RADIATION TECHNOLOGY IN THE PHILIPPINES*

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INTRODUCTION

Research and development work in the field of radiation technology has been actively pursued by the Philippine Nuclear Research Institute (formerly the Philippine Atomic Energy Commission) since the early sixties. Earlier studies were primarily on food irradiation, radiation sterilization and wood plastic combinates.

More recently a pilot scale multipurpose irradiation facility was set up with the technical assistance of the International Atomic Energy Agency (IAEA). This has encouraged the interest of local industry in radiation sterilization and food irradiation. Though on a small scale, some local manufacturers of medical products, pharmaceuticals, cosmetics and food are now availing themselves of the gamma irradiation services of PNRI. Also research and development on radiation vulcanization of natural rubber latex has been initiated, while the interest in wood plastic combinates has been revived.

Through seminars, training courses and workshops, the regional UNDP/IAEA/RCA Industrial Project and the new Project on Environmentally Sound Technologies have been instrumental in promoting radiation technology to the local industries.

RADIATION STERILIZATION

Studies on radiation sterilization of medical products such as absorbent cotton, surgical gauze, visceral packs, surgical gloves, scalp vein sets, feeding tubes, eye ointment and bone and tissue grafts have been ongoing since 1977.

In order to accelerate research and development and to demonstrate radiation technology to industry, the PNRI with the technical assistance of IAEA has set up a pilot scale multipurpose gamma irradiation facility. The batch type irradiator, a Gammabeam 651PT from Nordion International was commissioned in 1989 with an initial loading of 1 PBq (30,000 Ci) ^{60}Co. Under an IAEA technical assistance project (PHI/8/013), the multipurpose facility was reloaded with an additional 1.8 PBq (50,000 Ci) ^{60}Co in 1993.

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In collaboration with prospective users of the irradiation facility, PNRI has conducted studies to determine the viability of radiation sterilization or decontamination of some of their products. Studies included bioburden determination, dose validation and determining the maximum dose the products can tolerate without affecting their integrity.

Though on a small scale, these investigations led to the commercial radiation sterilization of rubber gloves, sutures, empty aluminum tubes and orthopedic implants and the decontamination of empty gelatin capsules, cosmetic raw materials and veterinary drugs.

Amnion and bone grafts are also being sterilized for a tissue bank, which has been set up in a government hospital. Interest has even been shown for the decontamination by radiation of handicrafts for export.

Local requirements for radiation sterilization or decontamination is significantly increasing as shown in Table I. In fact, PNRI cannot accommodate all the request for irradiation services because of the limited capacity of its irradiation facility. For example, while a small percentage of their products is being treated at our facility, a local rubber glove manufacturer is now resorting to have their products irradiated outside the Philippines.

This glove manufacturer is convinced of the technology and is seriously considering putting up an industrial service irradiation facility, within the next two years. However, they are worried about public perception and acceptance, considering the Philippine experience relative to the mothballing of the nuclear power plant.

The production manager of a glove manufacturer and a researcher from PNRI attended the Regional Training Course on Radiation Sterilization - Validation, Routine Control and Application of ISO Standards, in Bangkok, Thailand, last July 1994.

Though in principle, the Bureau of Food and Drugs (BFAD) considers radiation sterilization as an acceptable method of sterilization, no rules and regulations on radiation sterilization are yet available in the Philippines. Upon the initiative of PNRI, BFAD has drafted rules and regulations on radiation sterilization of medical products. It is also drafting rules and regulations on food irradiation.

RADIATION CURING

In 1991, a UV-curing system was installed at the particle board processing plant of the Forest Products Research and Development Institute (FPRDI) with the support of the regional Industrial Project.

During the two-week expert mission of Dr. Istvan Czajlik in November 1992, a one-day seminar/workshop on UV curing of surface coating of wood was organized at FPRDI. Participants were from the wood products and furniture industry, research institutions and universities.

Again, under the present regional project, a similar seminar/workshop was held at FPRDI, during an expert mission in September 1994. During these seminars, UV curing of surface coatings of wood was demonstrated. The participants, especially from the furniture industry showed keen interest in the technology. One problem however stood out, the non-availability of chemicals or formulations for UV curing from the local market.

ELECTRON BEAM TREATMENT OF FLUE GASES

With the support of the regional UNDP/IAEA/RCA Industrial Project, a National Executive Management Seminar on Electron Beam Treatment of Flue Gases was held at the National Power Corporation (NPC) in October 1990. Another national seminar on EB treatment of flue gases was organized by NPC and PNRI during the expert mission of Dr. Chmielewski from Poland in June 1994. Participants from the power industry and from environmental agencies attended these seminars.

In view of the more stringent standards for SO_2 and NO_x emissions set by the Department of Environment and Natural Resources (DENR), NPC is studying all options to meet these standards. Electron beam treatment of flue gases is a possible solution to said environmental problem. NPC is therefore very much interested in a feasibility study to determine its techno-economic feasibility. PNRI in cooperation with NPC submitted a project proposal on EB treatment of flue gases for IAEA technical assistance. However this was not considered for funding under the 1995 cycle.

A PNRI researcher participated in the RTC on Radiation Technology for Environmental Conservation in Takasaki, Japan, in September 1993, while Philippine participants to the recently held Regional Seminar on EB Technology for Purification of Flue Gases, in Japan, last October 1994, were from the NPC and the Philippine Associated Smelting Refining Corporation.

RADIATION VULCANIZATION OF NATURAL RUBBER LATEX

The Philippines, not being a large rubber producer, did not actively participate in the area of radiation vulcanization of natural rubber latex (RVNRL) under the Regional Industrial Project.

However in support of the government's recent move to improve our rubber industry, PNRI initiated research and development on RVNRL in 1993. This was decided upon after a national consultative meeting on RVNRL was held during the expert mission of Dr. K. Makuuchi of Takasaki Radiation Chemistry Research Establishment (TRCRE), in November 1992. Participants from the rubber industry, universities and research institutions attended the meeting.

This R&D on RVNRL is in collaboration with the Philippine Rubber Industries Association and the University of Southern Mindanao, where the Center for Rubber Research is located. It is also partly supported by a grant-in-aid from the Philippine Council for Advanced Science and Technology Research and Development.

IAEA project PHI/8/013 provided equipment needed for the studies and experts on RVNRL; Dr. K. Makuuchi from Japan, in November 1992 and Mr. Marga Utama from Indonesia in October 1994.

The response of Philippine natural rubber latex to radiation were investigated. Dose-effect response curves were determined and the vulcanization dose established. Properties and stability of the radiation vulcanized rubber latex are being determined. Preparation of dipped products from radiation vulcanized Philippine rubber latex was successful.

OTHER RELATED ACTIVITIES

Research on wood-plastic combinates was started in the late sixties. However R&D on wood plastic combinates was terminated when experiments on a large scale could not be carried out because of the prohibitive cost of the imported monomers and the lack of a large irradiation facility. Interest in wood plastic combinates was renewed with the move of government to ban logging.

In 1991 during an expert mission on wood-plastic combinates, provided by IAEA project PHI/8/013, a consultative meeting with wood products industry, resin suppliers and research institutions was held. The wood industry is enthusiastic about the new technology and recommended the tree plantation species to be studied. R&D is on going and four potential wood species have been identified as material for wood plastic combinates for floor parquet.

To strengthen its research capability on radiation technology, the PNRI sent one of its chemists to work on RVNRL at the TRCRE under the scientist exchange program of the Science and Technology Agency (STA) of Japan. Participants from PNRI attended the RTC on Radiation Chemistry in 1991, The RTC on Radiation Chemistry for Environmental Application in May 1993 and the recently concluded RTC on Fundamental Aspects of Radiation Technology in June 1994.

To introduce radiation chemistry to a wider sector, PNRI organized a two-week National Training Course on Radiation Chemistry. Lecturers for this course were supported by IAEA project PHI/8/013. Participants were from the academe, industry and research institutions.

Studies on food irradiation has also been on going for about three decades now. Pilot scale irradiation of onions, garlic and mangoes has been undertaken. Studies on the decontamination of frozen prawns and spices and quarantine treatment of mangoes, papayas and cut flowers are on going. The BFAD has granted conditional clearance for the decontamination of spices.

TABLE I

PRODUCTS IRRADIATED AT THE
MULTIPURPOSE IRRADIATION FACILITY

PRODUCT	1992	1993	1994
rubber gloves (sterilization)		1.1 m^3	15.6 m^3
empty aluminum tubes (sterilization)	1.7 m^3	15.8 m^3	17.3 m^3
sutures (sterilization)		1.1 m^3	
empty gelatin capsules (decontamination)	1.2 m^3	8.2 m^3	12.6 m^3
cosmetics raw materials (decontamination)			45 kg
spices (decontamination)	4.4 tons	2.5 tons	0.5 ton
onions (sprout inhibition)		1 ton	4 tons