SOAKING IN VELVET BEAN TEMPEH PREPARATION AND THE REMOVAL OF CYANOGENIC GLUCOSIDES.

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Introduction.

Though velvet bean was known and in use as food very long ago by the peasants in several regions in Indonesia, not many of the people in other regions know or even heard of that bean. In those specific regions the peasant was aware of the existing toxic substance in the bean. They were cautious enough in the way of using the bean as food. They gained the knowledge, most probable through trial and error, that the toxic substance could be overcome by soaking and finsing of the boiled bean. This knowledge has been practiced in the preparation of velvet bean tempeh as the important steps the people never omitted, e.i. the soaking and the rinsing steps. There has been no additional knowledge except the strong opinion that the toxic substance was a cyanogenic glucoside, that could be used to improve the safety. Incidence of intoxications though there are relatively rare, they gave considerable impact to the people in the form of negative recommendation of the utilization of the bean to others who can find the alternatives. Only the people living in poverty who had no alternatives, then consumed the velvet bean in the form of tempeh. The situation were limited in some regions known as critical area, most of them dry land with poor soil, and high population density.

In other word it is the safety matter that limit the extension in usage and production of the bean.
Better understanding of the nature of the toxic removal supported by a suitable technique, might break open the barrier, ma-

making the bean appreciated more. The appreciation should not limited only by scientist and gouvernment officials working on food, more than that, the people should by themselves change their opinion. This will be a difficult and a long process, but with optimistic efforts in line with the need and the taste of the people the goal will be gradually achieved. The Soaking studies in this research is, one of the steps.

The present practice of soaking the bean, the most common is done after the bean is boiled and peeled.
Any available water, from well or other sources are in used. About 2 liters of water per kilogram of bean is the ratio, most commonly taken, and the soaking time is from 44 to 54 hours with rinsing every 12 hours.

The nature of the removal of the toxic substance is a diffusion process. The factors as solubility, concentration gradient, temperature and time are variables that could be manipulated for better removal.
In practice those variables are either poorly controlled or unknown by the processors. By taking full consideration of all the variables which were experimented in this study, better techniques of removal were explored.

Experimental.

For cyanogenic glucosides removal experiment, the velvet beans were boiled 40 minutes, with ash added water 3 liters per kilogram of dried bean. The proportion of ash 30 gram per liter of water were used. Peeling was them followed the operation. Part of the peeled beans were them sliced to reduce the size. The slicing were varied to obtain different sliced or the minced from whole,one half,

one fourth, one sixth, one eight, and one tenth. Soaking were done in beakers for 36 hours with replacement of water every 12 hours. At the end, HCN content of the soaked bean, were determined. This experiment is intended to know the effect of size reduction or the increase of surface area. Part of the peeled beans were placed in a series of beaker, some were soaked for 36 hours as above and the other were soaked with continued water replacement with the same water required and the same length of soaking.

The continued water replacement experiments were designed for 12 hours, 24 hours and 36 hours cruding with the HCN determination.

In addition, a series of continuous soaking for 12 hours were run with temperature variation of the water from 40°C; 50°C and 60°C.

The HCN contents were determined following the procedure of AOAC by volumetrically measured the excess of silver nitrate, after exposure of the vapour from the digested samples. Difference pH of soaking water were assayed for possible selection of a reasonable pH giving the best removal.

Result and Discussion.

In usual practice the boiled and peeled bean are soaked without any size reduction of the bean. There exist strong opinion that size reduction could contribute to the removal of the toxic substance by soaking process. The experiment reveal facts as presented in table 1.

Table 1: Toxic substance in the form of HCN of different size reduction of boiled and peeled bean after 36 hours soaking in water.

Legend of size reduction	Time of soaking (hv)	Toxic substance (percent HCN) dry basis
Whole bean	0	0.00763
Whole bean	36	0.00435
One half bean	36	0.00369
One fourth bean	36	0.00302
One sixth bean	36	0.00250
One eighth bean	36	0.00270
One tenth bean	36	0.00258

The figures indicate the reduction of the toxic substance, is better as the particle size of the boiled and peeled beans are smaller. The practice of slicing prior to soaking according to this finding could be recommended.

Actually, slicing , mincing or chopping is not an additional operation. It is only a shift of the step in the flow sheet.

If it cause difficulty it will be related to the rinsing, which m might apt to losses of the smaller sliced bean together with the discarded soaking and rinsing water.

Continuous flow of water system in the removal of toxic substance with the same amount of water, shows that the rate of removal is not improved by slow flowing of water. Higher rate of removal was found with faster flow, namely 24 hours. With very fast flowing the removal of toxic substance was not promoted. The experimental re - sults are presented in table 2 .

Table 2: Continuous water replacement system by flowing versus batch type soaking in the removal of HCN from boiled and peeled whole bean.

Type of removal	Toxic substance left (HCN percent D.B.)
Original before removal	0.00763
Batch type removal 36 hr	0.00435
Continuous removal 36 hr	0.00437
Continupus removal 24 hr	0.00385
Continuous removal 12 hr	0.00523

In princples the continuous flow system of toxic removal is promising, and the best rate of flow giving the maximum toxic removal could be found later. In this experiment and as usually in practice froth were developed , and it interfered the flow of the liquid, especially with the slower flow rate.

With more velvet bean processed, it means more water will be used , and more water will be flowed per unit of time . With such flow , wider opening could be fitted with valve . By using a long type cylidrical vessel , or in villages bamboo trunk, the fresh water could be sprayed through a valve on the top surface , and a drain valve is assembled at the bottom part of the vessel. With such setting , a fluent flow of water just like the elluent in collumn chromatography could be obtained.

Preliminary trial with bamboo setting , frothing was eliminated, the beans which are usually slimy in batch soaking were felt far less, and almost need no rinsing.

The best size of the vessel , namely the height and diameter are under study this time.

Table 3: Effect of temperature on the HCN content, product of 12 hrs continuous water replacement type of soaking.

Temperature of soaking water (Degree centigrade)	Toxic substance left (percent HCN D.B.)
26	0.00513
40	0.00484
50	0.00461
60	0.00473

Varying the temperature with 12 hours continuous water replacement in elluating the toxic substance, gave figures as presented in table 3 . With the range of the temperature chosen, the effect is not as expected . It is not known yet with higher temperature and longer ellution . With such effect it is uneconomical to apply heating of the water used to remove the toxic substance of the boiled and peeled velvet bean , in the preparation of tempeh.

Table 4 shows figures obtained from batch soaking of boiled and peeled velvet bean in different pH of water .

Table 4: HCN content of soaked beans left, after soaking 36 hours in water with varying pH.

The pH of soaking water	Toxic substance left (percent HCN D.B.)
3	0.00414
4	0.00368
5	0.00367
6	0.00362
7	0.00335
8	0.00417
9	0.00342