

Individual sessions on assay methodology were devoted to reagents, automation, data analysis, and alternatives to radioassay. Individual sessions on applications were devoted to assays for steroids and other small molecules, assays for thyroid-related hormones and assays for peptides. Each session was introduced by an invited review paper summarizing recent advances in the particular subject field.

The subject of assay standardization and quality control was considered at length in two round-table discussion sessions, one on assay design, standardization and within laboratory quality control and one on external quality control, arranged in co-operation with the World Health Organization Special Programme of Research in Human Reproduction. These sessions evoked much interest and the importance of the concepts and techniques presented therein in the development of effective assay services was recognized.

The proceedings of the symposium, comprising the papers presented and the edited discussions, will be published by the IAEA.



REPORT ON AN INTERNATIONAL SYMPOSIUM, WAGENINGEN,
THE NETHERLANDS, 21–25 NOVEMBER 1977

The meeting was attended by 195 scientists from 39 Member States and 4 international organizations. Seventy-three papers were presented in 8 sessions.

Food Preservation by Irradiation

As shortages of food and energy still continue to constitute the major threats to the well-being of the human race, all actions aiming at overcoming these problems must be assigned vital importance. Of the two complementary ways of solving the food problem (i.e., increasing the production of food and decreasing the spoilage of food) a novel method designed to contribute to the latter purpose has been discussed at this symposium hosted by The Netherlands and held under the aegis of the Food and Agriculture Organization of the United Nations, the International Atomic Energy Agency and the World Health Organization. Progress made since the last symposium of this kind (Bombay, India, 1972: *IAEA Bulletin* Vol. 15 No. 1) was reviewed from the technological, economic and wholesomeness points of view by participants from 39 countries (60% of the latter were of the developing world).

From the reports presented on the use of radiations to control physiological changes in plants, feasibility of radiation preservation of potatoes, onions, garlic, as well as of some tropical and subtropical fruits (mangoes, papayas, litchis and avocado) was confirmed. For potatoes, onions and mangoes, optimal conditions of treatment and storage were established on a larger scale, combined with sizeable consumer trials. Combinations of ionizing radiation

with chemicals (salicylic acid, for potatoes), and physical agents (ultraviolet rays, for papayas) have been reported to be successful against the incidence of rot.

A considerable number of papers dealt with the control of microbiological spoilage of foods. Work since 1972 has shown that radurization of fruits and vegetables (bananas, mangoes, dried dates, endive, chickory, onions, soup-greens), meat, poultry, marine products (mackerel, cod and plaice fillets, shrimps), decontamination of food ingredients and food technology aids (enzyme preparations, proteins, starch, spices), radappertization of meat and animal feedstuffs as well as combination treatments with salt, heat and ultraviolet radiation may become practically feasible. Studies of mathematical models for microbial kill by radiation and of the influence of environmental factors on radiation sensitivity of spoilage micro-organisms were presented.

The largest number of papers has dealt with rather sophisticated studies on the minor chemical changes occurring in various foods and food components treated with ionizing radiations. Radiolysis of proteins (egg-white), carbohydrates (starch, cyclodextrins), lipids, phospholipids, aroma compounds and vitamins were investigated in detail. These assays, together with studies on radiation-induced chemical changes in complex foods such as meat, poultry, fish, rice, dates, coffee beans, spices and vegetables (potatoes, tomatoes) showed that although a large number of radiolysis products can be formed, all of them are known to occur also in unirradiated food and/or in food processed by long-established techniques of food preservation. Studies on the mechanism of radiation effects in frozen foods revealed an essentially direct-action pattern. The quantities of the radiolysis products induced in food irradiated with technologically acceptable doses are so low (characteristically in the milligram per tonne range) that the safety-for-consumption of the product cannot be endangered by the treatment. It was suggested that a computer data bank with all known radiation-induced (qualitative and quantitative) chemical changes should be established for the benefit of those interested in the technological, sensory and toxicological consequences of the irradiation process.

Several studies presented on toxicological aspects of food irradiation had already been based on radiation-chemical considerations. A report on animal toxicity tests with several identified radiolytic products of an important food component (starch) pointed to new approaches in toxicological testing. The importance of using new, quicker animal (mammals, insects) and microbiological methods for the assessment of toxicity, mutagenicity and cancerogenicity was emphasized and the applicability of these methods demonstrated. Studies on irradiated mackerel, vegetables, fruits as well as animal feeds could not reveal deleterious effects on the safety for consumption of these items.

Another aspect of public health concern, i.e. the microbiological safety of irradiated foods, was also considered at the meeting. The lectures dealt partly with basic problems of the radiation resistance of micro-organisms of public health significance, and partly with the qualitative changes in the microflora of foods irradiated for purposes of radication (radiation sanitation). Some of these changes appeared to be characteristic of irradiated fish and shrimps and of strawberries. Radiation treatment of poultry feed against salmonella was reported as very successful from the public health point of view in larger-scale experiments.

Public health approval and consumer acceptance were also discussed and proposals were made to deal with certain regulatory aspects of food irradiation both at the national and at

the international level. The need for harmonization of the legislative systems of various countries was stressed and reference was made to an Advisory Group meeting taking place, also at Wageningen, immediately after the symposium. Results of consumer tests with irradiated onions and potatoes were reported.

Design and operation of irradiation facilities received special attention. Principles of design of a fruit and vegetable irradiation plant and a large-scale irradiation service centre were described and some new methods (lyoluminescence, biological tests, etc.) for radiation-plant dosimetry were presented.

Economics and energy aspects of food irradiation were also discussed. Disinfestation of bulk grain, of bagged flour, preservation (radurization) of packaged beef cuts and salmonella elimination from (radicidation of) poultry with electron accelerators, using electron beams or X-rays, were computed to be economically feasible and competitive. Detailed analyses of the energy requirements of food preservation by irradiation and by some conventional methods (canning, refrigeration) showed the clear advantages of the radiation treatment over the other techniques.

Detailed discussions took place at the last session of the symposium on an action plan for future activities in the field. The proceedings will be published by the IAEA.



NEA/IAEA INTERNATIONAL SYMPOSIUM, HAMBURG
5-9 DECEMBER 1977

The symposium was attended by more than 250 participants from 20 countries and 4 international organizations. Sixty-four papers were presented at 9 topical sessions.

Safety of Nuclear Ships

The great advantage in the utilization of nuclear power for ship propulsion was recognized soon after the first nuclear reactor reached criticality. The long-term self-sufficiency of a nuclear ship, which does not require frequent refuelling, puts it in a position unattainable by any conventional ship. The first two civil nuclear ships were launched in 1959, the nuclear icebreaker "LENIN" (USSR) and the commercial nuclear ship "SAVANNAH" (USA). In 1968, the "OTTO HAHN" (Federal Republic of Germany) set sail for the first time. The nuclear icebreaker "ARCTICA" (USSR) started commercial operation in 1977, and its sister ship is in the final stage of commissioning. Unfortunately, the merchant "MUISU" (Japan) has not yet been put into operation because of design engineering problems; it will begin service following partial reconstruction of the reactor radiological shield.