agricultural products. A very interesting product which occurs in the market and making a good return is a chicken farm, the by-product is eggs. In the process some eggs are damaged by packaging at the farm and by transportation. This cracked eggs will be rejected as the waste. The ***turning from the waste to goods is one of the important point to be discussed.*** By applying the knowledge of food processing, the egg yolks could be processed into a sweet food called "Foi-tong".

Foi-tong shown in Figure 1.2 is one of the most flavored Thai traditional sweets made from 100% egg yolks. There is no kind of powder mixture. The production of Foi-tong is very interesting. The egg yolks are changed into egg emulsion and rilled into boiling sugar syrup. The egg emulsion is formed by the heat of the boiling syrup and shaped as golden well-done egg noodle absorbing the syrup in it. The best physical appearance of Foi-tong should be the very ***thin, round strings, as long and consistent as possible.***

(**Chaochumnan, 1990**). The quality of Foi-tong and its shelf life were studied in 1990 by Chaochumnan S., Thailand. The study focused on all emulsion factors such as the mixtures of the egg yolk, the concentrations of the sugar syrup, the ratios of vegetable oil. The quality and stiffness of Foi-tong was tested and achieved a satisfactory level, the shelf life was very good. But the experiment test, all of ***operational control factors*** were selected and accepted as control variables. The shape of Foi-tong string was not as good as expected.

Focusing on the process of Foi-tong cooking, the way to cook Foi-tong was developed from a cone made of banana leave operating by hand (Figure 1.1). The banana leave rilling cup had to be hold and moved slowly above the pan containing boiling syrup. After that metal rilling cup operating by a motor drive was applied. (Figure 1.3 and Figure 1.4). By those primitive methods, the rilling cup performed the circular movement above the syrup pan. Even the quality was improved but the physical properties, especially the shape of Foi-tong string still could not be better formed . The string was spread out, flat and not uniform .

The problem involved the **operational control factors** such as the size of the rilling hole, the circular velocity of rilling cup, the rilling height, the temperature and also the atmospherical pressure against the viscosity of the egg emulsion.

It was necessary to study all of these mentioned operational control factors in order that better quality and the expected Foi-tong string shape can be achieved. And if all factors are investigated and optimized, They provide essential background knowledge which could support the new design and development of Foi-tong machine manufacturing in the future.

1.2 Research Background

1.2.1 Foi-tong and its primitive method of cooking

- *Basic (manual) cooking method*

    1. Egg emulsion is poured in the banana leave cone

2. The banana leave cone is swung circularly above the brass pan with a certain height as shown in Figure 1.1

3. The egg emulsion filled in the cone flows through a small hole into the boiling syrup.

4. About 1-2 minute it will be well-done, like noodle, and called "Foi-tong"

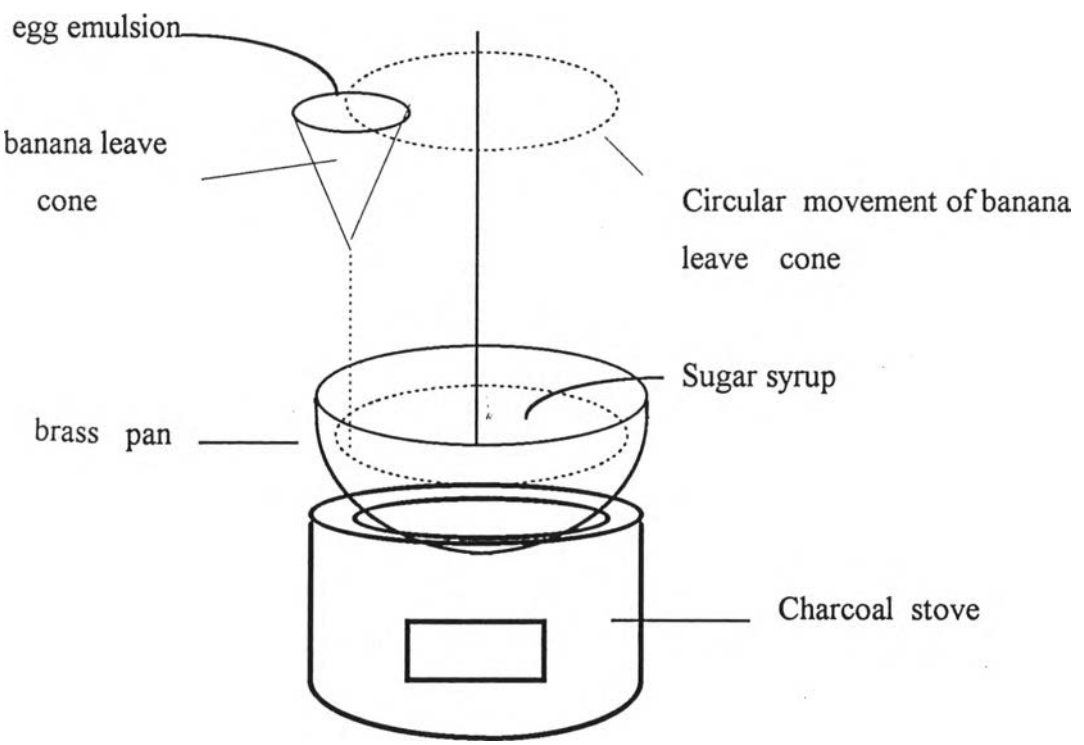

Figure 1.1 Basic Foi-tong cooking method

Mechanism : banana leave cone, with a single rilling hole
by hand - swinging around and above the brass pan

1.2.2 The development of Foi-tong machine (Chaochumnan, 1990)

The machine designed for Foi-tong production was designed by individual producers and kept secret. Some models are displayed for sale in the market place. One of a small Foi-tong machine was built for the research purpose by a student at Kasetsart University in Bangkok, Thailand, Sirilux Chaochumnan. She

studied the ***"factors affecting the quality of Foi-Tong"*** by using the ratio of duck and hen-egg yolks of 80:20 mixture and did the experimentation.

She found that the panelists preferred Foi-tong cooked in 60% concentration syrup. The more hen egg yolks or more vegetable oil used, the less stiffness, but the higher the glossiness. The same texture and appearance were obtained with the addition of the hen-egg yolks but its panelist's score was not statistically different.
The result also indicated that the outer thin albumen increased the stiffness of Foi-tong. The texture of Foi-tong was optimal at **18% outer thin albumen.**

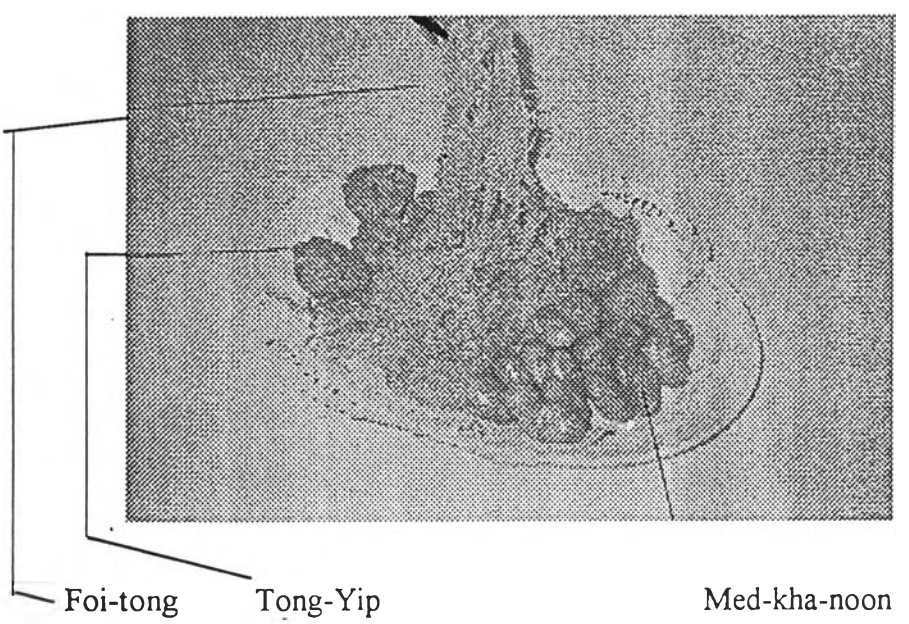

Figure 1.2 " Foi-Tong" looks like "Noodle, sweet noodle" which can be served as a dessert

Egg odor was suppressed substantially by the addition of synthetic jasmine flavor at the concentration of 0.1 % in syrup. Foi-tong could be kept for 90 days in LDP (Low Density Polyethylene) bag at 15°C.

The experiment was done by using that small apparatus to produce foi-tong string, instead of controlling by hand. The rilling cup of that machine was made by

stainless steel and had a single hole underneath its bottom part. It could be rotated by an electromotor above a round a brass pan containing sugar syrup in Figure 1.3 That apparatus was designed and set-up for producing foi-tong strings, not for a commercial purpose, but only in the case study of some factors affecting the quality and its shelflife as mentioned above. The operational control factors were fixed as the constant factors.

Mechanism : mechanical driving system (circular motion)
with a single nozzle rilling cup

1.2.3 The current Foi-tong apparatus, (Chueakittisak, 1991)

This apparatus was enlarged on the overall dimension. The design was developed into a multiple nozzle rilling cup. (Focusing on the rilling system mainly).

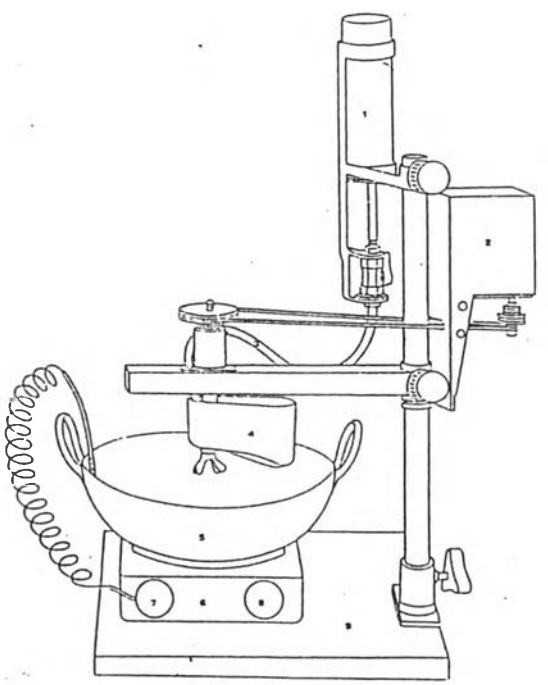

Figure 1.3 Primitive Foi-tong apparatus designed for testing the quality in educational purposes

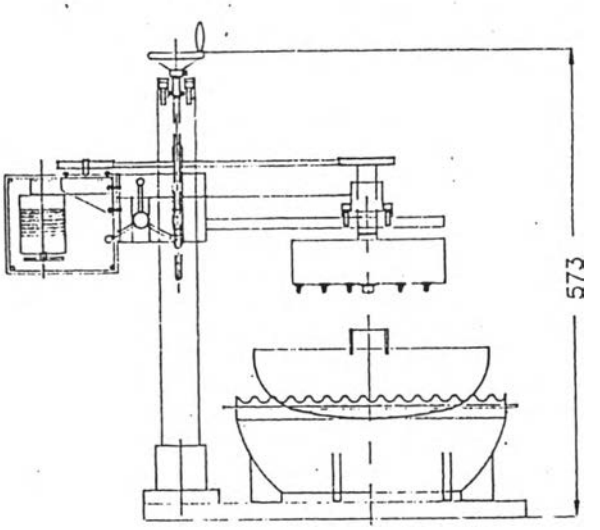

Figure 1.4 Primitive Foi-tong apparatus designed and built for foi-tong production

By the way the vertical adjustment could be performed by turning handwheel on the top part of the machine post. The rilling cup was driven by an electromotor with adjusted speed (Figure 1.4). The inconvenience was the rilling cup collision

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during picking-up the well-done foi-tong and the usually need to swing out the rilling arm by hand. The shape of foi-tong string was still flat and pread-out and not consistent.

Mechanism : mechanical driving system , rilling cup with multiple nozzles gas heating stove

1.3 Statement of the Problems

According to machine design background and interviewing some Foi-tong producers in Arng-tong (the next province to Ayutaya where there are a lot of egg sweet producers). Some of problems have been investigated as follows:

1.3.1. The production of Foi-tong by primitive machines still could not maintain the physical properties of foi-tong string

1) The string shape: diameter and roundness
2) The consistency of the string configuration

1.3.2 Process and unit operation of the primitive Foi-tong machine design was very simple. The operational control factors have not been studied yet and they are still unknown exactly. All of those factors needed to be investigated are:

1) The rilling height, the nozzle diameters, the circular velocity of rilling cup.
2) The problem of atmospheric pressure : It may have greatly influenced the expected physical properties of Foi-tong string
3) There was no temperature controller application by the primitive machine. The temperature could be one of the main factors affecting the building-up of the Foi-tong string If some temperature effects had been controlled, it would be able to research the unknown factors and define the optimum parameters available for development of the new design

1.4 Purpose of the Research

The purposes of this research are as follows:

1) To study operational control factors affecting physical and mechanical properties of foi-tong product.

2) To set up experimental equipment for studying the cooking conditions

1.5 Scope of Research

The research would cover the investigation of machine parameters which could be the causes of the problem statement, and the studies in these following areas for supporting a new design and for set-up an experimental apparatus.

1) Viscosity and the nozzle design

To be able to select an appropriate nozzle design. The viscosity of the egg emulsion will be studied and defined as well as the exact correlation between them

2) Pressure and circular velocity of the rilling

To study and define the circular velocity of the rilling motion relative to the translation movement of the egg emulsion string, the flow velocity of the fluid through the nozzle hole will be studied.

3) Circular velocity and the rilling height.

To study the rilling height which could affect the size of the Foi-tong string. And the revolution per minute of the machine rotation could cause tension force to linear expansion of the egg emulsion string.

4) Design and set up new experimental equipment

To design a new equipment for supporting an experimental test

5) Material use in process design

The appropriate material used for setting up new apparatus would also be selected according to the suitable properties for the emulsion , especially, the reaction against the emulsion flow would be taken into account.

6) Experiment test

The properties of new foi-tong strings, the product from the experimental apparatus, would be tested scientifically for both physical and mechanical properties of the string.

1.6 Expected Benefits

The expected benefit are as follows :

1) *The optimum shape (physical properties) of Foi-tong string*

The expected optimum shape of Foi-tong string must be very small ,round string, and consistent

2)*The mechanical properties of Foi-tong*

Not only the shape of Foi-tong string could have been controlled but also the *quality of Foi-tong.* The good strength test is required for this purpose.

3 *The optimum design of an effective experimentation equipment*

After this study all of operational control factors would have been investigated and optimized. They would be the important specification available for a new development and design of a new Foi-tong machine which could also be enlarged (for business purpose) or reduced (for the household , kitchenware) in sizes as required.

1.7 Research Procedure

The research would cover the investigation of essential background information involving Foi-tong processes , the study and creation of new conceptual design and prepare a pre-test equipment before designing an effective experimental apparatus for supporting the design of experimentation. The procedure of study are :

1 Review of concerned literature

2 Design a pre-test equipment to study the pressure affecting the string configuration of Foi-tong

3 Design and set-up the experimental apparatus to study operational control factors

4 Experimental Test

5 Study and analysis of results

6 Discussion and conclusion

7 Suggestion

The details of research procedure was shown in Figure 1.5

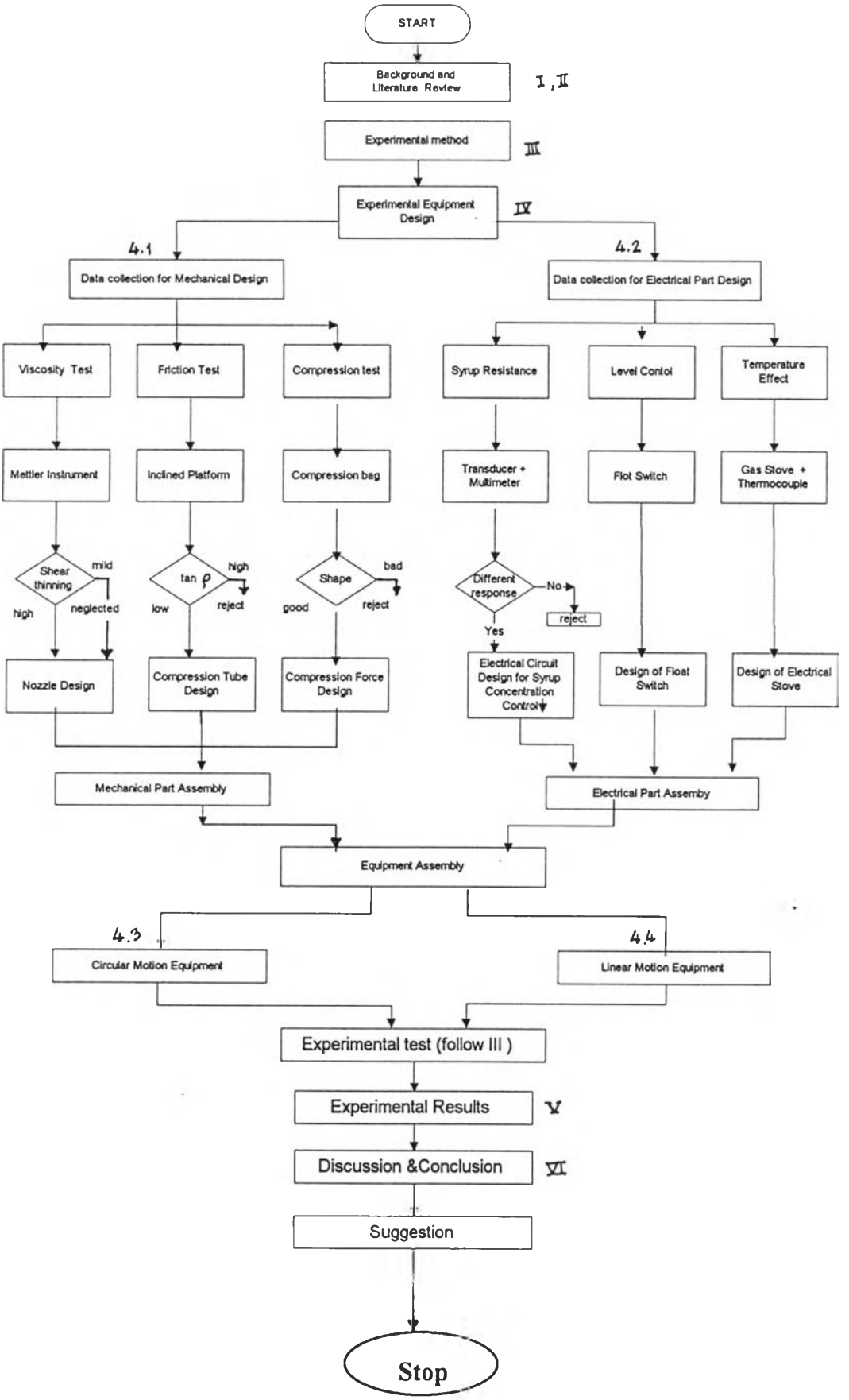

Figure 1.5 Research procedure