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Summary of Open Seminar
on Radiation Processing of Natural Polymers

A. Presentation

The following four (4) presentations were provided:

1. Global Status of Industrial Application of Radiation Processing
(Dr. Sueo MACHI , FNCA Coordinator of Japan)

It was emphasized that radiation application in industry, agriculture and environmental protection is expected to further contribute for sustainable development in both developing and developed countries. Highlights of this presentation include (1) Radiation source technology is well established and being developed for lower price and better reliability; (2) Ion accelerator is a new tool for material science and processing; (3)New high value polymer products will be developed using accelerators for commercial uses; (4) Radiation processing of natural polymers is emerging as a promising area; (5) Food irradiation is increasing to ensure food safety and to decrease post-harvest loss; and (6) Public acceptance is still challenge in increasing radiation applications

2. Recent Promising Research Outcome on Radiation Processing in Japan
(Dr. Masao TAMADA , Japan Atomic Energy Agency)

He showed promising research such as filter for ultra pure water (grafting), traditional wallpaper (crosslinking), and plant activator (degradation). These products have high possibility of suitability to solutions of social demands and needs of end users. To promote the technology transfer of radiation processing products to end users, it is very important to disseminate the advantages of radiation processing in the technologies for the polymer modification. Advantages are to modify the polymers around room temperature, in short time, and without any catalyst.

3. National Strategy for Developing Sustainable Agriculture in Thailand
(Mr.. Songpol SOMSRI , Department of Agriculture)

National Economic and Social Advisory Council (NEAC) indicated that, during in the last quarter of the past century, green revolution or commercialization of agricultural of modern farming has been emerging. The widespread use of chemical fertilizers and pesticides has raised questions about human and animal health, food quality and safety, environmental quality and the continued demise of the family farm. In 2004, NEAC held a National Brain Storming Seminar with representatives from all involved parties to identify Thailand's major agricultural problems and to find a sound solution for these problems. Sustainable agriculture is one of the answers. Referring to the sufficiency economy philosophy, a sustainable agriculture is a production system that emphasizes on the balance of ecosystem and concept of self reliance. The goal of sufficiency economy is to develop a harmonious and happy community, while connecting everything in nature. The sustainable agriculture should be practical, cost-effective, sustainable, potential for scaling-up in wider geographical, institutional and socio-cultural contexts as well as generating social, economic and environmental benefits. Examples for sustainable agriculture are integrated farming system, organic farming, natural farming, agro-forestry and new theory farming. Examples of the problems associated with agriculture are environmental problems, economic and poverty problems, social migration problems and incorrect problem solving of the government. SWOT analysis was performed to identify strength, weakness, opportunity and threats for Thailand agricultural problems. The sustainable agriculture strategy was suggested, using sufficiency economy philosophy. Four strategies were proposed for sustainable agriculture; Strategy I: Center of sustainable production, Strategy II: Empowering Thailand, Strategy III: Developing sustainable agriculture and Strategy IV: Increasing farmers' self reliance. However, turning strategy into action is the task of Thai government. In order to do so, the Thai government must draft national agenda of Sustainable Agriculture (SA), reengineer government organization, provide personnel and knowledge management, provide personnel and CEO by training and provide knowledge management.

4. Application of Chitosan for Plant and Agriculture

(Dr. Rath PICHYANKURA , Center for Chitin-Chitosan Biomaterials, Chulalongkorn University)

Chitin is a naturally occurring biopolymer which is most abundant next to cellulose. It is found only in a small group of living organisms, arthropods, mollusk, yeast and fungi. Chitin is a homopolymer of N-acetyl-d-glucosamine. Its chemical structure is very similar to cellulose, with the difference being acetyl amine group in chitin instead of hydroxyl group in cellulose. Demineralization and deproteinization are used to produce chitin from crab or shrimp shells. Chitosan is a derivative of chitin. Chitosan is produced when the acetyl amino groups in chitin are deacetylated. The degree of deacetylation (DD) affects the properties and functionality of the obtained chitosan. Unlike chitin, chitosan is soluble in weak acids such as lactic acid. Chitin and chitosan are used in many applications such as food, animal feed, textile, medicine, agriculture, materials and membrane. In agricultural applications, chitosan is used to induce plants' immune system, induce phosphate and nitrate uptake, increase production and reduce chemical as well as insecticide utilization. Chitosan is not a fertilizer, since it does not contain nitrogen (N), phosphorus (P) or potassium (K). Chitosan is not a pesticide or a hormone. Chitosan is rather an elicitor. What elicitors do is stressing the plant or regulating plants' stress. At the right amount, chitosan is able to induce stress in plants. Stress plays a major role for plants. From our experiments with a variety of strawberries, we found that only one species responded to chitosan. We also found that chitosan can slow down the growth of insects and viruses for okra. With the presence of chitosan, some plants showed higher amount of photosynthesis. Some plants showed higher ratio of silica body which is good for plants' wind and drought tolerance. In summary, chitosan has high potential for plant growth promoter. Nevertheless, to take the most advantages out of chitosan for each specific plant, the optimum molecular weight of chitosan and optimum conditions must be identified.

B. Round-table Discussion

Subject: Promising Application and Challenges of Radiation Processing

Chair: Dr.Sirinart Laoharojanaphand (Thailand)

Panel Members: Speakers of the above lectures

Focus for Discussion:

(1). Advantages of radiation processing

(2). Promising areas of radiation processing application in Agriculture

(3). Obstacles for industrial application of radiation processing

(4). Demand driven research and enhancement of linkage between research institutes and industry

Comment / Questions	Responses
Dr. Sirinart LAOHAROJANAPHAND (TINT's Deputy Executive Director) • Advantages of radiation processing	Dr. Sueo MACHI (FNCA Coordinator of Japan) • The uniqueness of radiation processing must be emphasized, especially when compared to chemical process. • This includes the fact that irradiation can be done for solid, liquid as well as gas stages at room temperature, which is highly advantageous for the industry. • The communication to the people in the industry is also very important.
Dr. Sirinart LAOHAROJANAPHAND (TINT's Deputy Executive Director) • Promising areas of radiation processing application in agriculture	Dr. Songpol SOMSRI (Senior Expert in Horticulture, Department of Agriculture) • Radiation processing can be used along with traditional methods to produce new variety of plants such as plants with seedless fruits or plants which are more resistant to insects, diseases or drought.
Dr. Sirinart LAOHAROJANAPHAND (TINT's Deputy Executive Director) • Obstacles for industrial application of radiation processing	Dr. Masao TAMADA (JAEA) • The major obstacle is the public acceptance. • The end-users think that they need a big facility to do the radiation processing. But, in fact, they can even rent or play for the radiation services. • Chemical processing is a big competitor for radiation processing, especially when chemical methods can also do similar things.
Dr. Sirinart LAOHAROJANAPHAND (TINT's Deputy Executive Director) • Demand driven research and enhancement of linkage between research institutes and industry	Dr. Rath PICHYANKURA (Center for Chitin-Chitosan Biomaterials, Chulalongkorn University) • Most of the time, researchers do basic research to create new knowledge and hardly pay attention to real applications. However, most of the companies in the industry are not

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<tr><td></td><td>interested in acquiring new knowledge.

• Researchers hardly concentrate on processing, bench-marking and other business things. They need to initiate more linkage. They have to go out more to visit the end-users to learn about the farmers and the industry. Researchers have to expose themselves more and get into the real actions so that they can use what they have learned to solve the end-users' problems.

Dr. Sueo MACHI (FNCA Coordinator of Japan)
• Sometimes, the industry people are conservative. We have to encourage them.

• Technology is the main driving force for the national development. Technology is the main reason why Japan could develop so progressively after the World War II.

• Thailand also needs technology establishment as well as development.</td></tr>
<tr><td>Dr. Darmawan (BATAN)
• How many new varieties of plants that Thailand has successfully developed?

• How can we compete with other techniques when radiation leads to cost increase?</td><td>Dr. Songpol SOMSRI and Dr. Sirinart LAOHAROJANAPHAND
• In Thailand, we have successfully developed a number of new varieties of plants, from rice and watermelon to okra and flowers.

Dr. Sueo MACHI
• Mutation can be done by both chemical and radiation processing. But about 80% of mutation is caused by radiation. We have to emphasize on unique advantages of radiation processing such as the fact that only radiation can induce cross-linking of PE at room temperature.

Dr. Rath PICHYANKURA
• We have to make things economically viable.

• It also depends on how we build the story behind our products.

• You can charge 10 times more for your products, while the cost increases only twice. You just have to verity how unique the radiation processing or your products are.</td></tr>
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