Contributions to Spectroscopic Based Food Research from Central and Eastern European Participants

Enabled by the EC PECO programme

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Recent Developments in EC Research in Applications of NMR Spectroscopy to Food Chemistry

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History

The first published application of NMR in food chemistry[1] dates back to the 1950's, being as old as the NMR method itself. In spite of the early appearance of the first paper, it was only recently that NMR techniques were recognised as useful analytical methods for food chemistry. Thus, most of the 1737 papers abstracted by the Food Science and Technology Abstracts between 1969 and 1992, were published after 1985. As an important recognition of the utility of the field, Trends in Food Science and Technology, published in 1992, an entire issue dedicated to applications of NMR techniques in food research[2]. A review of the field is also in press[3]. Recently NMR specialised departments from various research or teaching institutes have become interested in applications in food science. At the same time some institutes specialised in food research, established NMR departments. In order to meet the new needs, NMR manufacturers developed various NMR instruments dedicated to a variety of food analyses (e.g. Bruker's Minispec series). These dedicated spectrometers were added to a range of general purpose or state-of-the-art instruments, both commercial and in-house constructed ones, already working in this field.

Many individual researchers and institutions realised during recent years the potential importance of various NMR techniques for food sciences. NMR experiments are now

an essential part of research in the fields of biochemistry, biology and medicine. Fields like food science or environment and pollution control recently implemented these methods on a larger scale and have taken full advantage of them.

After much independent research in this field, the time has come for an integration of NMR and other spectroscopic methods applied to food quality control. The decision to bring together spectroscopists from different fields, institutes and countries was taken by the Commission of the European Communities (CEC) in June 1990. This was and is an ambitious task and aspects relating to food legislation and software for data transfer and analysis were to be addressed.

The EC Programmes Supporting the Applications of NMR in Food Science

Within the frame of the COST programme ("European Cooperation in Science and Technology") the CEC provides support for the development of the methods and their integration and standardisation in Europe. The COST programme (only one kind of programme among the various types that the CEC is associated with or initiates) was established in November 1971. The states that signed that resolution were 11 EC members (Belgium, West Germany, Spain, France, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, United Kingdom) and 7 non-members (Austria, Switzerland, Norway, Sweden, Finland, Turkey and Yugoslavia). In addition to these 18 states, both the Council of Ministers of the European Communities and the Commission of European Communities (CEC) signed the General Resolution adopted by the Conference of European Research Ministers in Brussels on 22 and 23 November 1971[4]. Denmark joined the COST frame later. From its establishment and until 1990, the COST projects provided a very useful tool for the advancement in science and technology in Western Europe and the other participant countries.

On June 29, 1990 a Resolution of the Council of Ministers of the EC gave access to COST projects to the Central and Eastern European Countries, by stating: The Council "welcomes the possibility of progressively including as members of the COST framework Central and Eastern European Countries undergoing reforms based on the founding principles of democracy, pluralism and the rule of law"[5]. On November 21, 1991 another Resolution of the Council enlarged COST to the Czech Republic, the Slovak Republic, Hungary, Poland and Iceland[6]. For reasons related to the internal situation in Yugoslavia, this country was not among the countries which signed the final Resolution of 21 November 1991. On 18 June 1992 COST was enlarged to admit Slovenia and Croatia "for their special situation as former parts of Yugoslavia"[7]. Thus, by the end of the year 1992 there were around 100 COST projects in progress, involving over 1000 teams from 25 European countries[4]. In its present form the COST programme is intended to have a dual function: 1) To carry out "a la carte" concerted

action projects outside European Community programmes; and 2) To provide European countries that are not members of the European Community with an opportunity to participate in Community programmes.

Within the EC R&D framework, the Council of Ministers of the EC approved on June 20, 1989 a specific research and development programme in the field of food science and technology, entitled FLAIR (Food-Linked Agro- Industrial Research)[8,9]. The overall objectives of the FLAIR programme are: 1) To improve food safety and quality for the consumer; 2) To promote food industry efficiency and competitiveness; 3) To reinforce the scientific and technical infrastructures serving the European food industry[9]. This programme complemented existing initiatives in EC countries through the development of collaborative links between different research groups and industries, and is concentrating on the interface between food processing, food distribution and the consumer. In the frame of the FLAIR programme, in June 1989 there were 561 laboratories involved in 22 COST projects and 11 Concerted Actions, with participants belonging to 11 EC countries and 7 third countries (COST countries)[9].

A further decisive step was taken by the CEC on June 1, 1990, when the FLAIR Concerted Action No. 1, entitled "Spectroscopic Techniques (NIR, FTIR, NMR) for the Rapid Direct Measurement of Food Quality" abbreviated as QUEST (QUality Established by Spectroscopic Techniques) begun its activity. The QUEST Action begun its activity with teams from 11 EC countries and 4 other COST countries, and it was intended to last 3 years. Later, the Action was extended for a further year, with new participants. Thus, on August 10, 1993 the QUEST Action consisted of teams from 38 organisations belonging to 17 countries. QUEST finished at the end of May 1994[10]. QUEST has been an active and efficient instrument of exchanging both scientists and ideas.

NMR and EC research programmes in Romania

The situation in Romania may be summarised as follows: In the past, only classical chemistry methods were employed as analytical methods in food analysis. The library and instrumental developments in the field of food chemistry in 1993 were not well advanced. There were some attempts to investigate the use of low resolution NMR in food analysis. High resolution NMR was not used to analyse food products. There are a few NMR spectrometers with field strengths ranging between 60 - 100 MHz located in several towns in Romania. In 1994 only one superconducting NMR spectrometer was installed in Romania. This superconducting NMR spectrometer is a state-of-the-art instrument of the Varian Gemini type, operating at 300 MHz, and it is located in the "Costin D. Nenitescu" Institute for Organic Chemistry, Bucharest.

In 1992 the Commission of the EC took the decision to launch a Pilot COST programme for countries (PECO). This led to the four teams (see PECO participants in the full list of participants at the end of this document), from individual institutes in Central and Eastern European countries becoming full funded participants in the QUEST project.

Thus, in March 1993, the "Costin D. Nenitescu" Institute for Organic Chemistry in Bucharest became a COST member. This is the result of the approval by the CEC of the proposal submitted by the NMR team for a Pilot COST project entitled "Applications of Nuclear Magnetic Resonance to Rapid and Direct Measurement of Food Quality". This Pilot COST project co-ordinated by Calin Deleanu was linked to the QUEST / FLAIR Concerted Action No. 1. The Romanian team rapidly integrated in several Action Groups of the QUEST (e.g. DBAG, FAST, IMAG). This Pilot COST programme should be considered as a recognition of both the importance of the only superconducting NMR spectrometer available in Romania and of the importance of updating food quality controls for our country. We believe that such pilot COST projects are a very useful support for Romanian researchers. Until the complete integration of Romania in the European structures, the chance that the individual Romanian teams have now, to submit research projects directly to such an important and impartial institution as the CEC, represents a necessary step in the decentralisation of the Romanian society.

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