

2.12 Contributions to the Development of Chemistry in South America: The Link between the Universities of Surrey, UK and San Agustin, Peru

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Based on experience gained in the 1961-70 period as an undergraduate student and later as a member of the teaching staff at the National University of the South, Bahia Blanca, Argentina, we have been developing long term projects in chemistry with well established objectives taking into account that applied science requires basic science and if genuine help is to be given to developing countries this help should be geared to provide the basis so these countries are able to develop their own technology. I discuss here:

1. The development of an MSc programme in chemistry at the National University of San Agustin, Arequipa, Peru.
2. Research developments in areas relevant to the needs of Peru.
3. The creation of the European Latin American Research Group on 'Macrocyclic Ligands for the Design of New Materials'.

1. Establishment of the MSc Programme in Chemistry in Peru

The MSc programme in chemistry at the National University of San Agustin, Arequipa, Peru was established in 1984 as the result of an agreement of collaboration in the field of chemistry signed by this University and the University of Surrey, UK. This programme was financially supported by the Overseas Development Administration (ODA), the British Council, the Peruvian National Research Council (CONCYTEC) and the University of San Agustin. The University of Surrey agreed to provide the academic staff to run most of the postgraduate courses in Peru with myself as Academic Director of the MSc programme.

This programme is currently offered to members of the academic staff of eight Universities in the southern region of Peru as well as graduates in chemistry and related areas working in industrial institutions in Peru. Its aims are:

- (a) to provide up to date knowledge in the three main branches of chemistry (organic, inorganic and physical chemistry).
- (b) to emphasise the role of industry in the national economy of the country by the introduction of two postgraduate courses in industrial chemistry.

- (c) to provide the basis for future research developments by encouraging students to make critical assessments of scientific papers related to the lecture course.

The course is run as a 3-year 'batch' process with intakes in 1984, 1987, and 1991. The award of the MSc degree of the University of San Agustin is given after the successful completion of twelve postgraduate courses in chemistry and a final research project, lasting two and a half years on a part-time basis.

The postgraduate courses (two years) are Inorganic Chemistry I and II, Organic Chemistry I, II and III, Physical Chemistry I, II and III, Quantum Mechanics, Mathematics and Industrial Chemistry I and II. Most of the courses were taught in English with simultaneous translation into Spanish during the first year. In the second year, students became familiarised with the language and translation was not always required. A period of six months was allocated for the research projects, most of which were funded by CONCYTEC. The areas covered ranged from aspects directly related to local industry (copper extraction, food science, natural products, water pollution) to pure academic research (different aspects of solution chemistry, metal extraction, thermochemistry). These projects were designed taking into account the available resources in terms of laboratory facilities in San Agustin which are very limited. Some of the projects were carried out in industry or with facilities provided by other universities in Peru. All research projects were externally assessed by Professor Wadsö, University of Lund, Sweden. A number of presentations to national conferences have emerged from these projects. A few projects have contributed to papers published in international journals. In the Peruvian context, this is undoubtedly a remarkable achievement. 8-9 separate staff (mainly chemists, also two chemical engineers and one biochemist and not all from Surrey) were involved in the MSc programme; 3 members of the San Agustin staff who graduated with MSc degrees in 1987 were given the responsibility of lecturing on some of the postgraduate courses. In order to assess their contribution to these courses, exams were set and assessed by the University of Surrey. This was a useful experience given that the University of San Agustin should be prepared to take over the running of the whole MSc programme in a few years, without any external help. The local staff was also in charge of running the practicals associated with the lecture courses, with guidelines provided by the University of Surrey.

Results. The total number of MSc graduates in the 1984-90 period is forty-one (twelve in 1987 and twenty-nine in 1990) at a total cost which would have covered only the training of four Peruvian postgraduate students in the UK at MSc level. The situation as far as employment is concerned is most encouraging since 68% are at present in academic posts in various Peruvian universities, 20% are in industry, 7% in technical jobs and 5% in business.

Future plans. The third intake of MSc students will take place in August 1991. Most of the courses will be taught by MSc graduates with guidelines provided by the University of Surrey. The supervision of research projects will continue to be the responsibility of the University of Surrey. The training of MSc graduates at PhD level in overseas Universities is now underway.

2. Research Developments in Peru

There is no doubt that international organisations have made significant contributions to the training of Latin American graduates at PhD level. However, it is often found that this training has not always been geared to the best benefit of the individuals or the countries involved, either because the research undertaken was not relevant to the needs of the country, or the Latin American institution does not have the funds required to acquire the research facilities needed by the returners to develop the research in which training was given. This has often resulted in brain drainage frustration. The steps taken by the Commission of the European Communities to overcome these problems are most encouraging. Although the main aim of the Community is to support high calibre research proposals (as assessed by the peer review system which operates at present), the implications of these research proposals to the scientific and economic development of a particular country are seriously considered.

As far as Peru is concerned, the Community is currently supporting a research project on "The Extraction of Copper by New Complexing Agents", involving the Universities of Surrey (UK), Catholic 'Santa Maria' (Peru), the Royal College of Surgeons (Ireland), ICI (UK) and the copper mining industry 'Cerro Verde' (Peru). As a result, two MSc graduates from San Agustin who are currently members of the Catholic University of Santa Maria are working on this project. They are expected to complete their PhD theses in March 1993.

3. The European-Latin American Research Group on 'Macrocyclic Ligands for the Design of New Materials for Environmental, Extraction and Recognition Purposes'

As a result of the successful development of the MSc programme at San Agustin and a network of contacts established with a large number of academic and industrial institutions in Latin America, a group of European scientists from 6 different countries currently collaborating in research activities have agreed to amalgamate their complementary skills to develop long-term research programmes in chemistry in collaboration with academic and industrial institutions in Latin America (Argentina, Brazil, Chile, Costa Rica, Peru and Uruguay).

After discussion with government officials, national and international organisations in various Latin American countries, it was decided to launch a research group on 'Macrocyclic Ligands for the Design of New Materials for Environmental, Recognition and Extraction Purposes', involving the production of macrocyclic ligands targeted for particular process applications, followed by the incorporation of these ligands into polymeric frameworks or natural materials (silica, alumina, cellulose, etc.) as well as the study of their properties. Applications would include the extraction of metals, the removal of pollutant agents, the resolution of racemic mixtures, etc. These processes are particularly relevant to Latin America where most countries possess an enormous amount of mineral resources, some of them not yet exploited, and where the environmental problems caused by methods currently used for metal extraction or resulting from the establishment of petrochemical industries are becoming a serious concern. The development of separation techniques based on new materials targeted to isolate biologically active compounds in natural products is another aspect that the group is planning to tackle.

The main objectives of the group to promote research in Latin America are:

1. To develop joint research projects in the specified research area.
2. To organise international meetings and workshops aiming to attract participation of young Latin American scientists including an international conference on 'Macrocyclic Ligands for the Design of New Materials' organised by the European-Latin American Research Group with the sponsorship of the International Union of Pure and Applied Chemistry (IUPAC) which will take place at the University of Surrey from 14-16 September 1992.

Conclusions

The quality of graduates produced by academic institutions is a key factor for industrial development in Latin America or elsewhere. The best way to achieve high quality graduates is by opening up opportunities to the teaching staff in Latin American universities. The MSc programme has offered this opportunity and these graduates have made excellent use of it. Their dedication, their efforts and their creativity to produce high quality work with limited resources should encourage highly industrialised countries to invest further in the developing world.

The MSc programme in Peru has in effect:

- (a) Built up local capability and encouraged the initiation of MSc courses in other areas at San Agustin (Physics and Mathematics);
- (b) Produced graduates with an excellent background to pursue PhD studies elsewhere;
- (c) Increased links among British, European and Latin American institutions. The creation of the European-Latin American Research Group with the participation of industrial and academic institutions from Europe and Latin America is bound to strengthen these links even further and to contribute significantly to the mutual benefit of the institutions involved.

The Author

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