

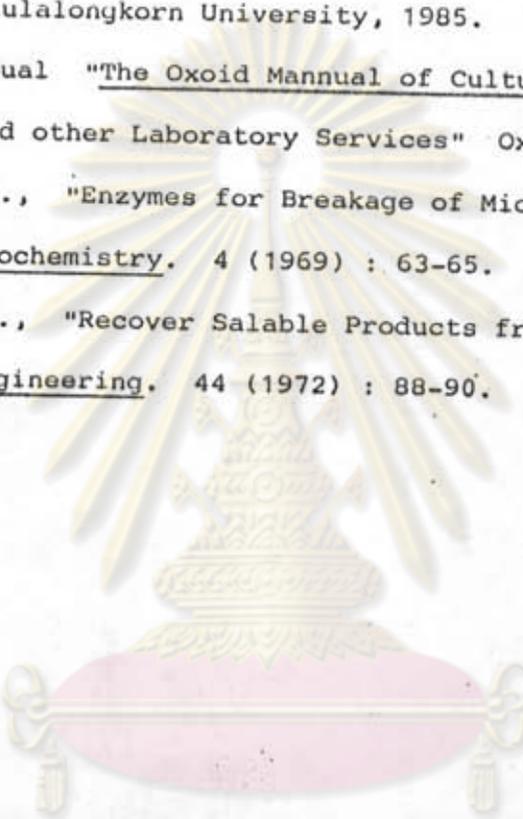
REFERENCES

1. Akin, c., Murphy, R., "Method for Accelerating Autolysis of Yeast"
U. S. Pat 4,285,976 Aug. 25, 1981.
2. Albrecht, J. J., Deindoefer, F. H., "Autolyzed Yeast Extracts Make
Food Flavorful" Food Engineering. 38 (1966) : 92-95.
3. Association of Official Analytical Chemists. "Official Methods of
Analysis" Association of Official Analytical Chemist Inc.,
Arlington., 1984.
4. Batterham, E. S.; Schutz, P. R., "Utilization of Brewers Yeast by
Pigs in Proceeding of the Seventeenth Convention (Clarke,
B. J., Harvey, J. V., Itzcovitz, S., James, A. A., eds.)
pp. 167-171. Perth, Western Australia, 1982.
5. Chao, K. G., Mc Carthy, E. F., Mc Conaghy, G. A., "Yeast Autolysis
Process" U. S. Pat 4,218,481 Aug. 19, 1980.
6. Clerck, D. J. Analysis of Yeast in A Text Book of Brewing, pp. 394.
Batterham & Hall Ltd, London, 1958.
7. Cochran, W. G., Cox, G. M., Factorial Experiment in Experimental
Design, pp. 122-146. John Wiley & Sons, New York, 1957.
8. Dixon, I. J. "Hop Substances and Yeast Behavior" Journal of
Institute of Brewing. 73 (1967) : 488-493.
9. Dixon, I. J., Leach, A., "The adsorption of Hop Substances on the
Yeast Cell Wall" Journal of Institute of Brewing. 74 (1968)
: 63-67.
9. Earle, R. L. "Contact Equilibrium Separation Process" in Unit
Operations in Food Processing, pp. 191-201. Pergamon
Press, London, 1965.

11. Ellison, J. "The Commercial Utilization of Waste Brewer's Yeast"
Brewing and Distilling International. 41 (1), (1974) :
29-31, 35.
12. European Brewery Convention. "Analytica - EBC." A. G. für Verlag
und Druckerei., Ch - 9403 Goldach., 1975.
13. Farnum, C. C., Cleland, J., "Extraction of Protein from Mechanically
Disrupted Feed Dried Brewer's Yeasts" Journal of Milk
Technology. 38 (4), (1975) : 219-222.
14. Hill, F. F. "Process for the Production of a Yeast Autolysate"
U. S. Pat 4,264,628 Apr. 28, 1981.
15. Holder, M. G. "Why Yeast Extracts are Important" Food Processing
Industry. 46 (1977) : 38-39.
16. Hough, J. S., Maddox, I. S., "Yeast Autolysis" Process Biochemistry.
5 (1970) : 50-52.
17. Hough, J. S., Briggs, D. E., Stevens, R., "Biology of Yeast" in
Malting and Brewing Science, pp. 425-431. Chapman and
Hall Ltd., London, 1971.
18. Indian Standard Institute. "Specification for Yeast Extract,
Microbiological Grade." Manak Bhavan, 9 Bahadur Shah Zafar
Marg New Delhi 110001., 1973.
19. Knorr, D., Shetty, K. J., Kinsella, J. E., "Enzymatic lysis of
Yeast Cell Walls" Biotechnology and Bioengineering.
21 (11), (1979) : 2011-2021.
20. Knorr, D., Shetty, K. J., Hoad, L. F., Kinsella, J. E., "An
Enzymatic Method for Yeast Autolysis" Journal of Food
Science. 44 (1979) : 1365.
21. Maltz, M. A. "Biochemical Methods of Protein Production" in
Protein Food Supplements, pp. 21-43. Noyes Data Corporation,

- Park Ridge, New Jersey, 1981.
22. Mazur, P. "Manifestations of Injury in Yeast Cells Exposed to Subzero Temperatures" Journal of Bacteriology. 82 (1961) : 662-672.
 23. Mazur, P. "Physical and Chemical Basis of Injury in Single - Cell Microorganisms Subjected to Freezing and Thawing" in Cryobiology, (Harold, M. ed.) pp. 263-269. Academic Press, London and New York, 1966.
 24. Menegazzi, G. S., Ingledew, W. M., "Heat Processing of Spent Brewer's Yeast" Journal of Food Science. 45 (1980) : 182-196.
 25. Mogren, H., Lindblom, M., Hedenskoy, G., "Mechanical Disintegration of Microorganisms in an Industrial Homogenizer" Biotechnology and Bioengineering. 15 (1974) : 261-274.
 26. Pepler, H. J. "Yeast Extracts (Review) " Economic Microbiology. 7 (1982) : 293-312.
 27. Perlman, D. "Disintegration of Cell" in Fermentation Advances, pp. 249-267. Academic Press, New York, 1969.
 28. Pyke, M. "The Technology of Yeast" in The Chemistry and Biology of Yeast, (Cook, A. H. ed.) pp. 535-568. Academic Press, New York, 1958.
 29. Robbin, E. A., Ridge, H., Sucher, R. W., Seeley, R. D., Suchuldt, E. G., Newell, J. A., Sidoli, D. N., "Concentrated Extract of Yeast and Processing of Making Same" U. S. Pat 3,914,450 Oct. 21, 1975.
 30. Sugimoto, H., "Synergistic Effect of Ethanol and Sodium Chloride on Autolysis of Baker's Yeast for Preparing Food Grade Yeast Extract" Journal of Food Science. 39 (1974) : 939-942.

31. Sugimoto, H., Takuchi, H., "Process for Autolysis of Yeast"
U. S. Pat 3,961,080 June. 1, 1976.
32. Teeradakorn, S. "Production of glucose isomerase by Streptomyces
sp 190-1 in 5 Lit Fermentor" Master's Thesis (to be
published) , Major Biotechnology, Graduate School,
Chulalongkorn University, 1985.
33. Oxoid Mannual "The Oxoid Mannual of Culture Media, Ingredients
and other Laboratory Services" Oxoid Limited, London, 1968.
34. Wiseman, A., "Enzymes for Breakage of Micro - Organism" Process
Biochemistry. 4 (1969) : 63-65.
35. Wysocki, G., "Recover Salable Products from Waste Yeast" Food
Engineering. 44 (1972) : 88-90.



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Appendix I

Analysis of Variance for Table 8-4

pH (A)	Temperature (°C) (B)			Totals
	40	50	60	
4	77.79	79.48	66.91	Σ 451.30
	78.06	80.45	68.61	
	<u>155.85</u>	<u>159.93</u>	<u>135.52</u>	
5	76.58	80.09	60.95	Σ 433.32
	73.55	79.13	63.02	
	<u>150.13</u>	<u>159.22</u>	<u>123.97</u>	
6	79.33	80.36	61.99	Σ 442.45
	77.88	82.16	60.73	
	<u>157.21</u>	<u>162.52</u>	<u>122.72</u>	
			Σ 1327.05	

Factor A is pH.

Factor B is temperature.

$$\begin{aligned}
 \text{Sum of square total (SSy)} &= \left[\sum \sum \sum Y_{ijk}^2 \right] - \left[\left(\sum \sum Y_{ijk} \right)^2 / n \right] \\
 &= \left[(77.79)^2 + (78.06)^2 + (76.58)^2 + \dots \right. \\
 &\quad \left. (60.73)^2 \right] - \left[(77.79 + 78.06 + \dots 60.73)^2 \right] \\
 &\quad / 18 \\
 &= 98852.12 - 97839.71 \\
 &= 1012.41
 \end{aligned}$$

$$\begin{aligned}
 \text{Sum of square factor A} &= \left[\left(\sum Y^2_{i..} / br \right) \right] - \left[\left(\sum \sum Y_{ijk} \right)^2 / n \right] \\
 (SS_A) &
 \end{aligned}$$

$$\begin{aligned}
 &= \left[(451.30)^2 + (433.32)^2 + (442.45)^2 \right] \\
 &\quad / 6 - \left[(77.79 + 78.06 + \dots 60.73)^2 \right] / 18 \\
 &= 97866.65 - 97839.71 \\
 &= 26.94 \\
 \text{Sum of square of factor} &= \left[(\sum Y^2 \cdot j. / ar) \right] - \left[(\sum \sum Y_{ijk})^2 / n \right] \\
 B (SS_B) &= \left[(157.21)^2 + (162.52)^2 + (122.72)^2 \right] / 6 \\
 &\quad - \left[(77.79 + 78.06 + \dots 60.73)^2 \right] / 18 \\
 &= 98772.57 - 97829.38 \\
 &= 943.19 \\
 \text{Sum of square interaction} &= \left[(\sum Y^2_{ij.} / r) \right] - \left[(\sum \sum Y_{ijk})^2 / n \right] \\
 AB (SS_{AB}) &= SS_A - SS_B \\
 &= \left[(155.85)^2 + (159.93)^2 + (135.52)^2 \right] / 2 \\
 &\quad - \left[(77.79 + 78.06 + \dots 60.73)^2 \right] / 18 \\
 &\quad - SS_A - SS_B \\
 &= 98839.50 - 97839.71 - 26.94 - 943.19 \\
 &= 29.66 \\
 \text{Sum of square of error} &= SS_Y - SS_A - SS_B - SS_{AB} \\
 (SS_E) &= 1012.41 - 26.94 - 943.19 - 29.66 \\
 &= 12.62
 \end{aligned}$$

Source of variation

Source	Degree of freedom	Sum of square	Mean square
A	2	26.94	13.47
B	2	943.19	471.50
AB	4	29.66	7.41
Error	9	12.62	1.40

Test for hypothesis

For interaction ;

$$H : (\alpha\beta)_{ij} = 0$$

$$f \ 9.99/1.40 = 7.136$$

$$f \ 0.05, 4, 9 = 3.62$$

One may have at least 95% confident level that interaction exists.

For factor A

$$H : \mu_i = 0$$

$$f \ (MS_A/MS_E) = 13.47/1.40 = 9.42$$

$$f \ 0.05, 2, 9 = 4.26$$

At 95% confident level, pH affects percentage yield of nitrogen in autolysed yeast .

For factor B

$$H : \beta_j = 0$$

$$f \ (MS_B/MS_E) = 471.50/1.40 = 336.78$$

$$f \ 0.05, 2, 9 = 4.26$$

At 95% confident level, temperature affects percentage yield of nitrogen.

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Appendix II

Yate's Method for Table 8-6 (Cochran, 1957)

Treatment combination total		1	2	3	Contrast means
1	113.89	256.52	569.99	1187.26	Mean effect = 74.20
a	172.63	283.47	617.27	191.3	A +23.91
b	114.38	307.31	113.45	-0.4	B -0.05
ab	169.09	309.96	77.85	-7.24	AB -0.91
c	133.39	58.74	-3.05	47.28	C +5.91
ac	173.92	54.71	2.65	-35.6	AC -4.45
bc	136.32	40.53	-4.03	5.7	BC +0.71
abc	173.64	37.32	-3.21	0.82	ABC +0.102

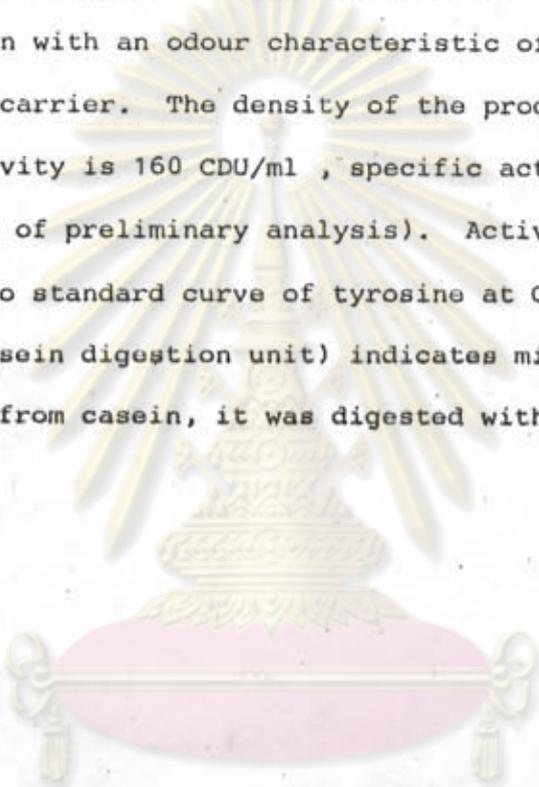
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Appendix III

Vegetable Protease Concentrate (Cariya papaya)

Auxilase liquid [®] (papain) is a clear, yellow-coloured, viscous solution with an odour characteristic of the proteases. Glycerol is employed as carrier. The density of the product is 1.26 (Merck No. 7138), activity is 160 CDU/ml, specific activity is 84.2 CDU/mg protein (Result of preliminary analysis). Activity was determined at OD₂₈₀ compare to standard curve of tyrosine at OD₂₈₀.

CDU (casein digestion unit) indicates microgram of tyrosine that liberated from casein, it was digested with papain for 1 minute at 37° C.



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Appendix IV

Specificalaation and Standard

Requirements for yeast extract in Indian Standard

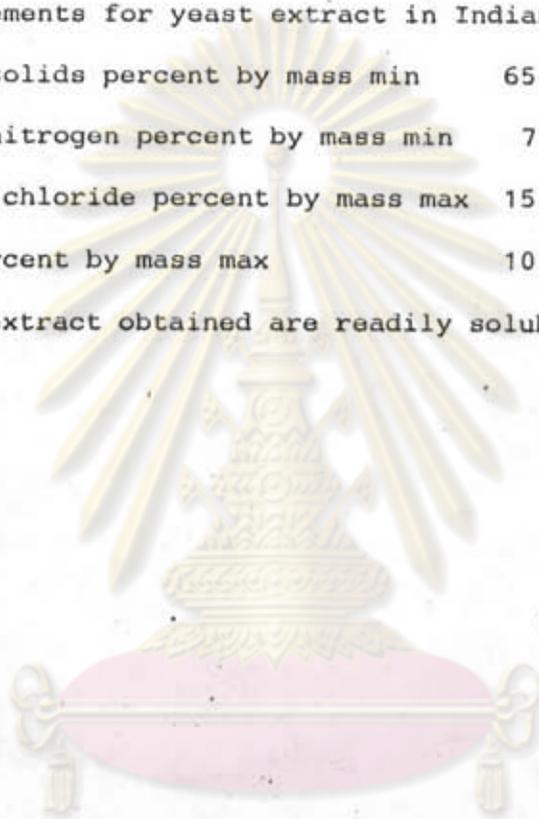
Total solids percent by mass min 65

Total nitrogen percent by mass min 7

Sodium chloride percent by mass max 15

Ash percent by mass max 10

Yeast extract obtained are readily soluble in water.



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