FELLOWSHIP SUMMARY REPORTS

Name: Atanu Biswas

Subject: Circular Bio-economic Strategies for Active Bio-Packaging for Food: Electrospun Nanobiocomposites as High Barrier Films

Theme number: III, TRANSFORMATIONAL TECHNOLOGIES AND INNOVATION

Host Institute: Institute de Agroquimica y Technologia de Alimentos (IATA), Paterna, Valencia, Spain

Host collaboratoe: Dr. José María Lagarón

Duration: 15 weeks (10th June to 17th July 2019 and 4th November 2019 to 16th January 2020)

1. What were the objectives of the research project? Why is the research project important?

The objective is to design novel food packaging systems, that are sustainable, biodegradable, and have good gas barrier properties through innovative processing and chemical modifications. The resulting packaging should provide shelf-life extensions for foods by minimizing the penetration of water, oxygen, and organic vapors into foods.

In the big picture, our project is meant to promote circular bioeconomy in the context of sustainability and environmental stewardship. Thus, we hope to substantially enhance our understanding of the science of food packaging and improve food preservation. We also utilize food waste through novel waste conversion technologies.

2. Were the objectives of the fellowship achieved?

Yes, our objective was largely met. During my stay we conceived several ideas and began implementing our research plans. We will continue to work together in order to implement all the ideas.

3. What were the major achievements of the fellowship?

Polyhydroxyalkanoates (PHAs) are biopolymers with desirable material properties similar to petrochemically derived plastics. We have been able to utilize food wastes and converting them to PHAs. We are also utilizing biopolymers such as starch, zein and cashew gum as encapsulants for flavor or drugs, to be used in food, cosmetics and pharmaceutical industries. The electrospraying technology that Dr. Lagaron developed is helping us to achieve these applications and has the potential for commercial applications.

4. Will there be any follow-up work?

Our work is ongoing, and the amount of follow-up work will be more than what we have done so far. Some of the materials that we prepared at IATA have been brought to NCAUR Peoria, IL for analysisi using analytical techniques such as NMR (both liquid and solid state).

a. Is a publication envisaged? Will this be in a journal or a publication? When will it appear?

We have already published one paper in a peer reviewed journal. Two more manuscripts will be submitted to peer reviewed journals in 2020.

Cherpinski, A., **Biswas, A**., Lagaron, J.M., Dufresne, A., Kim, S., Buttrum, M.A., Espinosa, E., Cheng, H.N. 2019. Preparation and evaluation of oxygen scavenging nanocomposite films incorporating cellulose nanocrystals and Pd nanoparticles in poly(ethylene-co-vinyl alcohol). Cellulose. 26(12):7237-7251.

b. Is your fellowship likely to be the start of collaboration between your home institution and your host?

Yes, already a visiting scientists from IATA, Spain has spent 3 months in my NCAUR/USDA lab at Peoria, IL. This year (2020) two more visiting scientists from IATA will spend 3 months in my lab.

We have also sent to IATA our proprietory starch-based polymers discovered in NCAUR. Scientists at IATA are working to find new applications for our patented polymers.

c. Is your research likely to result in protected intellectual property, novel products or processes?

It may result in a patent application, a novel product or process, but the possibility is quite low.

5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?

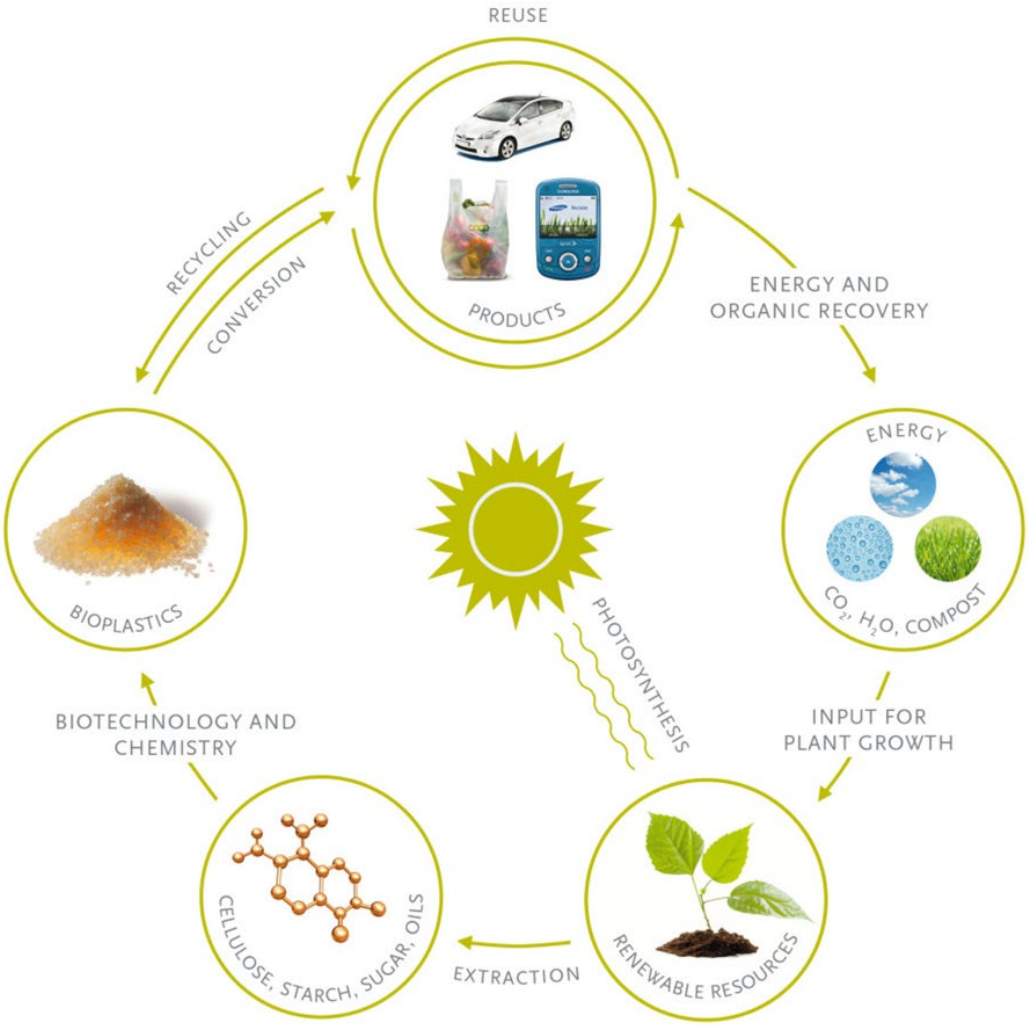
Please express this in terms of environmental/food security/food safety/economic/health (human and livestock and plant) benefits, etc.

This project is concerned with new food packaging materials from biobased and renewable-sourced polymers using novel physical processes and chemical modifications. These packaging materials are intended to protect and enhance food products, promote food safety, eliminate or reduce pathogens, extend shelf-life, and address antimicrobial resistance. Another benefit of this project is to reduce food waste, thus leading to greater use of food.

How was this research relevant to:

- The objectives of the CRP?
- The CRP research theme?

Our research addressed the 1. Bioproducts and Bioprocesses 2. Novel waste reduction technologies of the theme number: III, TRANSFORMATIONAL TECHNOLOGIES AND INNOVATION. Dwindling fossil resources, surging energy demand and global warming stimulate growing demand for renewable polymer products with low carbon footprint. We have utilized renewable polymer products for industrial applications such as food packaging, coatings, and encapsulation. Particularly noteworthy is our efforts to converted food waste into bioplastics.



Graph: Life cycle model
European Bioplastics

6. Satisfaction

a. Did your fellowship conform to your expectations?

This is an excellent fellowship which exceeded my expectation.

b. Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.

It provided me a very valuable and rare opportunity to collaborate with not only Spanish but also other European scientists resulting in collaborative contribution to a sound knowledge base for agricultural science. One such example that is a professor from Ankara University, Turkey would like to spend a year to work with me at NCAUR, Peoria, IL. Our work will result in several publications and promote international scientific understanding among OECD member countries. It will also make scientific advances and contribute to a sound knowledge base for agricultural policy making.

c. Did you encounter any practical problems?

The OECD program is perfect. As a USDA employee I had to face some internal barriers mandated by a new (2019) US government travel rules and regulations. I appreciate the help of everyone at OECD. In particular, Nathalie and Janet Schofield were very supportive. Dr. Rafael BLASCO & Dr. Vangimalla REDDY were helpful answering my questions. It was also very easy to communicate with folks at OECD.

d. Please suggest any improvements in the Fellowship Programme.

Nothing that I can think of.

7. Advertising the Co-operative Research Programme

a. How did you learn about the Co-operative Research Programme?

I learned about it from internal USDA/ARS announcement inviting applications.
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b. What would you suggest to make it more “visible”?

Setting up booth at technical conferences may be a good idea. I gave several presentations in Europe when I mentioned about this excellent program and encouraged attendees to apply for OECD fellowship.

c. Are there any issues you would like to record?

None.