Epoxidation of Plant Oils

Federal Manufacturing & Technologies

J. W. Lula

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Final Report/Project Accomplishments Summary

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Honeywell

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PROJECT Number KCP-T1-0003-RU:

Date: 5/05/00

Revision:

A. Parties

The project is a relationship between:

U.S. DOE Kansas City Plant

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PO Box 419159

Kansas City, MO 64141-6159

State Research Institute of Organic Chemistry &
Technology (GosNIIOKhT),

23 Shosse, 111023, Moscow, Russia

B. Background

This project was initiated to explore an improved process for epoxidating vegetable and plant oils. As part of the Department of Energy (DOE) Initiatives for Proliferation Prevention (IPP) program, the scientists at the State Institute of Organic Chemistry and Technology in Moscow had proposed a novel process to convert the unsaturated carbon-carbon bonds in vegetable oils to an epoxy ring. The resulting product has industrial uses as a non-toxic and non-leaching stabilizer and plasticizer for polyvinyl chloride and other halogenated polymers. It also is used as an additive for paints, coatings, and adhesives that have improved properties and chemical resistance. U.S. production of epoxidated oils amounts to approximately 150M pounds/yr. Western Europe also has several chemical plants producing epoxidated vegetable oils.

Currently all epoxidated vegetable oil required by the Russian industry is obtained from Western Europe. Developing an epoxidation process that could be incorporated into an

existing chemical manufacturing facility, such as the Chimprom plant in Volgograd, would benefit the Russian economy. Thus, the focus of this project was ultimately directed at commercialization of GosNIIOKhT's process for the production of a valuable industrial raw material. This project was undertaken in cooperation with the Pacific Northwest National Laboratories (PNNL) and GosNIIOKhT.

C. Description

The Initiatives for Proliferation Prevention (IPP) program was expanded to reach the Chemical and Biological Warfare segment of the Former Soviet Union's military. This project was the first attempt to involve the scientists from GosNIIOKhT in the IPP program and resulted in a signed contract in January 1998.

The tasks undertaken by GosNIIOKhT as part of this project included the following:

- Identify catalytic or chemical processes as candidates for seed oil epoxidation, based on technology developed in FSU/Russia. This would also include a patent search.
- Develop, operate, and provide data for a laboratory-scale epoxidation unit.
- Develop and implement equipment for an epoxidated oil extraction/purification process.
- Develop a stripping process and characterize properties for the epoxidated oil.
- Compare product to commercially available products.

The Kansas City Plant's role in this project was to assist in the following aspects:

- Assist in literature and patent searches.
- Provide information on the state-of-the-art of the commercial oilseed industry.
- Evaluate GosNIIOKhT's process from a technical feasibility standpoint.
- Identify potential U.S. industrial partners.
- Set up a meeting with oilseed industry experts to interface with the GosNIIOKhT scientists and potentially evolve into an IPP Cooperative Research and Development Agreement (CRADA).

D.

E. Expected Economic Impact

GosNIIOKhT wishes to develop an improved process for the epoxidation of vegetable and plant seed oil in order to invite investment in the Chimprom plant (Volgograd, Russia) for commercial production. This would provide much-needed capital for modernization of the facilities, plus jobs for local residents. It also would positively affect Russian industries that currently have to purchase the epoxidated seed oil material from outside the Former Soviet Union and help their balance of trade.

E.

F. Benefits to DOE

This project provided increased knowledge of a material which potentially can be used as an additive for epoxy adhesive and encapsulation compounds, paints, and coatings. It also has increased knowledge of many industrial plant chemical processes, such as used in the polymer pilot plant at KCP. And, of course, it has provided a learning experience in how the scientists of the Former Soviet Union go about their research and development and offered insight into their industrial capability.

F.

G. Industry Area

Russian technology that was developed and validated through this project could be used immediately within their society. Given that a substantial chemical facility exists at Chimprom, it theoretically would be possible for the Russians themselves to construct a manufacturing process for this process, given their technical ability to adapt and utilize equipment. However, this has not occurred to date.

G.

H. Project Status

This Thrust I project was successfully completed. As the final part of this project, a meeting was held in the U.S. between GosNIIOKhT scientists and a representative knowledgeable of the oilseed industry.

GosNIIOKhT was able to formally present their proposal, and also to learn about the state of the seed oil epoxidation industry first hand. However, currently there is not sufficient U.S. industry interest for capital investment in a new epoxidation process. The market is saturated with a very large producer, plus several other smaller producers. The smaller producers essentially must follow the pricing policies of the larger player.

H. Point of Contact for Project Information

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I.

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