Midterm Review

IPRO 352 – US EPA Design Competition for Sustainability: The Market Potential for Recycled Tire Material
Illinois Institute of Technology, Spring 2005

Project Objectives Updated:

- The planned prototypes for real market applications have been designed for analysis and have involved the following: water based coatings mixed with percentages of number 60 mesh modified rubber particles and agricultural mediums mixed with larger mesh particles. All materials were purchased with the intent of commercial availability to the general public and also, with the intent of use in a general population setting.
- A finalization to the business plan which confirms a business opportunity of using recycled tire material has been discussed and a focus will be finalized.
- There continues to be a focus on attracting the attention of corporate and private investors along with obtaining funds to carry out additional work.
- Fulfillment of P3 requirements has been continuing and our team wishes to achieve high recognition at the May meeting in Washington D.C. Three students and one faculty member will be attending the conference 15-18th.
- Fulfillment of requirements has been ongoing with the pursuing of set in motion analysis, documentation of a finalized business plan and media categories.

Project Background:

As discussed in the Project Plan initially, the P3 Award Competition in May of 2005, is sponsored by the Environmental Protection Agency and seeks to motivate teams of college students to research, develop, and design sustainable solutions to environmental challenges. The first stage involved the awarding of 66 design project grants to colleges, universities, and other post-secondary institutions in the United States. The Illinois Institute of Technology (IIT) obtained one of these grants in 2004 for a project on providing real world solutions to convert scrap tires into various construction materials. Our team has been busy with gathering contacts, information, and data in order to focus our efforts toward a more advanced solution to some hazardous impacts involving discarded tire rubber.

It is known that one-fourth of the 283 million tires scrapped in the United States were land-filled in 2003. In other countries, hundreds of millions of tires are put into landfills every year without being recycled. This exploits an enormous amount of land space, creates a high risk of toxic fires, breeds mosquitoes which spread life threatening diseases, and does not use valuable resources to their full capacity. This situation must be remedied immediately.

This project has introduced two viable technological solutions into the business arena so that tire recycling will become economically feasible. These two proven technologies are Solid-State Shear Extrusion (SSSE), a patented, non-cryogenic pulverization technology; and a new particle chemical modification technology. Both were developed here at IIT. The SSSE process is capable of producing fine rubber particles at a far lower

cost than competing cryogenic processes. The new particle chemical modification technology enhances the properties of the rubber particles produced by the SSSE process and enables them to be used in previously unattainable applications such as low Volatile Organic Compounds (VOC) paint coatings, waterborne sport surfacing and near-zero VOC powder coatings. Together, these technologies could result in a dramatic reduction of tires sent to landfills. Recycled rubber materials would be turned into environmentally benign polymeric coatings, inexpensive constructional materials, and other products for both developed and underdeveloped nations.

Team members have been developing test plans and refining strategies to integrate these two proven technologies into the business world. The strategy has continued to be discussed throughout our meetings with the intent of executing a combined effort to the business market. Materials have been prepared to create sample prototypes. Based on trial testing, marketing analysis, and data evaluation, an optimal business model will be designed. If this project becomes a success, this tire recycling IPRO project will become a model in the curriculum for future generations of students, demonstrating a successful effort by a multidisciplinary team working together to solve an environmental problem of planetary significance.

Research Methodology:

- Understand and identify project parameters
- Identify what would make the project a success
- Create project objectives, tasks to accomplish
- Plan and implement organizational structure

Technical Group Tasks

- Create prototypes - agriculture and water-based applications have begun.
- Test prototypes – design of experiment steps have continued to document crop results & varied surfaces for modified coating applications have begun and will be examined for durability.
- Analysis of results has been ongoing.

Agricultural Experimental Design

Constants:

Number of plants: 3 (Brassica Rapa (yellow field mustard), Soy beans, Kentucky Blue Grass + Tall Fescue mix)

Fixed % of second monomer in rubber particles (i.e. Fixed IPN)

Identical watering schedule for each pot

Identical Light exposure (intended)

Manipulated Variable

Amount of rubber particles in soil (0%, 33%, 66%, 100%by mass)

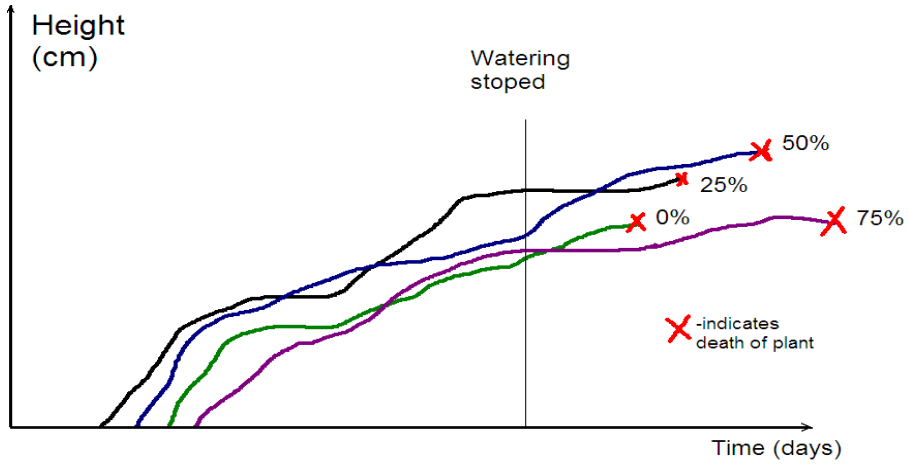
Measurable Variables

Time of penetrating the soil surface (time)

Height of plant/grass as a function of time (cm) – periodic data collection

Life span after watering is stopped (time)

Intended Results



Other concerns

Special care must be taken when adjusting the height of the lamp. Since we are assuming that all plants are receiving the same amount of light then we have to make sure that the assumption is valid. A solution to minimizing the problem would be to randomly assign places on the grid to each pot. All plants are receiving a light source that simulates that of the broad sun's spectrum or outdoor lighting.

The experiment will be repeated with a different type of soil and possibly different plants.

Coating experiment

Different concentrations of modified rubber particles are going to be added to coatings to reduce the price providing cheap filler and possibly improving surface qualities like slip resistance, durability and elasticity if the coating.

Coatings are to be applied to several different surfaces with the intent of testing adhesion and compatibility. The surfaces are: drywall, concrete panel, stainless steel, and white pine wood.

The paints we are going to test are:

Latex

White –hi gloss
White – flat
Red – hi gloss
Red – flat
Silver Metallic
Graham washable paint with no filler

Acrylic garage floor paint

Wood finish

Modified coating surfaces will be compared with original unmodified paints where both primed and unprimed cases will be looked at. Surface qualities are going to be tested. Organized sample exhibits are going to be prepared for both P3 and IPRO competitions.

Business Group

Tasks

- Understand the SSSE and the particle chemical modification technology
- Understand the Recycled Tire Market
- Define the Markets for the SSSE and the particle chemical modification technology
- Define our Competitors
- Construct a Business Model w/Assumptions
- Contact Industry Professionals to Confirm Business Model and Assumptions

Additional Requirements

- P3 presentation package encompassing People, Planet, & Prosperity is under organization which will balance our technical results & economic impacts.
- Team website under construction with the intent of use with P3 and IPRO day presentation demonstrating the proven research and application of the SSSE and chemical modification of the rubber particles.
- Exhibit poster will be of use for both P3 and IPRO demonstrating technical research as requested by the professors and economic impact regarding a potential market plan along with an oral presentation for both events.
- Delivery for IPRO day and P3 will result in a completed business plan, technical research data, comprehensive deliverables CD.

- Attend P3 award ceremony in Washington DC

Expected Results:

The IPRO team has created prototypes, water-based coatings and agricultural growing mediums, which have been modified with the processed recycled rubber. Both have included controls and a method of documentation. These two prototypes are expected to be competitive in their respective markets, but may not be the only applications that are reviewed. The envisioned final projects may have significant economic or functional advantages over pre-existing comparable products and that is our team's intent.

A business plan created should also introduce these two items to their respective markets whether by reducing current costs of production or wider use to the general consumer. It is expected that the plan will convince others that the technology to create inexpensive recycled tire material should be integrated into the production of various construction materials. The team continues to anticipate that public or private investors will be excited by the results of this project and will give future teams funding to continue these efforts and further investigate more complex applications unaware of by the current market.

The IPRO team will fulfill all P3 award requirements, fulfill all IPRO requirements, and provide all IPRO deliverables.

Project Budget:

Itemized budget

Categories	Sept. 2004 – May 2005	
a. Travel	Federal	Cost-share
Airfare		$800
Lodging		$800
Meals		$360
TOTAL TRAVEL COSTS		$1960
b. Equipment		
Spray gun	$5000	$450
Scrub abrasion tester	$5000	$50
TOTAL EQUIPMENT COSTS	$10,000	$500
c. Supplies		
Laboratory		$3000
Office		$300
TOTAL SUPPLY COST		$3,300
d. TOTAL PROJECT COSTS	$17,132	
e. COST-SHARE	$5,760	
f. INDIRECT COSTS	$1,372	
f. TOTAL REQUESTED FROM EPA	$10,000	

Schedule of Tasks and Milestone Events:

January 24th	Understand and define project
January 26th	Objectives set and organizational plan developed
January 31st	Groups and team leader assignments made
February 4th	Project Plan DUE
February 7th	Group Meeting
February 14th	Group Meeting
February 21st	Group Meeting
February 28th	Group Meeting
March 7th	Group Meeting
March 21st	Group Meeting
March 25th	IPRO Mid-term Review DUE
March 28th	Group Meeting
April 4th	Group Meeting
April 11th	Group Meeting
April 12th	Completed P3 presentation submittal Due
April 18th	Group Meeting
April 25th	Print Exhibit Poster Due - printing must be scheduled ahead of this date & one page Abstract DUE, website also due if to be included
April 27th	Oral presentation DUE
April 29th	IPRO Day: presentation
May 2nd	IPRO team debriefing
May 6th	Final Report Due – business & technical combined Comprehensive Deliverable CD DUE
May 16th – 17th	P3 Award Ceremony in Washington DC

Individual Team Member Assignments:

Organizational structure

Project manager	Zheyan (Jennifer) Chen
Technical group leader	Dimitre Kolev
Technical group	Dan Cornelius
	Anel Medrano
	Jean Cadet
	T. (Puifai) Santisakultarm
Business group leader	Marc Glanton
Business group	Jinit Patel (JP)
	Erica Fierro
Multimedia and new applications group leader	Julie Chandler
Multimedia and new applications group	Patrick Bowles

Tasks Assignment

Entire Group	Understand and define project
	Set objectives and develop organizational plan
	Make groups and team leader assignments
	Keep weekly timesheets
Project Manager	Keep a holistic eye on the team to make sure everyone is moving in the right direction
	Keep everyone informed of what they should be doing and how they are contributing
	Ensure the efficient utilization of resources by analyzing timesheets
	Lead team leader meetings
	Introduce group meetings, give overview of "the big picture" for the week
	Manage outside opportunities and distractions
	Ensure documentation of the entire process
	Make agenda for Monday and team leader meetings
	Assign the writing of minutes and a task list during meetings
	Research ethics involved in the project
Technical leader and group	Create and test prototypes
	Document test results and analyze results
	Refine prototypes

Business leader	Prepare technical report for the SSSE and the particle chemical modification technology Develop an analysis of the Recycled Tire Market and our Competitors Map a go-to-market strategy for the SSSE and the particle chemical modification technology Construct a Business Model w/Assumptions Develop contacts within the Recycled Tire Industry
Media/apps leader and group	Document project process with photos and other media Deliver website Deliver presentation for P3 and IPRO Deliver poster for IPRO Compile Comprehensive Deliverables CD
Team leaders	Deliver IPRO Midterm Review Deliver presentation for P3 and IPRO Deliver poster for IPRO IPRO presentation