

degrees or doctorates.

The situation is different with regard to Chemical Engineering, since the professional title of Chemical Engineer is conceded not by the university but by a professional association, *Ordem dos Engenheiros*. With reference to the recruitment of people with Master's degrees and doctorates their situation is, however, the same as that of Chemists.

Continuous education is still in its initial stages in Portugal. In general, it is represented by short courses organised by the universities or, very much more recently, by the integration of some industrial employees in Master's degree courses, authorised by their employers.

## 2. NEW TRENDS IN EDUCATION IN CHEMISTRY

It is difficult, within the scope of this national report, to call attention to necessities specific to Portugal. We believe that the main necessities tend at this moment, to be universal. The principal problems which exist in the teaching of Chemistry at university level result mainly from three factors:

i) the exponential development of Chemistry, whether at the simple level of new facts or, much more important, at the level of the appearance of new sub-areas of chemical knowledge.

ii) the great expansion of university education, with the consequent appearance of new kinds of students who need to be motivated.

iii) a general climate which has established itself in which society, in symbiosis with the media, is only interested in what is immediately applicable and, lacking scientific bases, blindly supports new fashions.

The challenge is to produce a new curriculum, no longer than the present undergraduate course, which reconciles a solid basic training according to a problem-solving perspective with a first approach to

the new, emerging areas and with the transmission of a sufficient number of facts consistent with a training in Chemistry.

Additional problems in Portugal which make the resolution of this situation more difficult is the poor training of students in Chemistry at the time they enter the university and their poor command of the English language, as most of the text books used are written in this language. The lack of industrial experience can also be a problem, whether from the point of view of the employer or of the young Chemist. The experience of sandwich courses should be evaluated from this perspective.

## 3. SUGGESTIONS

On an experimental basis, and for those universities that wish to adhere, to begin a course of Chemistry (at undergraduate level) which has a curriculum in common with various countries. The exchange of professors and students could then occur more easily, despite the eventual linguistic barriers.

1. The term *Licenciatura* is the title given to the first degree conceded by Portuguese universities

### Appendix 1 Degrees in chemistry in portuguese public universities<sup>a</sup>

#### 1. Universidade de Trás-os-Montes e Alto-Douro

- Physics and Chemistry (educational branch)

#### 2. Universidade do Minho

- Physics and Chemistry (educational branch)
- Chemistry (branch of control of quality of textile materials)
- Chemistry (branch of control of quality of plastic materials)

#### 3. Universidade do Porto

- Chemistry (scientific branch)
- Chemistry (educational branch)

#### 4. Universidade da Beira Interior

- Industrial Chemistry

#### 5. Universidade de Aveiro

- Physics and Chemistry (educational branch)
- Food Chemistry
- Chemistry (analytical chemistry branch)

#### 6. Universidade de Coimbra

- Chemistry (scientific branch)
- Chemistry (educational branch)
- Industrial Chemistry

#### 7. Universidade de Lisboa

- Chemistry (scientific branch)
- Chemistry (educational branch)
- Technological Chemistry

#### 8. Universidade Nova de Lisboa

- Applied Chemistry

#### 9. Universidade Técnica de Lisboa\*

- Instituto Superior Técnico
- Chemical Engineering (branch of Applied Chemistry)

#### 10. Universidade de Évora

- Physics and Chemistry (educational branch)

#### 11. Universidade do Algarve

- Physics and Chemistry

#### 12. Universidade da Madeira

- Chemistry (scientific branch)
- Chemistry (educational branch)

<sup>a</sup> Biochemistry degrees are not included

\*This is a degree in Chemical Engineering. However the content of Chemistry in the curriculum is high enough to include it in the list of the degrees in chemistry.

Source: Ministry of Education, Guia de acesso ao Ensino Superior

### Appendix 2 Examples of curricula for first degree in chemistry (*licenciatura* in some of the portuguese public universities)

Nota: Este apêndice é omitido, dado que os currículos descritos foram publicados em números recentes do *Química*.

### Appendix 3 M. Sc. Degree courses currently running in Portuguese public universities

#### Universidade do Minho

- Methodology of Teaching of Physics
- Chemistry (pedagogical branch)

#### Universidade de Aveiro

- Physics and Chemistry (pedagogical branch)