

Scrap Tire Recycling

Federal Manufacturing & Technologies

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CRADA Number 95-KCP-1021

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Scrap Tire Recycling

Project Accomplishments Summary

CRADA Number 95-KCP-1021

Date: 1/27/97

Revision: 0

A. Parties

The project is a relationship between

AlliedSignal FM&T
2000 E 95th Street
PO Box 419159
Kansas City, MO 64141-6159

Recycled Rubber Resources
1600 Brees Industrial Dr.
Macon, MO 63552

B. Background

As the automobile tire technology has grown and met the need for safer and more durable tires, stronger reinforcement and more chemically resistant rubber compounds have made recycling tires more difficult. Combined with a lessening demand for reclaimed rubber in new tires, this change had resulted in a gradual decline in the percentage of rubber recycled. By 1960, only about 20% of rubber products, including tires, were recycled. The introduction of steel-belted radial tires in the 1960s complicated the tire grinding process and led to a further reduction of the recycled content of rubber products to about 2%.

At this point in time, lacking a viable reclamation process and end use, scrap tires began to accumulate in the environment. Illegally dumped tires became an increasingly stubborn problem, leading to uncontrollable fires and insect breeding grounds. In an effort to resolve this problem, techniques and equipment were developed to grind tires into small pieces, and new markets were sought to utilize the crumb rubber product streams from ground tires. Industrial combustion processes were modified to accept scrap tires as fuel. These efforts have been beneficial, steadily increasing the percentage of scrap tires recycled to about 10% in 1985, and reaching 72% in 1995. By the end of 1997, fully 100% of tires generated in the U.S. are expected to be recycled.

Of the approximately 250 million scrap tires generated annually in the U.S., the principal market is tire derived fuel (TDF). Properly handled, TDF is cheaper than coal, burns cleaner, and generates positive public relations. In 1995, approximately 130 million tires were consumed as TDF by cement kilns, pulp/paper mills, industrial boilers, electric power utilities, and dedicated tire-to-energy facilities.

Besides TDF, other uses of scrap tires include civil engineering applications such as retaining walls, roadfill, and artificial reefs. In 1995, these uses accounted for about 15 million scrap tires. Another 2.5 million scrap tires were destined for use in agriculture, and 12.5 million tires were exported. Finally, approximately

20 million scrap tires were ground into crumb rubber for asphalt blending, compounding in new tires, various molded rubber products, playground/athletic surfaces, and friction materials. Ground crumb rubber for these types of products and applications is the focus of Recycled Rubber Resources, Inc.

At this project's inception, only the ground crumb rubber was a marketable product, leaving the wire and synthetic fiber to be land filled. FM&T's experience in material composition and particle size analysis was used to focus on these waste streams. FM&T's experience in material formulation was used to experiment with potential products from the crumb rubber and synthetic fiber streams.

C. Description

Recycled Rubber Resources (RRR) is a small business located in Macon, MO, incorporated in September 1993 for the purpose of grinding and recycling scrap tires. RRR primarily processes whole scrap tires, but also accepts non-tire rubber scrap material. The core business is custom grinding high-quality crumb rubber for the customer's specification of mesh size and product purity.

As a start-up company in an emerging industry, RRR has developed its process to produce very clean, fiber-free, high quality crumb rubber of various particle sizes. Focusing on the crumb rubber as the primary marketable product, the steel wire and tire cord fiber were initially landfilled. However, efforts to market the steel wire and fiber have continued, with promising outlets for each. Understandably, by reducing the amount of material landfilled, the operating costs for the business are also reduced. The objective of this project was to characterize the crumb rubber, synthetic fiber, and steel wire product streams, determining where improvements could be made in the grinding/separation process that increases the product value and lowers the operating cost. In this manner, the company will offer a higher quality product, become more competitive, and help resolve an environmental problem.

RRR and FM&T worked together to minimize the amount of landfilled material from the tire grinding process. Specifically, FM&T identified large quantities of rubber in the fiber waste stream. RRR purchased and installed additional equipment to recover this rubber. Because the fiber was cleaner (less rubber), a market was found for the fiber. Additionally, FM&T suggested a technique to clean the steel wire. RRR is scaling up this suggestion for production-sized quantities.

D. Expected Economic Impact

The results of this project have enabled Recycled Rubber Resources to grind tires more efficiently, producing higher quality crumb rubber and minimizing scrap material, such as steel wire and synthetic fiber, that previously went to a landfill. Economic benefits resulting from these process improvements include more job opportunities for local residents, as the company has had to expand operations to three shifts, nearly doubling the workforce from 14 to 27 employees. To supply RRR with raw material, jobs also have opened up for those in the business of collecting and disposing of scrap tires. Finally, process improvements have required capital equipment purchases amounting to \$80,000 in 1996.

E. Benefits to DOE

This project has enhanced the skills of FM&T technical staff in areas of composite fabrication such as particle separation, rubber compounding, extrusion, and injection molding. Skills also were enhanced in areas of material testing including particle size analysis, mechanical strength, thermal properties, and ash content.

F. Industry Area

The industries benefiting from this project include the automotive (crumb rubber in new tires), railroad (synthetic fiber in brakes), basic steel (remelting scrap steel wire), and manufacturers of molded rubber articles.

G. Project Status

This project was completed as scheduled.

H. Point of Contact for Project Information

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I. Company Size and Point of Contact

Recycled Rubber Resources is a small business of approximately 30 employees. Half of these employees have been added during the life of this CRADA. The point of contact at Recycled Rubber Resources is Matt DeBasio [(816) 385-7156]. The crumb rubber production of RRR initially was 15,000 pounds per month. Steady improvements in grinding and separation processes have

enabled crumb rubber production to increase to the current levels in excess of 1 million pounds/month. This level of production has enabled the company to expand to three working shifts.

J. Project Examples

The main result of this project is increased production of crumb rubber at RRR, coupled with less material (steel wire and synthetic fiber) that is going to the landfill. However, during the course of the project, a limited number of test samples have been molded using crumb rubber in combination with agricultural-based plasticizing oils and thermoplastic elastomers.

K. Technology Commercialization

As a result of this project, a substantial amount of crumb rubber was identified in the fiber waste stream. FM&T proposed a method to recover this material and RRR purchased the necessary capital equipment. With this additional equipment, RRR recovers an additional 50,000 pounds/month of crumb rubber.

L. Release of Information

I have reviewed the attached Project Accomplishment Summary prepared by AlliedSignal FM&T and agree that the information about our CRADA may be released for external distribution.

Matthew C. DeBasio

3/11/97

Name: Matthew C. DeBasio

Date

Organization: RRR, LLC

Title: President & CEO