Annex 3

Summary of FNCA Open Seminar

"Applications of Radiation Technology to Support Sustainable Development"

10th February 2016

Philippine Nuclear Research Institute (PNRI)

Manila, the Philippines

Presentation 1: Application of Radiation Technology for Industry and Agriculture in the Philippines

(Dr Lucille V. Abad, Head of the Chemistry Research Section, Atomic Research Division of Philippine Nuclear Research Institute (PNRI))

At present, the Philippine Nuclear Research Institute (PNRI) is the sole institute with irradiation facilities in the Philippines, namely the multi-purpose gamma irradiation facility built in 2008 and the 2.5 MeV electron accelerator facility established in 2011. These irradiation facilities are utilized by the researchers of the Atomic Research Division in producing radiation processed materials with various applications in agriculture, health, industry and environment. The radiation degradation of carrageenan as plant growth promoter has already been set up for multi-location field-testing across the country. Current studies are being made for the development of super water absorbent from natural polymers for use in agriculture to mitigate the effects of El Nino and water shortage. The PNRI has also investigated the use of radiation processing in the production of medical products such as wound dressings made from honey-alginate or PVP-carrageenan, vesicoureteral reflux bio-implant from PVP-chitosan and hemostatic agents from cellulose. These products have shown great potential in lab experiments and animal testing. Radiation grafting has also created specialized materials for environmental remediation and heavy metal absorption for the tanning industry. Value addition by grafting to abaca, a plant indigenous in the Philippines, has been investigated for use as absorbents.

Presentation 2: Research and Development of Radiation Processing in Japan for Industry and Environment

(Dr Masao Tamada, Japan Atomic Energy Agency (JAEA), Japan)

Many products such as heat resistant cable, button battery, and radial tire have been commercialized by technology transfer of economically feasible radiation processing since 1970s in Japan. This is because radiation processing such as crosslinking and grafting is a unique technique for material development, which cannot be realized by only thermal reaction.

Another key point of technology transfer is to respond the needs of end-users and utilize advantages of radiation processing. Crosslinking is the most available technique for modification of polymers. Car components of heat resistant cable, radial tire, and interior form sheet were produced by crosslinking to modify the thermal stability, reliability, and mechanical durability, respectively. Dummy lens made of poly (lactic acid) and spray coating of Washi (traditional paper in Japan), 3D dosimeter are promising products for commercialization. Grafting can introduce the desired functions into the commercially available trunk polymers. High performance adsorbents for uranium recovery from seawater, scandium collection from hot spring water, cadmium removal from scallop processing waste, and cesium removal from tap water were developed by the grating. The technology transfer of such developed materials proceeds in stepwise stages from technical consultation in exhibition and seminar and then collaborative research using radiation processing technology. Dissemination of radiation applications is an effective way to persuade end users to adopt the radiation technology for material development. A demonstration tool was commercialized to understand the radiation effect by exhibiting shape memory effect of the polymer modified by radiation-crosslinking.

Presentation3: Success Stories of Radiation Processing Application in Thailand in Industry and Agriculture

(Dr Phiriyatron Suwanmala, Thailand Institute of Nuclear Technology (TINT))

During the past decade, Thailand has been utilizing the advantages that radiation processing is able to offer in various fields, including industry and agriculture. Polymeric materials, especially natural polymers such as starches, cellulose, chitin and chitosan are natural materials with high potential for various applications from medical to environmental and agricultural due to their uniqu properties, especially biodegradability and biocompatibility. One of Thailand's success stories is the preparation of super water absorbent (or SWA) from cassava starch for agriculture application. The properties of SWA are very attractive to farmers. SWA acts as a local reservoir, releasing water vapour into soil and plants as needed and also maintain moisture at balance. Thailand is the world's largest exporter of cassava products. The production of cassava starch often exceeds the export and consumption scale which results in Thailand's surplus of unused cassava starch. The development of superabsorbent by radiation processing is therefore a promising method to increase the values of cassava starch which is abundant and inexpensive. The use of this natural polymer as SWA can relieve the lack of water in the arid rural areas of Thailand. In addition, radiation-induced degradation was used to reduce the molecular weight of the prepared chitosan, yielding oligochitosan. The obtained oligochitosan was tested for its potential use as plant growth promoter. The effects of oligochitosan on Thai chili's growth and productivity were investigated in term of plant height,

total number of chilies, total weight of chili, total number of green chilies, total number of red chilies, harvest time and weight per chili. The results showed that the application of oligochitosan, at the concentration of 80 ppm, mixed with the fertilizer displayed significant effects, statistically, on chili height, total weight of chili, total number of chilies, total number of green chilies, total number of red chilies and weight per chili. The results showed that productivity was increased up to 34%. The oligochitosan exhibited the ability to protect not only aphid inflection but also the ability to shorten the harvest time of chili plants. The treatment of chili plants by oligochitosan clearly displayed positive effects on chili's growth and productivity. These results suggest its potential use in agriculture purposes as growth promoter for Thai chili plants.

Presentation4: Biological Efficacy Evaluation of Radiation Modified Kappa-Carrageenan and Chitosan as Inducers of Resistance Against Major Pests and Diseases in Rice
(Dr Gil Magsino, University of the Philippines Los Banos)

The project on the biological efficacy evaluation of radiation modified kappa-carrageenan as plant growth promoter and inducer of resistance against major pests and diseases in rice is a component of a 3 year program on the development of plant growth promoter (PGP) from radiation modified natural polymers that started in May 2013. The National Crop Protection is in charge of the determination of PGP efficiency in field tests. Significant disease resistance against tungro virus and bacterial leaf blight was found in rice greenhouse and semi-field tests. There was also a surprising observation of how the crops treated with PGP remained standing while surrounding crops were lodged during the Typhoon Lando last October 2015. The current recommended treatment of PGP is 3 liters per hectare in three applications during the early vegetative stage (12-14 DAT), maximum tillering to panicle initiation stage (30035 DAT) and before flowering stage (45-50 DAT). Information dissemination and distribution of PGP are currently being done in farms on seven different regions in the country for a multi-locational field testing.