Technical Program for GPEC 2008

Plenary Speakers:

Dr. Seetha Coleman-Kammula, Simply Sustain LLC

Jerry Powell, Resource Recycling Magazine

Bio-based and Biodegradable Materials

B1. Polymeric Chain Extenders and Biopolymers
Roelof van der Meer, BASF Nederland
Volker Frenz, BASF AG, Germany,
Marco Villalobos, Abiodun Awojulu, BASF Corporation, Wyandotte, MI

B2. Manufacture and Applications of PHBV Polymers
Dr. Jim Lunt and Xuejun Chen, Tianan Biologic Materials Co., Ltd.

B3. Recycling of packaging products including biodegradable plastic materials such as PLA foam, plastic fibers and non-woven materials
Alberto E. Ramírez, PALLMANN Industries, Inc.

B4. Can I Run PLA on My Existing Extruders? A Practical Application Guide
Edward L. Steward, American Kuhne Corporation

B6. Degradation of Biodegradable, UV-degradable and Oxodegradable Plastics with In-vessel Food Waste Composting Environment
Joseph Greene, Ph.D., Department of Mechanical Engineering Mechatronic Engineering and Manufacturing Technology, California State University and Fengyu Wang, NWS Jepson Prairie Organics Inc.

B7. Banana Fiber Composites
Lina-Herrera Estrada, Carol Ochoa, Saeed Huda, Haibin Ning, Selvum Pillay and Uday K. Vaidya, University of Alabama at Birmingham

B8. Bio-Based Technology for Powder Coatings
Dr. Damiano Beccaria, Hexion Specialty Chemicals S.r.l, Dr. Bhima Vijayendran and Ms. Kathy Mitchell, Battelle Memorial Institute

B9. Effects of Natural Fiber Fillers on the Mechanical, Thermal, and Water Resistance Properties of Soy Protein-Cornstarch Plastics
Brian E. Ralston & Tim A. Osswald, University of Wisconsin-Madison

B10. Corn (Sugars) Based Polymer Chemistries
Michael Jaffe, George Collins, Anthony J. East, Willis Hammond, and Medical Device Concept Laboratory, Department of Biomedical Engineering, New Jersey Institute of Technology, and Paul Friedhoff, Iowa Corn Promotion Board

B11. NatureWorks® Polylactide Biopolymer: A Sustainable Polymer for the 21st Century
Richard C. Bopp, NatureWorks LLC

B12. Development and Implementation of Soy-Based Foam in Automotive Applications
Cynthia M. Flanigan, Christine Perry, Deborah F. Mielewski, Ford Research and Advanced Engineering Laboratory, Ford Motor Company
Asad Ali and Ashford Galbreath, Adv. Materials & Comfort Engineering, Seating Systems Division, Lear Corporation

B13. Advanced Materials from Novel Bio-based Resins
Shriram Bagrodia, Cereplast Inc.

B14. Bioplastics in Supermarket Applications in UK
Robert Dvorak & Edward Kosior, Nextek Limited

B15. Sustainable Materials for Packaging and Injection Moulding Applications
Kishan Khemani, Ph.D., Plantic Technologies Ltd

B16. High Performance Polymers made with Renewable Resources
Dr. Joe Kurian - Dupont

Reclamation & Supply

RS1. PET recycling: 2 case studies in Austria
Barry B. Hunter, American Starlinger-Sahm, Inc., Elfriede Hell (Presenter), General Manager Recycling Technology, Starlinger & Co. Ges.m.b.H.

RS2. Vertically Integrated Value Adding (VIVA) to the Co-mingled Plastics Stream of Packaging Recyclables of PCR or PIR
Alfred Eiden, Polytech Resources Pty Ltd

RS3. Tricks of the Trade: Tools for Successful Implementation of Programs Using Recycled
Rod Jackson, QTR Inc.

RS4. Using Recycled Polyethylene: Avoiding the Pitfalls
Frits van der Klooster & Chris Ernst, Advanced Blending Technologies, LLC

RS5. Plastic Lumber:Life Cycle Analysis of Technology Developments
J.Ngothai , University of Adelaide, School of Chemical Engineering, G. Di-Mauro Hayes , J.Majumdar, RMIT University Centre for Design & M.Jollands , RMIT University School of Civil, Environmental and Chemical Engineering

RS6. The Litterability of Plastic Bags: Key Design Criteria
K.Verghese, RMIT University Centre for Design , M.Jollands & M.Allan , RMIT University School of Civil, Environmental and Chemical Engineering

RS7. Economic and Environmental Comparison of Reprocessed Polyethylene versus Virgin Polyethylene Liners
Lan Nguyen, Frank Ruiz, Nigel Lawrence, Victor Garibay-Heritage Bag Company

RS8. What's New in Size Reduction for Effective Reclamation
John Farney, National Sales Manager – Cumberland Engineering, Inc.

RS9. What's New in Material Handling for Reclaim Extrusion
Keith Larson, Colortronic North America, Inc

RS10. Low Bulk Density Scrap Recycling/Reclaim Options
Dana Darley, Extrusion Auxiliary Services, Inc

RS11. Recycling of Mixed Post Consumer Plastics Using Advanced Separation Techniques
Edward Kosior and Robert Dvorak, Nextek Limited, United Kingdom

RS12. The Use of Peroxide Masterbatches in the Processing of Regrind and Post Consumer Waste
Marty Paisner, Polyvel, Inc. - Innovations for Success

Recycling

R1. Characterization of Post-Consumer Plastic mixtures Compatibilized by Block Copolymers – Part II
Sarah Bobek, Aniket Selarka, Ned V. Gvozdic and Charles L. Beatty,
Department of Materials Science and Engineering University of Florida

R2. Recycling of Long Glass Fiber Reinforced, Padded Instrument Panels
Robert Egbers, Sr., American Commodities Inc**.**

R3. Automotive Interior Material Recycling and Design Optimization for Sustainability and End of Life Requirements
Steven R. Sopher, JSP

R4. Sustainable Automotive Component Manufacturing Solutions
Gordon C. Miller, M.,M.,&A., LLC

R5. Plastic Composite Railroad Crossties
Henry Sullivan, TieTek

R6. MSS Optical Sorting Technologies for Automated Sorting of Electronic Scrap – Practical Case Studies from the USA
Felix A. Hottenstein, MSS, Inc.

R7. Flame Retardants: Regulatory Issues and Landscape
Raymond B. Dawson & Susan D. Landry -Albemarle Corporation

R8. Reducing Environmental Emissions of Flame Retardants in the Plastics Industry for a Sustainable Future
Susan D. Landry -Albemarle Corporation

R9. Trends & Challenges for Start-Up & Emerging Companies in the Clean-Technology Marketplace
Eric Koester, Attorney Heller-Ehrman, LLP

R10. PIQET: A Life Cycle Management Tool forSustainable Plastics Packaging
J. Majumdar, K. Verghese, Centrefor Design, RMIT University and
L. Fitzpatrick Birubi Innovation Pty LtdMelbourne, Australia

Student Posters

GPEC 2008 Student Poster #1

Title: The Degradation of Biodegradable Polylactide Correlated to the Average Molecular Weight
Authors: Rocco Viggiano, and Christopher Mann**,** Plastics Engineering Department**,** Penn State University at Erie, the Behrend College

GPEC 2008 Student Poster #2

Title: Recycling in the Caribbean
Author: Jesse Haedrich, Penn State, Plastics Engineering Technology

GPEC 2008 Student Poster #3

Title: Nanotechnology Safety Education
Authors: Obiageli B. Onovo, Kishanchandra Golla, Pittsburg State University & Dr. Chris C. Ibeh, Faculty Advisor

GPEC 2008 Student Poster #4

Title: Review of Utilization of Waste Tires in Asphalt
Authors: Khaldoun Shatanawi* and Carl Thodesen, Graduate Research Assistants, Department of Civil Engineering, Clemson University

GPEC 2008 Student Poster #5

Title: Review of Waste Product Utilization in Highway Construction
Authors: Khaldoun Shatanawi* and Carl Thodesen, Graduate Research Assistants, Department of Civil Engineering, Clemson University

GPEC 2008 Student Poster #6

Title: Degradation of Polylactic Acid (PLA) Exposed to Steam
Authors: L.F. Vargas[1], B. Welt[1], P. Pullammanappallil[1], A. Teixeira[1],M. Balaban[1], C. Beatty[2], [1]Department of Agricultural & Biological Engineering. [2]Department of Materials Science and Engineering: University of Florida.

GPEC 2008 Student Poster #7

Title: Preparation and Thermal Analysis of Polyurethane Composite Using Oil Palm Based Polyol and Fiber

Authors: Min Min A.[1*], Yaakob, Z.[1], Mohd Hilmi M.[2], Khairul Zaman Hj M D [2], Kamarudin.S.K.K[1]**,** [1]Department of Chemical & Process Engineering, Faculty of Engineering, University Kebangsaan Malaysia, [2]Radiation Processing Technology Division, Malaysia Institute for Nuclear Technology (MINT), Bangi

GPEC 2008 Student Poster #8

Title: New Polyacetal Polyols for Polyurethanes

Authors: Mihail Ionescu, Semonti Sinharoy and Zoran S. Petrovic, Pittsburg State University, Kansas Polymer Research Center

GPEC 2008 Student Poster #9

Title: Thermoplastic Starch

Author: Michael Thurman, Pittsburg State University

GPEC 2008 Student Poster #10

Title: Alternative Techniques to Characterize Polyester Based Biopolymers

Authors: Andréanne Harbec[1], Florine Maes[1], Marie-Claude Heuzey[1], Louis-Simon Lussier[2] and Charles Dubois[1]**,** 1- Department of chemical engineering, École Polytechnique de Montréal, 2- Defence RDC-Valcartier, Québec

GPEC 2008 Student Poster #11

Title: Postconsumer HDPE/Agave Fibre Foamed Composites Coated with Chitosan Used for Removal of Heavy Metals

Authors: M.O. Vázquez[a], V.S.Herrera[a], C. Gómez[a], D. Rodrigue[b] and R. González-Núñez[a]*
[a] Departamento de Ingeniería Química, Universidad de Guadalajara, [b] Department of Chemical Engineering, Université Laval, Québec

GPEC 2008 Student Poster #12

Title: PLA and Cellulose Based Degradable Polymer Composites

Author: Mihir A. Oka, Graduate Student, School of Polymer, Textile and Fiber Engineering Georgia Institute of Technology

GPEC 2008 Paper Abstract #B1

Title: Polymeric Chain Extenders and Biopolymers

Authors: Roelof van der Meer, BASF Nederland
Volker Frenz, BASF AG, Germany,
Marco Villalobos, Abiodun Awojulu, BASF Corporation, Wyandotte, MI

ABSTRACT

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Engineering polymers based on condensation thermoplastics like PET, PBT, Polyamides, Polycarbonates and Biopolyesters have to be reprocessed during recycling at very high temperature, where degradation of these polymers are extremely rapid.
As the result of this regradation, the possiblities for reprocessing internal process regrind as well as postconsumer - recycle reclaims back into demanding application is very limited.
The polymeric chain extender offer a possibility to rebuild molecular weight and melt strengths of these polyester, blends and related product and open a new window of opportunity for recycling.

GPEC 2008 Paper Abstract #B2

Title: Manufacture and Applications of PHBV Polymers

Authors: Dr. Jim Lunt and Xuejun Chen, Tianan Biologic Materials Co., Ltd.

ABSTRACT

Today the world is experiencing an unprecedented change in the dynamics of everyday life. Globally, oil reserves are being depleted at an increasing rate. Simultaneously, evidence of global warming due to the increasing levels of greenhouse gas emissions is being acknowledged. To face this new reality, new materials derived from renewable resources which will reduce the burden on fossil fuel and also reduce the environmental impact of persistent organic pollutants (green house gases), are continuously being developed.

Tianan Biologic, located in Ningbo, China has been developing PHBV biopolymers since April 2000. PHBV is a bioplastic, produced by bacteria from readily available natural sugar feedstocks. It is fully Biodegradable, and uses no genetically modified organisms or feedstocks

This presentation will discuss the Tianan company vision, manufacturing status, potential applications and properties of Tianan Biologic's PHBV bioplastic products.

GPEC 2008 Paper Abstract #B3

Title: Recycling of packaging products including biodegradable plastic materials such as PLA foam, plastic fibers and non-woven materials

Author: Alberto E. Ramírez, PALLMANN Industries, Inc

ABSTRACT

PALLMANN develops and manufactures size reduction machines and complete systems for the plastics and recycling industries. We have over 100 years in the industry, one of the largest R&D facilities, and a firm commitment to the sustainability movement. PALLMANN continues to offer innovative solutions to the industry, including Size Reduction technology and Agglomeration of Thermoplastics with our Plast-Agglomerator. Our innovating technology is presently applied in such processes as reclamation of carpet waste, packaging products including biodegradable plastic materials such as PLA foam, plastic fibers and non-woven materials, films, etc.

GPEC 2008 Paper Abstract #B4

Title: Can I Run PLA on My Existing Extruders? A Practical Application Guide

Author: Edward L. Steward, American Kuhne Corporation

ABSTRACT

PLA (Polylactide resin) is one of the bio-plastics that has found some product applications and seems to be an extrudable material of growing interest. Any polymer that is made from a renewable resource and that it is a degradable and environmentally friendly material seems to gain favor in some markets, especially if it can be processed on existing machinery.

This paper will discuss the requirements to efficiently extrude PLA on a single screw extruder with an optimum screw design and processing conditions. Different sizes of extruders will be looked at to give some guidelines as to the required equipment to successfully extrude this material.

GPEC 2008 Paper Abstract #B6

Title: Degradation of Biodegradable, UV-degradable and Oxodegradable Plastics with In-vessel Food Waste Composting Environment

Authors: Joseph Greene, Ph.D., Department of Mechanical Engineering Mechatronic Engineering and Manufacturing Technology, California State University and Fengyu Wang, NWS **J**epson Prairie Organics Inc.

ABSTRACT

Biodegradable and oxodegradable plastics degraded in an in-vessel compost operation along with food waste from San Francisco, California. Biodegradable plastics included, corn starch based biobag, Mirel PHA bag, BioTuf Ecoflex bag, Husky corn starch based trash bag, PLA lids, sugar cane lids, and Kraft paper. Also buried were polyethylene shrink-wrap, UV degradable plastic bag, and oxodegradable plastic bag. The samples were placed in perforated plastic sacks and mixed with food waste at NorCal and Jepson Prairie Organics (JPO) composting operation in Vacaville, California. After 180 days, the materials that completely degraded included PLA lids, Mirel bags, Ecoflex bags, Husky bags, and corn starch trash bags. Small fragments of sugar cane lids and Kraft paper were visible. The sugar cane and Kraft paper fragments were very moist and would disintegrate when picked up. The Kraft paper and sugar cane fragments did not completely biodegrade due to the lack of mechanical agitation while in the plastic sacks. If the materials were placed in the compost soil, higher degradation would occur due to better interaction with the compost soil. The oxo-biodegradable plastic bags, LDPE plastic bags and UV-degradable plastic bag did not experience any degradation and did not fragment into smaller pieces.

GPEC 2008 Paper Abstract #B7

Title: Banana Fiber Composites

Authors: Lina-Herrera Estrada, Carol Ochoa, Saeed Huda, Haibin Ning, Selvum Pillay and Uday K. Vaidya, University of Alabama at Birmingham

ABSTRACT

The study of chemical treatments, binders and processing methods has become an important aspect for developing banana fiber reinforced polymer composites for automotive and consumer applications. Since the properties of a composite greatly depend upon the fiber-matrix interaction and the processing method, the present work focuses on the study of the effect of sodium hydroxide (NaOH) chemical modification of fiber surface and subsequently processed using epoxy resin with banana fibers. The flexural and compressive behavior of the composites was evaluated. In addition, environmental tests were conducted and the properties were evaluated before and after moisture absorption in these composites. The compressive strength is higher for composites with NaOH pretreated fibers and decreases with fiber content. Immersion in water at 90°C, caused a 24% decrease in strength in the NaOH pre-treated fiber composites and a 43% decrease for untreated fiber composites. In 55% mass fractions of banana fiber water exposure caused a reduction of 68% and in 50% mass fractions a 55% decrease in compressive strength.

GPEC 2008 Paper Abstract #B8

Title: Bio-Based Technology for Powder Coatings

Authors: Dr. Damiano Beccaria, Hexion Specialty Chemicals S.r.l, Dr. Bhima Vijayendran and Ms. Kathy Mitchell, Battelle Memorial Institute

ABSTRACT

Over the past decades, powder coatings have become more commonly used, especially in key sectors such as aluminum window frames, household appliances and transportation. With no requirement for volatile liquids or solvents, powder coatings are easy to use, ecologically sound and cost effective. Suitable for three dimensional shapes, dry powder coatings show high transfer efficiency and are recyclable. There is great interest in the replacement of petrochemical feedstocks with biobased feedstocks for use in a wide range of application areas. Battelle and Hexion Specialty Chemicals have teamed to develop and bring to market a bio-based option for powder coatings. This technology is based on renewable resource feedstocks from soybeans and corn. The initial research for this novel technology, with funding support from the Ohio Soybean Council, targeted the quality and performance requirements of conventional petroleum-based powder coatings. The added benefit of low-temperature curing was discovered with this bio-based technology. This performance enhancement over conventional powder coatings produces a durable, cost-effective, low-temperature thermally-cured powder coating suitable for temperature sensitive substrates without sacrificing appearance and coating performance. Technical success has been demonstrated for processability, flexibility, and chemical and physical properties.

GPEC 2008 Paper Abstract #B9

Title: Effects of Natural Fiber Fillers on the Mechanical, Thermal, and Water Resistance Properties of Soy Protein-Cornstarch Plastics

Authors: Brian E. Ralston & Tim A. Osswald, University of Wisconsin-Madison

ABSTRACT

Plastics derived from renewable resources are one piece of the puzzle in reducing fossil fuel dependence. Viable bio-based materials will one day contribute to a more sustainable economy. Many bio-based materials are biodegradable as well as renewable, offering an outlet for overflowing solid waste streams. Soy protein-based plastics are one promising class of renewable, biodegradable materials.

Many potential applications of soy protein plastics take advantage of the biodegradability of this material, including protective tubes for nursery trees, agricultural mulch films, plantable flowerpots and garden cell packs. Upon degradation, soy protein plastics can provide nutrients to the soil. Additional applications include more complex extruded, injection molded and thermoformed parts such as compostable food trays, containers, flatware and packaging. Soy protein plastics also could be used in biomedical applications such as tissue scaffolding, implants and drug delivery.

The ranges of mechanical performance of soy protein plastics (*e.g.*, tensile strength, elongation, modulus) are comparable to commodity resins such as polypropylene (PP), polystyrene (PS), and polyethylenes (PE). However, soy protein plastics with high modulus and strength have extremely low elongation, and *vice versa*. Soy protein plastics also display substantial water sensitivity. Moisture content of the resin affects behavior during processing. The properties of finished parts can fluctuate with humidity. Improving mechanical properties and reducing water sensitivity are the two most urgent challenges facing soy protein plastics. One method to meet these challenges and bring soy protein plastics to market is blending soy proteins with other bio-based polymers, including poly(lactic acid) (PLA) and cornstarch. Natural fiber composites of these blends can yield further property improvements.

The work reported here includes viscosity data from capillary rheometry and mechanical properties and water sensitivity from injection molded and extruded samples of soy-cornstarch blends, as well as natural fiber composites of these blends. Capillary rheometry data shows the viscosities of soy protein plastics are comparable to commodity resins, allowing soy protein plastics to be processed on conventional plastics processing equipment. The objective of this work is to gain an understanding of how soy protein plastics can be processed in order to manufacture commercially viable parts from these materials.

GPEC 2008 Paper Abstract #B10

Title: Corn (Sugars) Based Polymer Chemistries

Authors: Michael Jaffe, George Collins, Anthony J. East, Willis Hammond, and Medical Device Concept Laboratory, Department of Biomedical Engineering, New Jersey Institute of Technology, and Paul Friedhoff, Iowa Corn Promotion Board

ABSTRACT

Sugars may be viewed as a chemical feedstock to produce new monomers, polymers and additives for the commercial polymer industry. Interest is focused on compounds such as the dianhydrohexitols (isosorbide and its isomers) that offer molecular geometry and chemical functionality compatible with many existing commercial polymers. Applications ranging from the creation of new polymer backbones for use as thermoplastics or thermosets to the identification of low molar mass compounds that can act as plasticizers, stabilizers or compatiblizers are under investigation. Of special interest is the impact of substitution symetry and controlled stereochemistry in the design and performance of new, cost-effective structures with commercial potential. As petroleum becomes more expensive and the assurance of long range, cost-effective supply questionable, creation of alternative chemistries from renewable resources such a corn (glucose) becomes more attractive.

GPEC 2008 Paper Abstract #B11

Title: NatureWorks® Polylactide Biopolymer: A Sustainable Polymer for the 21st Century

Author: Richard C. Bopp, NatureWorks LLC

ABSTRACT

No abstract available.

GPEC 2008 Paper Abstract #B12

Title: Development and Implementation of Soy-Based Foam in Automotive Applications

Authors: Cynthia M. Flanigan, Christine Perry, Deborah F. Mielewski, Ford Research and Advanced Engineering Laboratory, Ford Motor Company and Asad Ali and Ashford Galbreath, Adv. Materials & Comfort Engineering, Seating Systems Division, Lear Corporation

ABSTRACT

Using agricultural crops as material feedstock is becoming more prevalent as scientists search for alternative choices to petroleum based products. Soybeans are one crop within North America that is economical and readily available for use in plastic applications. Recently, we have been evaluating the use of soy as reinforcement and resin in a variety of polymer matrices, including flexible and rigid polyurethanes. Our main focus has been on using functionalized soybean oil in the manufacture and formulation development of flexible, polyurethane foams for seating applications. Soy-based foams reduce the environmental footprint compared with the manufacture of petroleum-based foams. Ford Motor Company has researched methods to synthesize soy polyols, reduce odor in the foam and to maximize soy content in foam formulations. In a partnership between Ford Motor Company and Lear Corporation, we have demonstrated the feasibility of formulating and processing soy-based polyurethane systems that have the key properties required for automotive interior and seating foam applications. Prior to launch of this soy technology, numerous processing trials were completed on headrest, armrest and seating applications. We will review the main steps required for moving the technology from a laboratory setting to production environment and launch of the soy technology in 2008 Mustang. Lastly, we will discuss the technical and commercial challenges and benefits of implementing soy-based foam.

GPEC 2008 Paper Abstract #B13

Title: Advanced Materials from Novel Bio-based Resins

Author: Shriram Bagrodia, Cereplast Inc.

ABSTRACT

Cereplast Hybrid Resins™, also known as BIOPOLYOLEFINS™, are bio-based plastic resins, replacing 50 percent or more of the petroleum content in traditional plastic products with renewable source materials such as starches from corn, tapioca, wheat, and potatoes. The addition of Cereplast Hybrid Resins™ to the existing line of Compostable Resins™ further establishes Cereplast as the leading solutions provider in environmental and sustainable plastics. The first product from the Cereplast Hybrid Resins™ family is Biopropylene™, a 50 percent bio-based resin that can replace traditional polypropylene in many applications. Cereplast Hybrid Resins™ can be processed at the same cycle time as traditional plastics on conventional equipment, but requires less energy in the production process by using significantly lower processing temperatures. In addition, Cereplast Hybrid Resins™ meet the requirements for toxicity set by ASTM D 6400-04 specifications , making Cereplast Hybrid Resins™ safe for all applications. This paper further discusses mechanical properties and potential applications of Biopropylene™.

GPEC 2008 Paper Abstract #B14

Title: Bioplastics in Supermarket Applications in UK

Authors: Robert Dvorak & Edward Kosior, Nextek Limited

ABSTRACT

The UK is seeing a significant growth in the development and use of biopolymer and compostable packaging in the retail grocery sector. There is a growing interest in using biopolymers amongst the major grocery retailers and brands, partly as a result of an increase in conventional packaging costs, but predominantly as a point of differentiation and for the positive consumer perceptions associated with the term ‘biodegradable’ or ‘compostable’. The introduction of these new materials may have environmental benefits in specific food packaging applications but may also create risks for established recycling operations for both oil based plastics and compostable material, and must be managed carefully.

The paper discusses food packaging product innovations as well as issues associated with biopolymer use such as packaging weight, energy use, the issues of GM crops, renewable biopolymer sourcing, labelling of bio-based packaging, shelf-life and transport considerations and compost disposal options.

This paper also includes a summary of life cycle research into the environmental benefits of biopolymers compared with conventional plastics and recycled content plastic packaging for rigid tray packaging.

GPEC 2008 Paper Abstract #B15

Title: Sustainable Materials for Packaging and Injection Moulding Applications

Author: Kishan Khemani, Ph.D., Plantic Technologies Ltd

ABSTRACT

Plantic Technologies has developed several sustainable renewable Australian grown renewable resource raw material, corn starch, based green packaging and injection moulding products. Currently, Plantic® sheets are thermoformed into rigid trays of all shapes and sizes and are used in packaging application. These trays are biodegradable and water dispersible, and are used by leading chocolate manufacturers such as Cadbury's and Lindt. Starch extracted from the hybrid high-amylose corn is purified and modified, and then processed with other ingredients inside a twin-screw extruder and extruded into either resin pellets or large rolls of sheet that look and feel like commodity plastic. The resin and sheets can be produced in any color of choice and are easily further processed into diverse products. Plantic's current commercial tray grade is certified compostable to up to 1000 microns thickness under various US (ASTM D6400) and European (EN 13432) and Global (ISO 14855) standards. Additionally it is also certified compostable to 250 microns thickness in a Home Compost, Soil and Water environment.

Plantic's future research and development efforts are focused on developing future technology platforms that will introduce new product applications for starch based materials. For instance, we are developing water resistant grades of products for packaging and other applications. Furthermore, we have projects aimed at developing gas-barrier materials and thin film grades of sustainable and biodegradable resin. Some of our efforts are also focused on combining our starch technology with nanotechnology in the development of these and other new applications.

GPEC 2008 Paper Abstract #B16

Title: High Performance Polymers made with Renewable Resources

Author: Dr. Joe Kurian - Dupont

ABSTRACT

There is a growing need to develop environmentally friendly materials that provide performance and functionality equivalent to or better than petroleum based materials. DuPont is committed to research and development that will increase the use of renewable materials in its offerings and reduce dependency on petroleum. For over 15 years, DuPont has been developing integrated science and technology that collaborates with nature to produce a new category of bio-based materials called DuPont Renewably Sourced Materials. There are many diverse applications for Renewably Sourced products ranging from fabrics to carpets, inks and coatings, to construction materials and packaging. DuPont Engineering Polymers recently announced the commercialization of a new family of high-performance thermoplastic resins, flexible polyamides and elastomer products made with renewable resources. The new products are DuPont™ Sorona® EP thermoplastic polymers, polyamide 6,10 & polyamide 10,10 and DuPont™ Hytrel® RS thermoplastic elastomers made with renewable resources. One of the key ingredient in Sorona® renewably sourced polymer is Bio-PDO™, which is derived from corn sugar using a proprietary fermentation process. DuPont™ Hytrel® RS thermoplastic elastomer will use a 100% bio-derived DuPont polyol, Cerenol™, made with Bio-PDO™. DuPont Tate & Lyle bioproducts LLC, a joint venture between DuPont and Tate & Lyle, will supply the Bio-PDO™ from the Loudon, TN, facility. The performance and processing characteristics of Renewably Sourced polymers are as good as or better than those of current products made wholly from petrochemicals. This presentation will provide an overview of sustainable materials, design and development, product offerings, polymer properties, comparisons with similar petroleum derived polymers, commercialization status and applications. More information can be found at the web site: http://www.renewable.dupont.com.

GPEC 2008 Paper Abstract #RS1

Title: PET recycling: 2 case studies in Austria

Authors: Barry B. Hunter, American Starlinger-Sahm, Inc., Elfriede Hell (Presenter), General Manager Recycling Technology, Starlinger & Co. Ges.m.b.H.

ABSTRACT

Requirements and practical results of PET Recycling
- possible sources of PET waste
- general demands on recycling of PET
- stakeholder requirements (colour, IV, AA, transparency, etc.)
- Case study 1: recycling and reuse of inhouse PET preforms
- Case study 2: recycling and reuse of post-consumer PET bottles

GPEC 2008 Paper Abstract #RS2

Title: Vertically Integrated Value Adding (VIVA) to the Co-mingled Plastics Stream of Packaging Recyclables of PCR or PIR

Author: Alfred Eiden, Polytech Resources Pty Ltd

ABSTRACT

Packaging materials constitute a substantial quantity of Post Consumer Recyclables (PCR). Urban waste management entities operate material recovery facilities (MRF) for the purpose to recover the individual materials of the domestic generated PCR for reclamation of their intrinsic values, to the good of the community and the good of the environment.

The conventional method of recovering selected plastics types from the plastics stream into Recyclates is well established and practiced. The VIVA concept provides a different approach to the selection and processing of the plastics fractions to be processed collectively. The VIVA concept proposes to integrate the selected co-mingled plastics fractions vertically through the process tiers to produce particulate composite compounds such as wood/plastics composites (WPC) and even final marketable products from WPC.

The VIVA concept is identified as being more cost effective than the conventional approach in realizing value from the co-mingled plastics fraction of the Domestic Packaging PCR. The integration provides advantages in material sourcing, transportation and complete utilization of the plastics stream.

GPEC 2008 Paper Abstract #RS3

Title: *Tricks of the Trade*: Tools for Successful Implementation of Programs Using Recycled

Author: Rod Jackson, QTR Inc.

ABSTRACT

Tricks of the Trade: Tools for Successful Implementation of Programs Using Recycled

Unsuccessful implementation of programs utilizing recycled plastics damages the credibility of all compounders. This presentation focuses on the key elements of successful project implementation including project feasibility, feedstock sourcing, design development, advance quality planning, and trial processing. Implementation of these key elements will improve the likelihood of successful implementation of recycle programs, strengthening the compounding industry.

GPEC 2008 Paper Abstract #RS4

Title: Using Recycled Polyethylene: Avoiding the Pitfalls

Authors: Frits van der Klooster & Chris Ernst, Advanced Blending Technologies, LLC

ABSTRACT

Manufacturers using recycled polyethylene generally experience decreased manufacturing efficiencies, increased scrap rates and lower product quality. Two of the major problems contributing to recycled material problems are;

1) The materials have lost their identity; recycled suppliers describe (generally inaccurately) the material for sale only by MI and density, and what a manufacturer orders is often different from what is received.

2) Even with hundreds of grades of polyethylene available it is difficult to find recycled materials that meet the exact specification required by the application.

The patented OptiMISER® System utilizes a systematic approach and advanced blend formulating software that allows manufacturers to achieve high recycled content, up to 100%. The OptiMISER System uses a fast and low cost characterization process that accurately determines material properties. An advanced optimization engine uses the properties, with application specific algorithms, to create blends of two or more recycled materials that match the manufacturer's key material specifications. The result is that recycled materials can now be used at higher percentages and in previously avoided high quality applications.

GPEC 2008 Paper Abstract #RS5

Title: Plastic Lumber:Life Cycle Analysis of Technology Developments

Authors: J.Ngothai , University of Adelaide, School of Chemical Engineering, G. Di-Mauro Hayes , J.Majumdar, RMIT University Centre for Design & M.Jollands , RMIT University School of Civil, Environmental and Chemical Engineering

ABSTRACT

Plastic lumber is a major business with large production especially in North America and a growing business in Australia. There are some local manufacturers, using recycled co-mingled waste to produce plastic lumber for park benches, jetties, decks and railway sleepers. Current uses are limited by low strength and impact performance, as well as a lack of approved test methods. Current research at the University of Adelaide is analyzing the effect of process parameters on mechanical properties, and how these can be enhanced by the use of suitable compatibilizers.

Current research at RMIT University is analyzing the effect of these potential technology developments on the environmental impact of plastic lumber compared to wood planking, using a life cycle analysis

GPEC 2008 Paper Abstract #RS6

Title: The Litterability of Plastic Bags: Key Design Criteria

Authors: K.Verghese, RMIT University Centre for Design , M.Jollands & M.Allan , RMIT University School of Civil, Environmental and Chemical Engineering

ABSTRACT

Single use plastic bags are used by the billion in supermarkets, fast food outlets and retail stores because of their excellent fitness for use, resource efficiency and cheap price. They come in many varied shapes, sizes and materials. Because of their light-weight nature they are only a tiny fraction of the tonnage of plastic used in the packaging industry, yet they make a major contribution to litter, thanks to their large surface area and lack of biodegradability. In 2006 the Australian Government Department of Environment and Heritage initiated and funded, courtesy of the Natural Heritage Trust, a study to investigate the effect of bag design on litterability. This paper draws on report materials from the study that are the intellectual property of the Commonwealth. The paper presents a review of previous studies on plastic bags, a review of international plastic bag regulations, as well as the results of an assessment of the environmental impact of bag design using a streamlined life cycle assessment and the litterability of bag design using equipment including wind tunnels. The paper concludes with recommendations for bag design to maintain resource efficiency while reducing litterability.

GPEC 2008 Paper Abstract #RS7

Title: Economic and Environmental Comparison of Reprocessed Polyethylene versus Virgin Polyethylene Liners

Authors: Lan Nguyen, Frank Ruiz, Nigel Lawrence, Victor Garibay-Heritage Bag Company

ABSTRACT

One often thinks that using products with recycled content is always good for the environment. However, guards be taken against unintended consequences a result of failing to analyze a product's full life cycle. A study was conducted to evaluate the relative benefits and limitations of using recycled polyethylene versus prime, virgin-based polyethylene used in trash bags and liners. This paper compares the processability, economic, performance characteristics and environmental impact of the two approaches.

GPEC 2008Paper Abstract #RS8

Title: What's New in Size Reduction for Effective Reclamation

Author: John Farney, National Sales Manager – Cumberland Engineering, Inc.

ABSTRACT

Size reduction is an important part of any recycling or reprocessing operation. The physical properties of the materials involved require different systems to maximize the efficiency of your size reduction process. For example, bottles are ground up in one type of machine, while automotive bumpers require a slightly different system to generate the best quality regrind.

New developments in size reduction technology allow more flexibility, improved energy efficiency, ease of clean-out and improved regrind quality than ever before. Peripheral equipment like metal detectors, conveyors, wash lines and screeners round out a complete package. This makes it easier for the processor to install a complete system and be up and running in a short period of time.

Starting your re-pelletizing process with a quality feed stream will produce a better quality product

GPEC 2008 Paper Abstract #RS9

Title: What's New in Material Handling for Reclaim Extrusion

Author: Keith Larson, Colortronic North America, Inc

ABSTRACT

Material handling is an integral part of an efficient reclaim processing operation. The reclaim material and other ingredients need to be conveyed and blended in the correct proportions to ensure a quality product out of the downstream end of your process.

Conveying systems work better if they are designed for the specific material to be handled. For instance, film reclaim is a much lower bulk density, so it is conveyed differently than traditional pelletized resins. Powder additives, and resins, are much heavier, and present a different set of design parameters.

Blending and feeding can be as simple as a volumetric auger, and as complex as a complete loss-in-weight feeding system. One is more expensive than the other, but offers many advantages over the traditional volumetric systems.

New equipment and control systems are making equipment much more user-friendly and reliable. Better filtration, PLC control systems and new feeding equipment are just a few examples of improved offerings from equipment suppliers.

It is important that the material handling part of your system is properly designed, or you will not maximize the performance of your extrusion process.

GPEC 2008 Paper Abstract #RS10

Title: Low Bulk Density Scrap Recycling/Reclaim Options

Author: Dana Darley, Extrusion Auxiliary Services, Inc

ABSTRACT

Low bulk density scrap, such as film, fiber and foam, can be very difficult to reprocess due to varying forms and contamination levels, as well as its poor feed characteristics, both before and after size reduction. We will take a look at all currently available technology for reprocessing such scrap, describe each process and review the Pros and Cons. We will then draw our conclusions and discuss proper application of each process. Technologies reviewed include: a) Simple edge trim re-pelletizing systems, b) Fluff/regrind direct reclaim systems for feeding ground scrap directly back to the extruder, c) Scrap densification systems for producing agglomerated particles for easier blending and feeding, d) Traditional re-pelletizing systems where scrap is pre-size reduced, extruded and pelletized, and e) Combination re-pelletizing systems using specialty extruders, with integral shredder/compactors.

GPEC 2008 Paper Abstract #RS11

Title: Recycling of Mixed Post Consumer Plastics Using Advanced Separation Techniques

Authors: Edward Kosior and Robert Dvorak, Nextek Limited, United Kingdom

ABSTRACT

The most commonly recycled post consumer plastics have been packaging plastics mainly in the form of beverage containers such as HDPE and PET bottles. However bottles are only one third of the domestic plastics waste stream so recycling systems that collect all plastics packaging are faced with the problem of how to handle the remaining materials. This paper will address the performance of advanced separation techniques applied to the recycling of mixed plastics streams that have been generated from post consumer collections after the main bottles have been removed. The composition of the plastics, the process costs and economic value of the finished products are evaluated to discover if they provide a viable method of recycling this large stream of materials.

GPEC 2008 Paper Abstract #RS12

Title: The Use of Peroxide Masterbatches in the Processing of Regrind and Post Consumer Waste

Author: Marty Paisner, Polyvel, Inc. - Innovations for Success

ABSTRACT

To be both green and profitable, many plastic manufacturing processes need to reprocess scrap into useful, saleable products. By its very nature the regrind derived from scrap is usually heterogeneous particularly by way of its melt properties. The proper use of peroxide masterbatches can transform regrind, and also post consumer waste, into a useful raw material stream where not only the melt properties are homogenous, but other desirable properties are developed, resulting in high quality products. This paper shows the chemistry behind peroxide-induced modifications of polypropylene and polyethylene, the advantages of using the peroxide additive in masterbatch form, and anecdotal cases where regrind and post-consumer waste were transformed into useful products.

GPEC 2008 Paper Abstract #R1

Title: Characterization of Post-Consumer Plastic mixtures Compatibilized by Block Copolymers – Part II

Authors: Sarah Bobek, Aniket Selarka, Ned V. Gvozdic and Charles L. Beatty,
Department of Materials Science and Engineering University of Florida

ABSTRACT

Mechanical properties of mixed post-consumer plastics were improved by addition of block copolymers. When block copolymer of appropriate molecular architecture is added to mixed plastics, it can serve as compatibilizer improving the interfacial strength between different plastics. Mechanical properties of these polymer systems have been maximized by addition of combination of block copolymers. Properties of these polymer systems were even further enhanced by the addition of natural fibers.

Properties of compatibilized and fiber reinforced mixed post-consumer plastics were compared against the non-compatibilized and non-fiber reinforced mixed plastics having the corresponding compositions. Phase morphology was characterized by examining the fracture-surfaces imaged by Electron Scanning Microscope. Mechanical properties were characterized by measuring tensile and impact properties.

GPEC 2008 Paper Abstract #R2

Title: Recycling of Long Glass Fiber Reinforced, Padded Instrument Panels

Author: Robert Egbers, Sr., American Commodities Inc**.**

ABSTRACT

The punched sections of composite substrate/foam/skin (punch outs) have traditionally gone to landfill, typically at a cost of $0.05/lb. to the Tier 1 supplier. Wipag Recycling in Germany has developed a process whereby the substrate material is recovered from the composite structure, separating the resin from the foam and skin. The resin has 99.8% purity and can be subsequently blended back into virgin resin for production at a specified percentage without statistically varying the physical properties of the LFPP IP substrate. The WIPAG laminate separation process has been in commercial operation at American Commodities Inc. (ACI) in Flint, MI for the past 7 years albeit with SMA, PC/ABS and TPO substrates.

With regard to recycling LFPP, traditional wisdom dictates that the material properties of the resin will be reduced after each heat history due to glass fiber length attrition, caused from the processing of the material. This study shows that up to 30% of resin reclaimed from the composite substrate can be added to virgin material with a minimal effect on the properties of the final part.

GPEC 2008 Paper Abstract #R3

Title: Automotive Interior Material Recycling and Design Optimization for Sustainability and End of Life Requirements

Author: Steven R. Sopher, JSP

ABSTRACT

There is a move in the automotive industry to promote the use of sustainable products. Sustainability considerations in automotive design must include a variety of factors. These include:

1. Weight reduction
2. Commonization of materials
3. Use of more environmentally friendly materials
4. Ease of disassembly at vehicle's End-Of-Life
5. Consideration of RoHS requirements
6. Compliance to OEM, Federal and Industry regulations
7. Recyclability of materials and current recycling stream
8. Component design and performance requirements
9. Vehicle and occupant safety

While evaluating all of these considerations when designing for sustainability, it is necessary to understand the allowances for performance and cost trade-offs as they relate to meeting the needs of both the OEM and end user (or customer).

This paper will explore the industry trends, particularly those published by the OEM's as they relate to designing for sustainability and recyclability. This paper will compare some of the newer industry recycling guidelines, as well as vehicle End-Of-Life dismantling requirements. This paper will also explain the intention of the newer vehicle component part guidelines for sustainable development as they relate to automotive component design and ease of disassembly and recyclability. Case studies will be presented to evaluate component part design and the move toward the use of more commonly recycled and recyclable products.

Industry trends will also be reviewed as they apply to market demand for more environmentally friendly materials. The pros and cons of using some of the new bio-based materials will also be compared and contrasted.

GPEC 2008 Paper Abstract #R4

Title: Sustainable Automotive Component Manufacturing Solutions

Author: Gordon C. Miller, M.,M.,&A., LLC

ABSTRACT

Being sustainable means that a product or service meets both today's needs and results in minimized burden to our children and their children and to the environment for the future.
This paper will present a proven alternative to environmental issues such as heavy metals used chrome plating for application to plastic components in the global automotive, light truck, and heavy truck industry. It will highlight how this technology, Fluorex® bright film, further contributes to a "greener" environment by eliminating environmental hazards and residual footprints from substances such as heavy metals by using film based solutions contributing to the development of lighter and potentially "greener" light weight vehicles. This translates in both better fuel economy in vehicles using this technology and reductions in emissions from the manufacturing processes. Other environmental benefits for other coating opportunities using Flourex® Paintfilm will be evaluated based on this technology that specifically involve more opportunities to minimize the environmental impact and improve recyclability while contributing to a more aesthetically pleasing environment by enhancing the appearance of vehicles worldwide.
This is a solution for manufacturers to provide the appealing and marketable look of chrome or other pleasing surface characteristics on plastic components while being environmental compliant and responsible. This is a sustainable solution for coloring and coating – Fluorex® bright film and Fluorex® paintfilm – a "green" alternative to painting metal and plastic products that enhances the environmental benefits of plastics is both possible and here today.

GPEC 2008 Paper Abstract #R5

Title: Plastic Composite Railroad Crossties

Author: Henry Sullivan, TieTek

ABSTRACT

TieTek has developed a plastic composite railroad tie that can replace creosote-treated hardwood ties in heavy freight and transit track.
The TieTek™ tie is produced from recycled High Density Polyethylene combined with reinforcing fillers and fibers to provide required stiffness, compression strength, impact tolerance and fastener holding power. The proprietary manufacturing process utilizes blending, intensive mixing, extrusion and molding to produce consistent mechanical properties from a realistic range of polymer properties encountered in the recycling stream
This innovative polymer product, used successfully on commercial track for more than 13 years, has several beneficial environmental impacts:

- Uses 50 million lbs of post-consumer and post-industrial recycled HDPE annually.
- Consumes rubber from 1 million recycled tires annually.
- Preserves mature hardwood trees.
- Avoids the need for toxic wood preservatives.
- Product is recyclable at end of useful life. This is truly “cradle-to-cradle” recycling.

GPEC 2008 Paper Abstract #R6

Title: MSS Optical Sorting Technologies for Automated Sorting of Electronic Scrap – Practical Case Studies from the USA

Author: Felix A. Hottenstein, MSS, Inc.

ABSTRACT

This paper presents practical case studies of the latest MSS optical separation technologies for automated sorting of WEEE materials. The MSS e-Sort(tm) and MetalSort(tm) provide identification and separation of the following materials: 1) Plastics: ABS, HIPS, PC, blends; 2) Circuit Boards; and 3) Metals: Ferrous, non-ferrous, stainless.

The e-Sort(tm) combines state-of-the-art near-infrared spectroscopy, color-sorting capability and induction metal detection technology. One machine can generate either two outputs from one input stream (one positively ejected fraction, one pass fraction) or three outputs (two positively ejected fractions, one pass fraction).

Pictures, video and performance data of three industrial e-Sort system installations will be presented.

GPEC 2008 Paper Abstract #R7

Title: **Flame Retardants: Regulatory Issues and Landscape**

Authors: Raymond B. Dawson & Susan D. Landry -Albemarle Corporation

ABSTRACT

Flame retardants are used in many common items that we encounter to make a significant contribution to our safety and well being every day of our lives. Since flame retardants work in a passive mode to help prevent fires from starting and slow down the progress of fires that do start, we generally do not realize the important role they have in many of the products we use on a daily basis. In the end-use application, flame retardants delay the spread of fires or delay the time of flashover in order to enable people more time to escape the effects of the fires. The ultimate purpose of their use is to save lives, reduce injury, reduce destruction of property, and reduce local pollutants that result from fires.

Despite the ability to help save lives, flame retardants have received a considerable amount of negative publicity due to perceived environmental and toxicological issues. A great deal of information is publicly available on the potential health and environmental effects of commonly used flame retardants, including EU Risk Assessments.

Industry is responding to the challenge to ensure that flame retardants are sustainable. Environmental criteria alone are not sufficient to guarantee sustainable flame retardants for the future. This paper will address the current regulatory issues and climate for flame retardants, with specific emphasis on issues that need to be addressed to ensure the sustainable use of flame retardants in the future.

GPEC 2008 Paper Abstract #R8

Title: Reducing Environmental Emissions of Flame Retardants in the Plastics Industry for a Sustainable Future

Author: Susan D. Landry -Albemarle Corporation

ABSTRACT

Flame retardants are used in many different types of plastics to help prevent fires from starting and slow down the progress of fires that do start. Despite the ability to help save lives, flame retardants have received a considerable amount of negative publicity due to perceived environmental and toxicological issues. Industry is responding to the challenge to ensure that flame retardants are sustainable. A tremendous amount of Human Health and Environmental data have been generated of various flame retardants. However, environmental criteria alone are not sufficient to guarantee sustainable flame retardants for the future.

As part of the commitment to responsible production and use of flame retardants, the Bromine Science and Environmental Forum (BSEF) has launched an emissions reduction program. This program is called the Voluntary Emissions Control Action Program (VECAP^{TM}). This unique emissions control program was developed to address emissions of chemicals, with brominated flame retardants (BFRs) being the first to utilize the program. This paper addresses the details and progress of VECAP and potential benefits to the plastics industry.

GPEC 2008 Paper Abstract #R9

Title: Trends & Challenges for Start-Up & Emerging Companies in the Clean-Technology Marketplace

Author: Eric Koester, Attorney Heller-Ehrman, LLP

ABSTRACT

The years 2006 and 2007 saw popular culture embrace issues such as global warming, alternative energy production, biofuels, hybrid transportation, and carbon credits. Clean Technology became the fastest growing investment sector and produced some of the most-watched initial public offerings of the recent past. While this new 'fame' has led to an increase in new companies and initiatives, investment dollars, state and federal legislation, and media coverage, it has also led to concerns that the marketplace is a bubble without strong fundamentals to drive the marketplace. Certain investment funds have set up new funds designed to purchase failed and distressed clean-technology companies. What is the current status of the clean-technology marketplace? What fundamentals exist for the companies that are succeeding and those that fail? Where are the investment dollars and how can companies take advantage of the current marketplace? While some may question aspects of the clean technology revolution, it is without question that a fundamental shift in our consciousness and our culture are occurring -- that has led to unique opportunities and challenges for tomorrow's leaders in clean-technology markets.

GPEC 2008 Paper Abstract R10

Title: PIQET: A Life Cycle Management Tool forSustainable Plastics Packaging

Authors: J. Majumdar, K. Verghese, Centrefor Design, RMIT University and
L. Fitzpatrick Birubi Innovation Pty LtdMelbourne, Australia

ABSTRACT

Plastics are lightweight, flexible, durable and practically unbreakable which make plastics attractive materials in the packaging industry. However, extensive use of packaging also leads to littering, waste management problems, unnecessary use of precious resources and environmental pollution. Assessment of the life cycle of packaging is, therefore, important for its efficient use with minimal environmental impact. The Packaging Impact Quick Evaluation Tool (PIQET) has been developed for this purpose by the Sustainable Packaging Alliance (SPA) - a strategic initiative of the Centre for Design-RMIT University, Packaging & Polymer Research Unit-Victoria University and Birubi Innovation Pty Ltd.

PIQET is a web-accessible, independent, scientifically based decision support tool which allows rapid evaluation of environmental impacts of packaging systems throughout the life cycle. Development of the tool included methodology development to convert complex life cycle assessments (LCA), environmental data, and packaging waste management and recycling data into a readily usable business ready decision making tool.

PIQET evaluates environmental aspects of packaging based on the total life cycle of the system including raw material production, conversion, transportation and end of life options. A range of environmental indicators including generation of greenhouse gases, depletion of non-renewable resources, water use and solid waste are reported by PIQET. Other packaging specific indicators required by (Australian) National Packaging Covenant (NPC) Key Performance Indicators (KPIs) such as product to packaging ratio, percentage of packaging going to landfill are also reported.

An overview of the development of PIQET methodology and its capabilities will be presented. A number of case studies will be presented to illustrate how design change, procurement policy or waste management strategies can make plastics more sustainable. The paper concludes with a discussion of the future development of PIQET.

GPEC 2008 Student Poster Abstract #1

Title: The Degradation of Biodegradable Polylactide Correlated to the Average Molecular Weight

Authors: Rocco Viggiano, and Christopher Mann**,** Plastics Engineering Department**,** Penn State University at Erie, the Behrend College

ABSTRACT

The effects of temperature, shear rate and residence time were studied using an injection molding machine and biodegradable polylactide (PLA). The extent of the degradation was characterized by analyzing the optical properties and the molecular weight of the processed material. A spectrophotometer was used to quantify the changes in color due to degradation. Gel permeation chromatography (GPC) and nuclear magnetic resonance spectroscopy (NMR) were performed on the degraded PLA to determine the molecular weight change and chemical structure. The effects of degradation on color were correlated to the average molecular weight of the polymer.

GPEC 2008 Student Poster Abstract #2

Title: Recycling in the Caribbean

Author: Jesse Haedrich, Penn State, Plastics Engineering Technology

ABSTRACT

The current issue with recycling in the Caribbean, Saint Thomas being the focus, is getting a constant flow of materials from the local population. The solution to this is the several tourist streams producing a large amount of waste on the island. In 2004 alone, more than 1.4 million cruise ship passengers entered through the port of Charlotte Amalie. Since then the popularity of the island has continued to increase, bringing more cruise ship passengers on top of over 80 flights daily coming from North and South America and Europe. The idea would be to collect recyclable goods from tourist by means of depositories in high tourist traffic areas including towns, port areas, and popular beaches. Also material may be obtained from direct contact with cruise ship companies, and taxi drivers. Saint Thomas and its neighboring Island Saint John are both steadily growing in house construction market. With the collected material, plastic extruded wood, a high quality replacement for traditional wood, can be produced for use in floors and decking on the island. Another issue is determining what new consumer product can be created using the material that are easy obtained. A study will be conducted to see what plastics are being thrown away, and in what proportions. With availability determined, a product can be engineered and tested for its intended use as durable building supply.

GPEC 2008 Student Poster Abstract #3

Title: Nanotechnology Safety Education

Authors: Obiageli B. Onovo, Kishanchandra Golla, Pittsburg State University & Dr. Chris C. Ibeh, Faculty Advisor

ABSTRACT

Materials at the nano [10^{-09} meter in at least one dimension] level, nanomaterials exhibit multifunctional characteristics that are desirable in many technical applications. There are also possible potential risks to human beings and the environment, from exposure to nanomaterials. The hazards could range from mild to fatal, making nanosafety an important issue in nanotechnology. This paper explores the issues surrounding nanosafety. The environmental and health effects of nanoparticles are examined and discussed, and the necessary safety precautions and ethical issues are stated. It was found that there is need to create safety and ethics policies that will help in mitigating the possible harmful effects of nanotechnology on society and the environment. Implementing precautionary measures will safe guard lives and the environment.

GPEC 2008 Student Poster Abstract #4

Title: Review of Utilization of Waste Tires in Asphalt

Authors: Khaldoun Shatanawi* and Carl Thodesen, Graduate Research Assistants, Department of Civil Engineering, Clemson University

ABSTRACT

It is estimated that currently, in the United States, there are 188 million tires in stockpiles. Additionally, 300 million tires are being generated every year. The use of crumb rubber in asphalt binder has become one of the methods to reduce the growth of the stockpiles. Studies show that 12% of the tires generated are being used in asphalt applications. The addition of crumb rubber to asphalt had been proven by many researchers and field applications to improve the performance properties of asphalt pavements and increase their service life.

This poster will describe the current state of the practice regarding the use of waste rubber in asphalt applications. Specifically, the various uses of crumb rubber in asphalt will be introduced. The various processing methods for grinding tires into crumb rubber are described, including the effects of the grinding procedure on the resulting rubberized asphalt. The noise reduction properties of rubberized are introduced and explained.

Generalized comparisons of selected properties for rubberized asphalt and polymer modified (such as SBS) asphalts will be introduced. Compaction temperature, permanent deformation, and noise reduction of polymer modified asphalts versus rubberized asphalt are all reviewed.

GPEC 2008 Student Poster Abstract #5

Title: Review of Waste Product Utilization in Highway Construction

Authors:Khaldoun Shatanawi* and Carl Thodesen, Graduate Research Assistants, Department of Civil Engineering, Clemson University

ABSTRACT

In the United States, the field of waste disposal is a relatively new one. Approximately 100 years ago, the main waste disposal systems were dumping or open burning. It was only in 1965 that the first federal legislation (i.e., the Solid Waste Disposal Act) was enacted to directly approach the waste problem. As such, the country is only now starting to come to terms with the amount of waste it produces.

This poster introduces the current practices of using waste materials in highway construction. Recycled products have emerged as a viable alternative to virgin materials in many areas, including the highway construction field. Previous studies have identified the following thirteen waste materials with specific applications for the highway construction industry: Bottom Ash, Compost, Construction Debris, Fly Ash, Glass, Plastics, Reclaimed Asphalt Pavement, Shingle Scraps, Slag, Sludge, and Tires.

The focus of this poster is to present the current situation of waste generation in the United States. Specifically, the uses of recycled plastics in highway construction and highway applications are discussed.

GPEC 2008 Student Poster Abstract #6

Title: Degradation of Polylactic Acid (PLA) Exposed to Steam

Authors: L.F. Vargas[1], B. Welt[1], P. Pullammanappallil[1], A. Teixeira[1],M. Balaban[1], C. Beatty[2], [1]Department of Agricultural & Biological Engineering. [2]Department of Materials Science and Engineering: University of Florida.

ABSTRACT

Structure integrity and reduction in molecular weight of polymer polylactic acid (PLA) during exposure to steam was investigated. Thermoformed PLA drinking cups were cut into sheets of 6cm x 4cm, and exposed to steam at 100°C, 110°C and 120°C for 1, 2, 3, 4 and 8 hours. Also, an experiment was conducted using 120°C for 24 hours to evaluate extreme conditions. Structure integrity was assessed through brittleness and physical damage, and weight-average molecular weight was estimated using the intrinsic viscosity method at 30°C. Overall results show that PLA structure and molecular weight are severely affected by steam conditions such as humidity, pressure and temperature. Molecular weight dropped over time following a first-order reaction model, and kinetic constants showed to be temperature-dependent obeying Arrhenius equation with activation energy (Ea) of 52.3 KJ/mol. A mass balance demonstrated that 84.7% of the polymer is finally converted to its pure monomer -lactic acid- when subjected to steam at 120°C for 24 hours.

GPEC 2008 Student Poster Abstract #7

Title: Preparation and Thermal Analysis of Polyurethane Composite Using Oil Palm Based Polyol and Fiber

Authors: Min Min A.[1*], Yaakob, Z.[1], Mohd Hilmi M.[2], Khairul Zaman Hj M D [2], Kamarudin.S.K.K[1], [1]Department of Chemical & Process Engineering, Faculty of Engineering, University Kebangsaan Malaysia, [2]Radiation Processing Technology Division, Malaysia Institute for Nuclear Technology (MINT), Bangi

ABSTRACT

Polyurethane (PU) composites were prepared using a palm oil-based polyol and palm fiber. At first polyurethane were prepared by prepolymer synthesis and prepared molding with oil palm trunk (OPT) fiber. Glass transition and degree of separation from differential scanning calorimetry , dynamic mechanical analyses and Fourier transform infrared measurements. The analyses showed that different composition of polyurethane becomes more flexible at the higher polyol content in the polyurethane composite. Effect of fiber adding shows in the thermal properties of polyurethane composite. The main interest in studying these biomass composites of fiber and matrix from renewable resources and the formed composite constitute an attempt towards environment al preservation.

GPEC 2008 Student Poster Abstract #8

Title: New Polyacetal Polyols for Polyurethanes

Authors: Mihail Ionescu, Semonti Sinharoy and Zoran S. Petrovic, Pittsburg State University, Kansas Polymer Research Center

ABSTRACT

The synthesis of new polyacetal polyols as new polyhydroxyl intermediates for elastic polyurethanes was investigated. The synthesized polyacetal polyols are telechelic polymers with terminal hydroxyl groups either as diols or triols of molecular weight 3000-5000. They were obtained by the reaction of glycols with divinyl ethers in the presence of acid catalysts. New polyols have the following general structure (Figure 1) where **X** is a starter molecule (diol or triol), **m** = functionality and **n** = polycondensation degree:

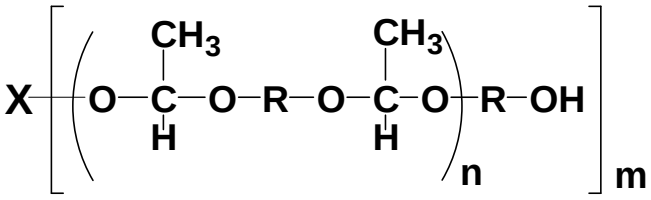

Figure 1: General structure of polyacetal polyols

The polyacetal polyols are colorless viscous liquids. They were characterized by FT-IR, ^{1}H and ^{13}C NMR, Gel Permeation Chromatography, DSC and by determination of hydroxyl number, viscosity and acid numbers. The polyacetal polyols were transformed successfully to cast polyurethanes by the reaction with an aromatic isocyanate, MONDUR CD (Bayer). The resulting elastomeric cast polyurethanes were characterized by determination of glass transition temperature (Tg), tensile strength, elongation, hardness, swelling properties and soluble fraction in toluene as solvent. The polyacetals are well known nontoxic, bio-compatible and biodegradable polymers

The cast polyurethanes obtained had characteristics comparable with the polyurethanes based on conventional polyether triols, copolymers propylene oxide-ethylene oxide. The polyacetal polyols are suitable for the synthesis of elastic polyurethanes (polyurethane elastomers, flexible polyurethane foams. The polyacetals are well known non-toxic, biocompatible and biodegradable polymers. It is interesting to study the biodegradability of the polyurethanes based on polyacetal polyols which it is expected to be new biodegradable polymers

GPEC 2008 Student Poster Abstract #9

Title: Thermoplastic Starch

Author: Michael Thurman, Pittsburg State University

ABSTRACT

The utilization of Thermoplastic Starch (TPS) is a key factor in the effort to bring the plastic industry to become more environmentally friendly. TPS can be processed by means of when a slurry of additives such as starch, water, and crude glycerin are compounded with necessary coupling agents along with virgin resins such as HDPE by means of extrusion. The advantage of utilizing a TPS resin is that depending on the starch content, applications can be made of a biodegradable or semi-biodegradable nature.

What makes TPS environmentally friendly is that the starch ingredient which is incorporated within the slurry comes from agricultural crops such as corn, wheat, and potatoes. Also the crude glycerin, which is used as a plasticizer in the TPS process, is a by-product from the biodiesel industry. This proves to be beneficial not only to the environment but to the American farmer. Once the TPS resin has been successfully compounded by means of extrusion the newly formulated resin may be pelletized right off the cooling trough of the extrusion line and utilized in processes such as blown film to make plastic bags and films of a bio-degradable nature. Biodegradable commodity items used for packaging, shopping and so forth, will prove to be sustainable to a Greener Environment in the future.

GPEC 2008 Student Poster Abstract #10

Title: Alternative Techniques to Characterize Polyester Based Biopolymers

Authors: Andréanne Harbec[1], Florine Maes[1], Marie-Claude Heuzey[1], Louis-Simon Lussier[2] and Charles Dubois[1], 1- Department of chemical engineering, École Polytechnique de Montréal, 2- Defence RDC-Valcartier, Québec

ABSTRACT

The degradation of conventional plastics, which are made of petroleum base raw material, requires decades and has well-known harmful impacts on the environment and its different ecosystems, as these materials end up in landfills. During the recent years, the interest demonstrated towards biodegradable polymers has expanded from medical applications to other fields, such as food and goods packaging, as an answer to the aforementioned environmental problems. The characterization of the polymer biodegradation process can be done by measuring the mechanical or physical properties of samples, which have been submitted to well-controlled experimental conditions. during time. In this work we evaluate two different techniques, dynamic mechanical analysis (DMA) and near-infrared spectroscopy (NIR), to monitor the biodegradation of polyesters: a poly-L-Lactide (PLLA) thermoplastic and a polycaprolactone elastomer. For the former, 0.5 mm thick film samples for spectroscopic measurements or rectangular specimens for the DMA, were both composted at 56ºC and at 60% of the soil water capacity retention. Polycaprolactone samples were composted under similar conditions for 20 days. The results of NIR analysis conducted on PLLA samples composted for different length of time show a clear change in the relative intensity of characteristic absorption bands in the 2200-1700 nm area, as samples degradation level increases. This evolution can be related to changes in the other properties of the material, such as the crystallinity percentage or the molecular weight. The DMA technique was used to evaluate the glass transition temperature of polymers. Our results were not as conclusive for PLLA than they were for polycaprolactone samples, probably due to the fragility of the degraded samples after their drying out. Indeed, experiments done with the elastomeric composition have shown an evolution of the glass transition temperature with composting time. Those preliminary observations portend good possibilities for the future use of DMA measurements and NIR spectroscopy in the fast characterization of the degradation of biopolymer materials.

GPEC 2008 Student Poster Abstract #11

Title: Postconsumer HDPE/Agave Fibre Foamed Composites Coated with Chitosan Used for Removal of Heavy Metals

Authors**:** M.O. Vázquez[a], V.S.Herrera[a], C. Gómez[a], D. Rodrigue[b] and R. González-Núñez[a]*
[a] Departamento de Ingeniería Química, Universidad de Guadalajara
[b] Department of Chemical Engineering, Université Laval, Quebec

ABSTRACT

Composites of post-consumer HDPE with agave fibre were prepared by single screw extrusion using azodicarbonamide (ACA) as foaming agent to increase surface area. The absorption capacity of the composite coated with chitosan was evaluated in Cd^{2+} and Cu^{2+} solutions. A chemical pre-treatment was applied to the composite improving the interfacial interaction with chitosan to enhance compatibility. Chitosan gel is used to coat the modified hydrophilic polymer surface. Atomic Absorption Spectroscopy (AA) was used to measure metal uptake after contact with solution in batch studies. Adsorption Isotherms were obtained at three different temperatures and pH. The experimental results show the composite's ability to immobilize chitosan on its surface and capacity for metal ion absorption. The equilibrium isotherms for Cd and Cu adsorption on chitosan-coated composite were described by the Langmuir model and maximum adsorption is obtained. This material represents an attractive low cost recycled material to adsorb metal ions from polluted waters.

GPEC 2008 Student Poster Abstract #12

Title: PLA and Cellulose Based Degradable Polymer Composites

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ABSTRACT

PLA based composites were prepared with cellulose as reinforcement. The aim was to improve the mechanical and thermal properties of degradable polymer composites through understanding of the reinforcement mechanisms and directing the extent of interfacial interactions. Composites containing up to 20 wt% reinforcement were prepared using melt and solution processing techniques. The effects of filler surface modification on the composite properties are studied by grafting lactic acid on the surface of the microcrystalline cellulose particles. Grafting lactic acid chains was observed to reduce particle agglomeration. A 20% increase in composite modulus was obtained with 10 wt% addition of microcrystalline cellulose. Similar increase in modulus was observed with only 5 wt% addition of surface modified microcrystalline cellulose. The influence of size of reinforcement on the mechanical and thermal properties of the composites is investigated through the use of hydrolyzed microcrystalline cellulose. Understanding of the reinforcement mechanism and the ability to control the interfacial interactions is a step toward synthesizing degradable composite materials having properties similar to or better than those of the commodity plastics.