CHAPTER IX

CONTACT EQUILIBRIUM FOR EXTRACTION

9.1 Apparatus

9.1.1 Centrifuge (MSE CENTAUR 2)

9.1.2 Shaker (Aquaterm water bath shaker)

9.1.3 Refractometer (ATAGO, 0-16% $\pm$ 1%)

9.2 Reagents

9.2.1 Lactic acid 80%

9.3 Procedure

9.3.1 Equilibrium time

i) Prepared yeast autolysate with addition of papain at the level of 0.1% (based on dry weight of yeast protein), adjusted pH of yeast slurries to 6 and incubated yeast slurries at 50°C for 48 hours.

ii) Separated yeast autolysate from cell debris by centrifuging at 3000 rpm for 15 minutes, collected cell debris.

iii) Added distilled water to cell debris ranging from 1:2 to 1:30 (by dry weight) and shaked by shaker at 200 rpm, 30°C for different periods of time ranging from 2.5 to 9.0 minutes, until total soluble solid in solution was constant.

iv) Plotted total soluble solid against time.

9.3.2 Equilibrium line

i) Added distilled water to cell debris as 9.3.1 ii ranging

from 1:2 to 1:30 (by dry weight) and shaked by shaker at 200 rpm, 30 C for 8 minutes .

ii) Separated the supernatant and cell debris by centrifugation at 3000 rpm for 15 minutes, collected both supernatant and cell debris.

iii) Determined percentage total nitrogen both in supernatant and cell debris .

iv) Plotted percentage total nitrogen of supernatant against percentage total nitrogen of cell debris .

9.4 Results of contact equilibrium for extraction

9.4.1 Equilibrium time

Soluble solid (°brix) in supernatant at different time of extraction are shown in Table 9-1 and Figure 9-1.

Table 9-1 Contact equilibrium data for extraction of soluble solid (°brix) from autolysed yeast cells

Time (minutes)	Ratio of yeast (dry basis) to water (w/w)				
	1:2	1:3	1:7	1:15	1:30
2.50	9.6	8.2	5.0	2.6	1.2
5	10.0	8.4	5.2	2.8	1.4
6	10.2	8.5	5.3	2.9	1.5
7	10.4	8.6	5.4	3.0	1.6
8	10.6	8.7	5.5	3.1	1.7
9	10.6	8.7	5.5	3.1	1.7

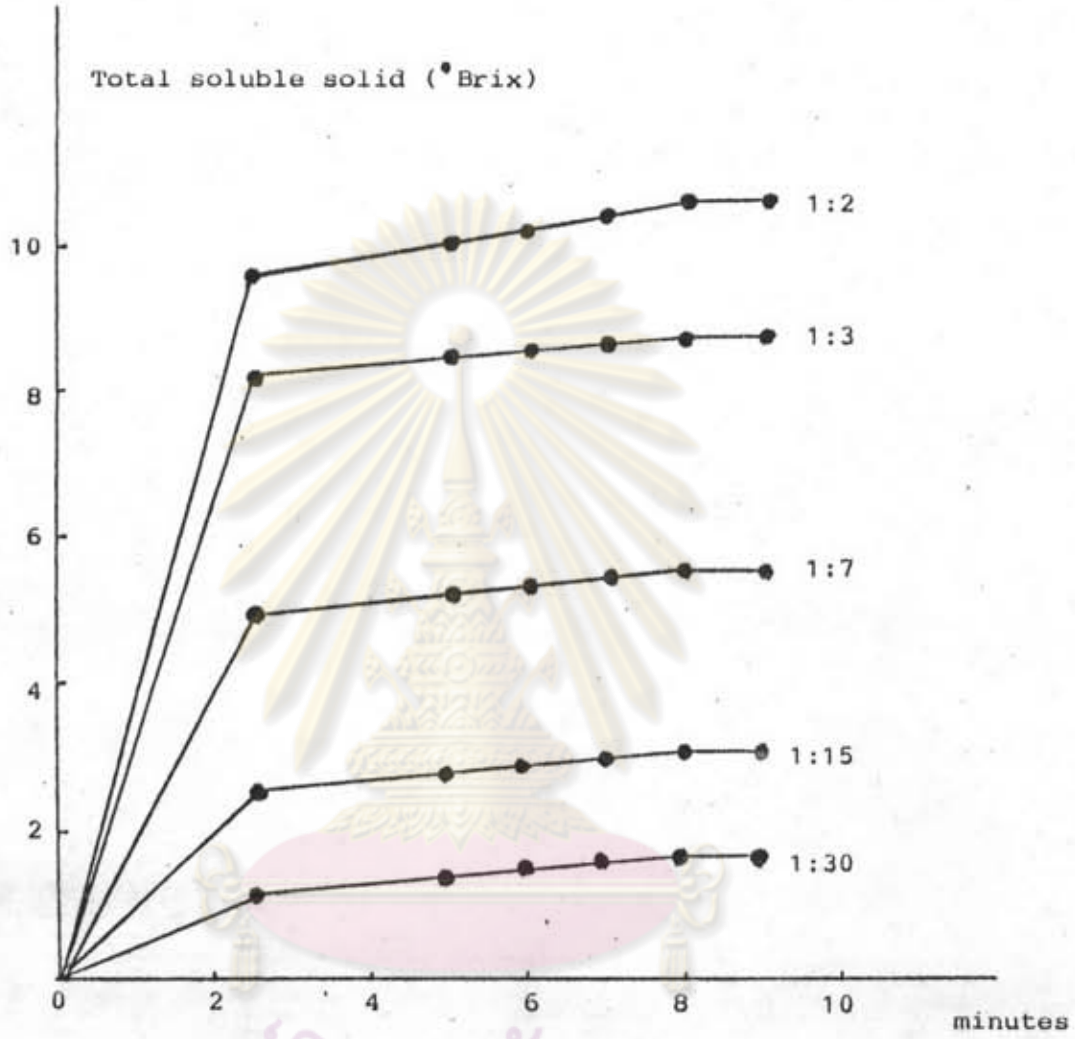

Figure 9-1 Equilibrium time of extraction at 30°C 200 rpm

9.4.2 Equilibrium line

Nitrogen contents of supernatant and yeast cell at different ratio of yeast to water are shown in Table 9-2 and Figure 9-2.

Table 9-2 Contact equilibrium data for extraction of soluble nitrogen from autolysed yeast cells

Ratio of yeast (dry basis) to water (w/w)	Percentage of nitrogen in supernatant (g/100 g supernatant)	Percentage of nitrogen in cell debris (g/100 g in dry weight)
1:2	1.12 ± 0.01	6.80 ± 0.14
1:3	0.90 ± 0.01	6.31 ± 0.17
1:7	0.56 ± 0.01	5.93 ± 0.12
1:15	0.32 ± 0.01	4.88 ± 0.04
1:30	0.19 ± 0.00	4.54 ± 0.01

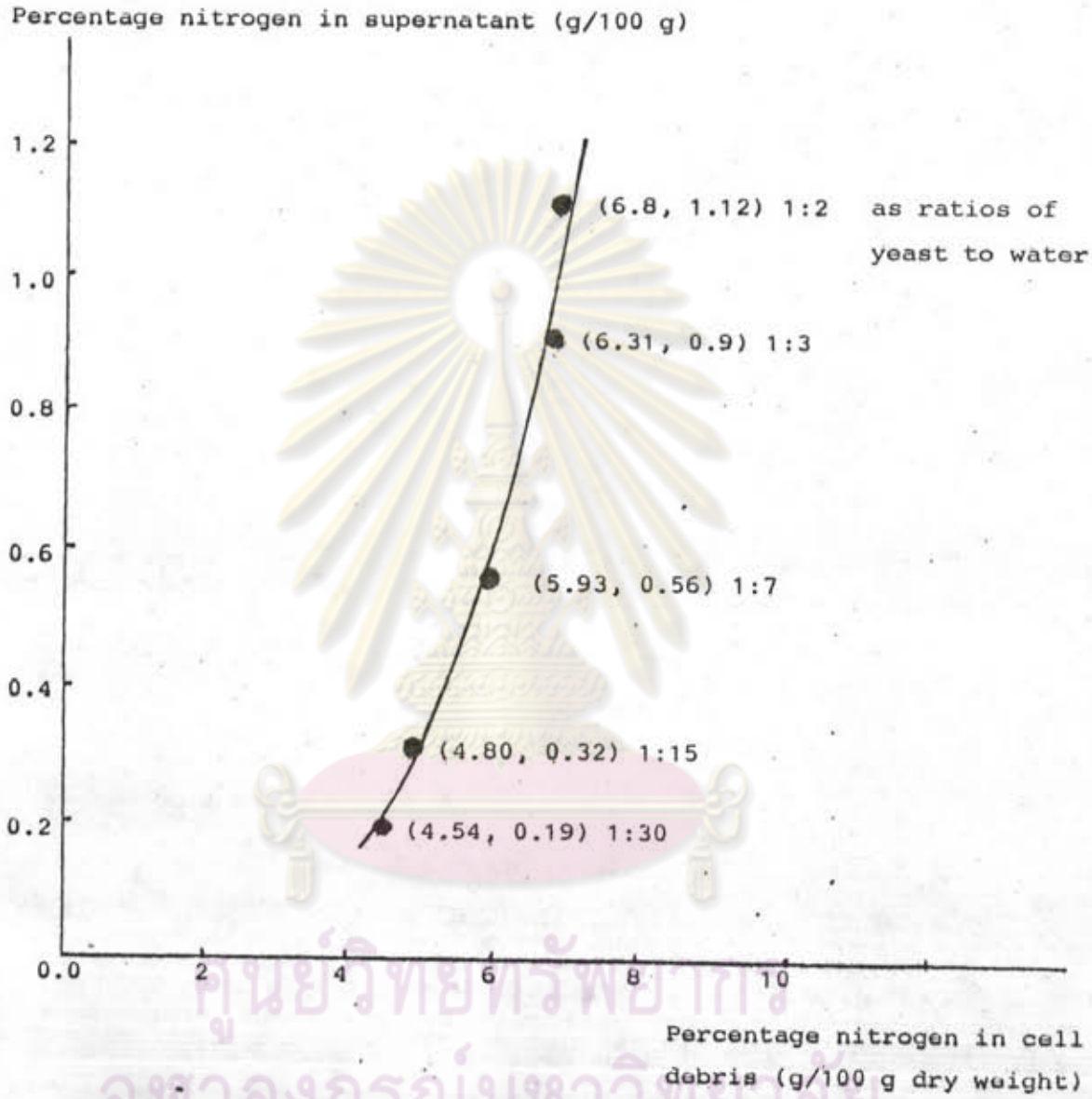

Figure 9-2 Equilibrium line of extraction at 30 °C, 200 rpm

9.5 Discussion

9.5.1 Equilibrium time

It is necessary to ensure condition of equilibrium (i.e. equilibrium time) in determining equilibrium line. From experimental results shown in Table 9-1, Figure 9-1, it took 8 minutes to achieve equilibrium in every ratio of yeast to water. It took short time to achieve equilibrium because yeast cells were small (about 1 μ) and had more interfacial area to contact liquid stream, therefore the rate of transfer of solubles is great.

9.5.2 Equilibrium line

Experimental results shown in Figure 9-2 demonstrated that the slope of equilibrium line was large. For a given configuration of extraction and hence its operating line, slope of operating line will affect the number of stages required in the extraction to achieve a given extraction yield. From equation 6.3, L/V is the slope of operating line. Large slope of an operating line will require more stages to acquire a given extraction yield. Small L/V implies high ratio of water to cell debris solid and more evaporative duty will be required to concentrate the extract obtained.