

THE CHEMICAL ENGINEERING DIPLOMATE: A NEW SOURCE OF SENIOR PROCESS PERSONNEL

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Abstract

For the past two decades, most senior process personnel for South African sugar factories have been holders of the Diploma in Sugar Technology. Factors that have led the industry to withdraw this course and offer training towards a Diploma in Chemical Engineering instead, are discussed. The syllabus contents of both courses are compared and the continuing involvement of the Sugar Milling Research Institute (SMRI) in the latter course is indicated.

Introduction

The training of Sugar Technologists in South Africa was comprehensively covered in 1981 by Wiehe.¹ Two years later it was decided to shelve the Diploma in Sugar Technology and draw future process personnel from those who hold the Diploma in Chemical Engineering which was introduced by local Technikon about 5 years ago. The short-comings of the Diploma in Sugar Technology that led to this change are discussed and the curricula of both Diplomas are compared. Related courses offered by the South African Sugar Association's Industrial Training Centre are also presented.

Shortcomings of the Sugar Technology Course

Several meetings involving the SMRI, the local Technikon and the industry, culminated (in May 1983) in a symposium on training held at the SMRI. At this symposium, three disadvantages of the Diploma in Sugar Technology course were identified and several recommendations were made.

Over-specialisation

Thirty percent of lecture-time was spent on specialist sugar subjects and only eighteen percent on general Chemical Engineering subjects. The Diplomate thus had a comprehensive education in Sugar Technology but lacked sufficient training in other engineering fields. This was to the detriment of the technologist as he could not readily move out of the industry — and his employer, because there was little chance of his factory benefiting from experience gained outside the confines of his mill. It should be noted that at the inception of the Diploma in Sugar Technology, this may have been considered to be an advantage.

Viability

All three local Technikon can offer the Diploma in Sugar Technology on an annual basis, but there is insufficient demand from the industry to warrant this, perhaps even at one Technikon. A course offered only intermittently is difficult to organise and detracts from the image of the Technikon since the course cannot be included permanently in its prospectus. The Diploma has served the industry well and it must be conceded that its non-viability is partly because there are three Technikon all attempting to offer the same course.

Status of the Diplomate

The status of processing staff at factories was believed to be lower than that of their counterparts in the engineering department. It was felt that this was because senior engineers were almost exclusively University graduates who often brought to the factory extensive experience from other industries. It is rare indeed to draw a Sugar Technologist from a non-sugar environment.

Recommendations

It was recommended at the symposium that:

- the Diploma and Certificate courses in Sugar Technology should be stopped at the end of 1983 and 1984 respectively.
- the industry should draw senior process staff from either University- or Technikon-trained Chemical Engineers who would have a broader educational background.
- milling companies rather than the SMRI should recruit and offer bursaries or employment to students.
- the SMRI should be responsible for the supervision of students during their periods of practical training, and that some of this time should be used to deliver lectures in Sugar Technology.
- Chemical Engineers who join the industry should attend an intensive course in Sugar Technology which should be provided by the SMRI.
- the South African Sugar Association's Industrial Training Centre should continue to provide a range of courses for existing factory process staff. Details of the courses are given in the Appendix.

The Diploma in Chemical Engineering

The curriculum of the three semesters of theory for this Diploma compared with that of the discontinued Diploma in Sugar Technology is given in Table 1.

TABLE 1
Comparison of curricula of the Diploma in Sugar Technology and the Diploma in Chemical Engineering

Semester	Sugar Technology	Chemical Engineering
First	1. Chemistry Theory 2. Chemistry Practical 3. Physics 4. Mathematics 5. Chemical Works Organisation and Practice I 6. Sugar Manufacture	1. Chemistry Theory 2. Chemistry Practical 3. Physics 4. Mathematics 5. Chemical Works Organisation and Practice I
Second	7. Organic Chemistry I 8. Chemical Plant I 9. Analytical Chemistry Practical 10. Analytical Chemistry Theory 11. Sugar Technology I 12. Sugar Machinery I 13. Factory Control	6. Organic Chemistry 7. Chemical Plant I 8. Inorganic Chemistry 9. Physical Chemistry 10. Chemical Technology 11. Drawing: Chemical Engineering
Third	14. Chemical Works Organisation and Practice II 15. Chemical Plant II 16. Sugar Technology II 17. Sugar Machinery II 18. Organic Chemistry 19. Sugar Cane Husbandry 20. Drawing: Chemical Engineering	12. Chemical Works Organisation and Practice II 13. Chemical Plant II 14. Statistical Methods 15. Applied Thermodynamics 16. Chemical Technology II

TABLE 2

Comparison of lecture time allocated to subjects and subject groups in the Diploma in Sugar Technology and the Diploma in Chemical Engineering

Subject group	Sugar Technology			Chemical Engineering		
	Subject title	Time allocated		Subject title	Time allocated	
		Hours	%		Hours	%
General	Physics	136	9	Physics	136	9
	Mathematics	85	5	Mathematics Statistical Methods	85 68	6 5
	Total for this group	221	14	Total for this group	289	20
Chemistry	Chemistry Theory	102	6	Chemistry Theory	102	7
	Chemistry Practical	68	4	Chemistry Practical	68	5
	Organic Chemistry I & II	153	11	Organic Chemistry	102	7
	Analytical Chemistry Theory	68	4	Inorganic Chemistry	102	7
	Analytical Chemistry Practical	68	4	Physical Chemistry	68	5
	Total for this group	459	29	Total for this group	442	31
Chemical Engineering	Chemical Plant I & II	187	12	Chemical Plant I & II	187	13
	Drawing: Chemical Engineering	102	6	Drawing: Chemical Engineering	102	7
				Chemical Technology I & II	187	13
				Applied Thermodynamics	102	7
	Total for this group	289	18	Total for this group	578	40
Management	Chemical Works Organisation & Practice I & II	136	9	Chemical Works Organisation & Practice I & II	136	9
	Total for this group	136	9	Total for this group	136	9
Sugar	Sugar Manufacture	68	4	NIL		
	Sugar Technology I & II	153	10			
	Sugar Machinery I & II	170	11			
	Factory Control	34	2			
	Sugar Cane Husbandry	51	3			
	Total for this Group	476	30			
	Course total	1581	100	Course total	1445	100

Features to note are that the first-semester subjects are identical and that the new course has only sixteen subjects instead of the twenty for the Diploma in Sugar Technology.

The courses are compared in greater detail in Table 2. Forty percent of the Diploma in Chemical Engineering courses comprise Chemical Engineering subjects; the figure for the Diploma in Sugar Technology is eighteen percent. In both courses, however, only nine percent of the time is devoted to subjects that teach managerial skills and computer usage is not included in either Diploma. It is planned to replace Chemical Works Organisation and Practice I with a new subject that would include Computer Science as one-third of its syllabus. The time that will be devoted to teaching the basics of Sugar Technology to Chemical Engineering students during their practical training is not included in this table.

The course is run on a "sandwich" basis at the local Technikons as well as at Technikons in other provinces. Several unsponsored students are following the course. Difficulty in placing students in industry for their practical training has been experienced by the Technikons, and at least one College is teaching the three theory semesters consecutively.

It is therefore possible to recruit trainees who have completed one or two semesters, thus avoiding the need to employ a first-year student who might have a 40 to 50% chance of failing the course. Another option is to employ students who have completed the Diploma, or at least the theoretical part of it.

The Higher Diploma in Chemical Engineering

This is a "post-graduate" Diploma; holders of the Diploma in Chemical Engineering or in Sugar Technology may study

towards it. It is offered as a part-time or day-release course over 2½ to 3 years. Curriculum details are given in Table 3.

TABLE 3

Curriculum of the National Higher Diploma in Chemical Engineering

Part 1	Mathematics I Chemical Engineering Drawing Thermodynamics: Chemical Engineering I Applied Physical Chemistry Principles of Chemical Engineering Production Engineering in the Chemical Industry Information Retrieval and Documentation
Part 2	Mathematics II Thermodynamics: Chemical Engineering II Unit Operations Fluid Flow Heat and Mass Transfer Process Plant Design

Involvement of the Sugar Milling Research Institute

A three week intensive course in Sugar Technology is available. The core of the specialist component of the old Diploma course is taught. It is planned to offer this course annually, or as demand may determine. Further details are given in Table 4.

TABLE 4

Intensive course in Sugar Technology for Chemical Engineering and Chemistry Graduates and Diplomates

Day	Lecture and tutorial	Laboratory practical
1	Factory Terminology	Pol, brix and purity
2	Cane Handling & Cane Preparation	Reducing sugar analysis Starch
3	Cane Milling	—
4	Cane Diffusion	—
5	Juice Clarification	—
6	Mud Filtration	Colour analyses
7	Juice Heating	Sugar analyses
8	Evaporation	Sugar analyses continued
9	Sugar Boiling and Crystallisation	—
10	Masseccuite Centrifugation	—
11	Factory Control	Filtrate analyses
12	Aspects of Steam Usage	Miscellaneous analyses
13	Refinery Operations	Test (Theory)
14	Instrumentation	Effluent handling (Lecture)
15	Test Review	—

The SMRI is also available to establish a programme for, and to supervise students while, they are at mills undertaking practical training. This would supplement the assistance offered by the Technikons.

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REFERENCE

1. Wiehe, H.F. (1981). Activities of the Training Division of the SMRI - A Seventeen-year Review. *Proc S Afr Sug Technol Ass* 55:59-61.

APPENDIX

Processing Courses available at the South African Sugar Association's Industrial Training Centre

Module No.	Contents	Duration
1. Sugar manufacture		
1	Introduction to Sugar Manufacture	4 days
2	Basic Theoretical Aspects	4 weeks
3	Juice Extraction	2 weeks
4	Clarification and Filtration	1 week
5	Evaporation	1 week
6	Pan Boiling	1 week
7	Crystallisation, Centrifugation and Sugar Drying	1 week
8	Quality Control	3 weeks
2. Laboratory worker		
1	Use of Laboratory Equipment. Basic Factory Analytical Determinations	4 weeks
2	Further Analyses	4 weeks
3	Analyses Concluded. Calculation of Daily Reports etc.	4 weeks
3. Pan boiler		
1	Pan Boiling	2 weeks