CHAPTER VI
DISCUSSION AND CONCLUSION

6.1 DISCUSSION

The experimental equipments which are used for testing string configuration of Foi-tong have some differences both in working principle and working performance. This Chapter will discuss about advantages and disadvantages of them as follows:

6.1.1 Circular motion

This equipment was designed for a single rilling hole, as a pre-test specially. The equipment had to be fixed in a rotary spindle of a vertical milling machine and supplied pressure into the rilling system by an eight-tension-spring decoration. The spring force pulled down the piston rod and the piston compressed the egg emulsion, discharging it throughout the rilling hole into boiling syrup in the pan.

A. Advantages

A positive portion of the circular motion has been noticed:

- *Simple design*

The compression tube design was a simple system and there were a few components. It means the ease of maintenance.

- *Ease of use*

Because its control was not so complicated, The vertical and speed adjustment has been done by the vertical spindle and speed regulator respectively.

- *Ease of egg emulsion filling*

The egg emulsion came into the tube easily while the piston was raised up and it was discharged throughout the rilling hole.

- Disassembly ability

It was very simple and easy to disassemble and clean

B. Disadvantages

- The adjusting systems i.e. the vertical adjustment and the speed control would be complicated, in case both systems have to be built in and become a complete equipment set.

- It was difficult to apply air compression into a rotation system like, as in this rotation rilling tube. This means that a special air supply device has to be purchased for a rotary system. This the another reason for using milling machine cause of using a milling machine.(no need to purchase one)

- The setting -up cost could be high.

- It can provide only one single rilling hole, this means that such equipment produces low quantity for Foi-tong production.

- Difficulty in the nozzle control. The ON/OFF action of the rilling nozzle was operated by hand only. This means the nozzle lid could be closed or opened when the whole equipment keep stop rotating only.

- During a stop period, the egg emulsion is heated by the hot vapor and the rilling hole becomes clogged.

- Egg emulsion could be supplied into the tube only when the equipment stops.

6.1.2 Linear motion

The equipment with linear motion performs movement in a horizontal plane. The reciprocating movement will be actuated by a direct current motor. Its speed is transferred from a circular motion and is maintain approximately at the same speed in m/min.

A. Advantaged

- Simple design

A translation movement only required a simple mechanical driving system to

carry the compression tube and perform a reciprocating movement a long the horizontal rail.

- There is no centrifugal force that causes side effect to the string shape of egg emulsion

- Ease to supply an air-compression system. The air hose was not in a mess.

- Very safe for operator to use it . Because the linear motion slowly traverses on the rail ,the consequence is the safety of operator.

- There are many rilling holes along the bottom rounded edge of the triangular cup It means the increase in the production of Foi-tong . (In case the machine prototype has been well developed)

- The speed and the height adjustment were controlled electrically

- The discharging of the egg emulsion was possible by pneumatic by which the filling system can perform its task automatically.

- The cooking temperature was controlled by a temperature controller which had been adjusted and displayed the actual and the setting temperatures digitally.

- The compression tube is also easy to maintain and disassemble for washing.

- There were two stop depots to prevent dropping of the egg emulsion and the dwell time was also set by the electrical circuit as long as required
- The decoration of control system elements can be more appropriately installed and more convenient than the circular motion.

B. Disadvantages

- The design of the linear apparatus was complicated by the control system . but it is appropriate for a large scale .
- There were a lot of machine parts which could affect the setting up cost.
- The compression tube needs a pneumatic supply which also has effect on the cost.
- This type of machine has high power consumption ,the electric stove consume 6 kW. It could not be connected to the normal 220 Volt AC power line

6.2 Conclusion

Form the start until the end of this thesis could be concluded in all aspects of the experimental equipment design and it is tested by using the following two equipment types.

6.2.1 By circular motion type

1) The operational control factors have effects on physical property of Foi-tong string as already discussed in Chapter 5. Thus, it has been concluded as follows:

a. **The effect of the pressure [p]**

By increasing the pressure of piston , the diameter of Foi-tong was inceased. (h , s = cont.)

b. **The effect of the rilling height [h]**

By increasing the rilling height , the diameter of Foi-tong was decreased. (p, s = cont.)

c. **The efffect of the rilling speed [s]**

By increasing the rilling speed , the diameter of Foi-tong was decreased. (p , h = cont.)

d. **The effect of interaction between the pressure and speed**

[p & s]

By increasing both the pressure (p) and the rilling speed (s), and decreasing the rilling height h, result in the decrease at the diameter configuration of Foi-tong string at the significant level of 0.05 ($\alpha = 0.05$)

$$p \ \& \ s \Rightarrow \varnothing, \qquad \text{at } \alpha = 0.05$$

e. **The effect of interaction between the pressure and the height**

[p & h] By increasing the pressure ,the diameter was increased . But the increasing of the rilling height forced the diameter of Foi-tong string to be smaller at the significant level of 0.05 ($\alpha = 0.05$)

$$p \ \& \ h; \Rightarrow \varnothing, \qquad \text{at } \alpha = 0.05$$

f. **The effect of interaction between the speed and the height**

[s & h] By increasing the speed ,the diameter was decreased . But the increase of the height caused the diameter to be smaller.

$$s \ \& \ h; \Rightarrow \varnothing, \qquad \text{at } \alpha = 0.05$$

g. **The interaction of the three operation control factors**

[p & s & h] also caused to the diameter configuration of Foi-tong string, at the significant level of 0.05 ($\alpha = 0.05$)

$$p \ \& \ s \ \& \ h; \Rightarrow \varnothing, \qquad \text{at } \alpha = 0.05$$

h. **The appropriate operational control factors**

The smallest diameter was considered from the mean values of diameter in Table 5.1 without the problem of bubbles and string broken up as noted in the remark column It was found that the smallest dia.was 0.78 $\pm$ 0.15.This value was corresponded to the three operational factors at the following levels :

The rilling height (h)	=	*100*	*mm*
The pressure (p)	=	*0.3*	*bar*
The rilling speed (s)	=	*90*	*rpm*

2 .The operational control factors **affected mechanical property** of Foi-tong string.

The graphs in Figure 5.6, 5.7, 5.8, 5.9 ,5.10, and 5.11 shows that all operational control factors have effect on the strength of Foi-tong string.

6.2.2 **By linear motion type**

As mentioned in Chapter V the compression tube could not exactly regulated. Therefore, the experimental test could not be followed as anticipated. The data collection was also unstable and unreliable.

The main cause :

The compression tube was not made with high precision . The pneumatic piston alignment was not parallel to the alignment of the compression tube . This caused **very high friction** . Therefore , it needed the higher pressure of 2 ,3 ,4 bar to perform the suction force inside the tube . It should not be too high in comparison to the circular motion type. Thus , because the pressure could not be controlled, the experiment was therefore interrupted . There were some data that could be collected , just enough for one way ANOVA only.

6.3 Suggestions

Suggestion for further research have been made as follows :

1. The design of a circular motion :

The use of spring compression was appropriated for the test . However for further research it could be possible to design the system in a smaller scale , to make it suitable as the house-hold apparatus for cooking in family .

A driving system can be supplied by 220 Volt current and step down for a small , low volt (12) Volt DC motor to perform the rotation .

A design should be the design for assembly ,ease of use and disassemble for cleaning

Light in weight , possibly designed in plastic material and low cost.

2) **The design of a linear motion type :**

The use of a linear motion type should be in large scale . It can be suitable for a big amount of foi-tong production . For further studied and development can be suggested as following:

A rectangular brass pan should be increased its length in order to increase the length of foi-tong string and be matching to the picking-up system.

An automatic picking-up system should be added . The design of the picking -up system should also be performed synchronously with the rilling process and its dwell time.

Light- weight designed compression tube and less friction . Ease for disassemble ,cleaning, and low cost design.