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ENVIRONMENTAL & PRODUCTIVITY TECHNOLOGY INNOVATION FOR THE FOOD MANUFACTURING INDUSTRY

NEEDS STATEMENT TITLE: **RECYCLING PROCESSES FOR PLASTIC FOOD CONTAINERS -- ET-3-A-(1,2,7)**

DATE: MAY 1, 1996

TECHNOLOGY REQUIRED

The food industry seeks the means to position plastic packaging in a favorable environmental light through research in the following areas:

- development of methods to separate materials in multi-layered packages for recycling
- development of economic recycling processes for all categories of plastics

Safety of recycle is a high priority in the food industry. The industry seeks processes for recycling in all categories of plastics that eliminates concern for absorption of harmful substances from post-consumer plastic into the food. Verification of process efficacy needs to be conducted at the laboratory bench and in pilot plant scale. In order to be able to use recycled plastics as packaging material, the food industry additionally requires information on the functional properties of recycle, both mechanical and sensory.

BACKGROUND

Recycling is the reuse of a packaging material from post-consumer waste to form new products. Plastic materials package almost 50% of food in the U.S., but recycling rates for these materials lag far behind those of paper (about 30% including non-food applications), glass (<50%) and aluminum cans (>60%). While plastics present many attractive packaging options to the food industry, a negative has been recyclability of all categories of plastics. The reasons for this are: a) plastic packaging, especially for food, is seldom only one type of polymer, and difficulties exist in separating the layers of different polymers and b) methods such as methanolysis (producing monomers of PET), glycolysis (producing oligomers of PET), and Supercycle® (a high temperature wash) from Johnson Controls, Inc. have made PET recycling economical, but other categories of plastics still await development of economical methodologies. The pyrolytic process, which can heat plastics at high temperatures (900 -1450 F) in a closed, emission-free system in the absence of oxygen to produce monomers, can accept some mixing of polymers, but the method is far from adequate for handling the myriad of polymer combinations in today's market.

Exhaustive treatments of PET, as described above, have made this recycled plastic safe for use in food packaging when simple washing treatments would not. Similar technologies for HDPE, PVC, LDPE, polypropylene, polystyrene, and combination plastics would render these plastics safe for food contact.

State legislatures, particularly in California and Oregon, have passed laws requiring certain percentages of recycle in some types of containers. California requires companies selling these containers within California to provide evidence that they are complying with the law. As the target figure for percent of recycled content moves upward, point-of-use difficulties increase for the packer because even if an efficient method exists and safety concerns are not at issue, a paucity of information exists on mechanical attributes of food-directed packaging with increasing amounts of recycled content. Data on mechanical testing of resin blends and the mechanical effects of additives on blends, PET, and PETP fill the literature but not with regard to container requirements for food packaging. The primary focus of all testing is on PET which is not at all the most interesting plastic in food packaging today.

STATE OF THE ART

1. *Methods*. Methanolysis, glycolysis, high temperature washing, and sandwiching recycled PET between virgin layers of PET are well established methods in the reuse of post-consumer PET for food packaging. Pyrolytic processes can handle some combinations of resins.

- *Limitations*. Most of the methods are PET-directed but are efficacious in their removal of harmful substances. Pyrolysis is not sufficiently developed to accept all combinations of resins for subsequent separation. Chemical recycling methods for other categories of plastics, if known, are cost prohibitive for food packaging applications and must be demonstrated to remove harmful substances from the post-consumer resin.

2. *Methods*. Mechanical tests are well established to evaluate recycled resins. Tests may include tensile strength, % elongation, impact strength, heat seal range, and water and oxygen permeability. Trained sensory panelists can evaluate resins for residual odors as a result of reprocessing as well as taste for transfer of aromas into foods packaged in recycled materials.

- *Limitations*. None

TECHNOLOGY SPECIFICATIONS AND CONSTRAINTS

Chemical processes in recycling developed for all types of polymers and/or commingled plastics must be economically attractive to the food industry because the profit margin in the food industry is low. A critical need in processes that clean plastics is for removal of any harmful substances present in the post-consumer material. Protocols are published for challenging processes with a range of surrogates that represent typical contaminants. One is published by the National Food Processors Association: Plastics, Rubber, and Paper Recycling/A Pragmatic Approach, edited by Charles P. Rader, Sheryl D. Baldwin, David D. Cornell, George D. Sadler, and Richard F. Stockel, ACS Symposium Series 609, American Chemical Society, Washington, D.C., 1995, Chapter 34, *Assessing Reclamation Processes for Plastics Recycling*. The other document is published by the Division of Food Chemistry & Technology, HFS-216, Center for Food Safety & applied Nutrition, U.S. Food and Drug Administration, Washington, D.C. 20204. The title is *Points To Consider for the Use of Recycled Plastics in Food Packaging: Chemistry Considerations*. Both of these documents detail methods to verify the efficacy of any potential recycling process against unsafe substances in post-consumer recycle.

The Needs Statements have been prepared by university and industry experts under the direction of the National Food Processors Association's technical staff according to the outline and format prescribed by the systems implementer, R. J. Philips & Associates, Inc.

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