



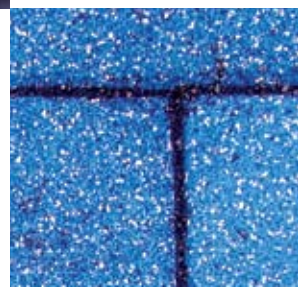


Picking up the crumbs

Learn how health concerns and the current economic state are keeping ground scrap tire rubber from reaching its true market potential.

by Michael Blumenthal

"The future ain't what it used to be," a quote attributed to Yogi Berra, certainly sums up the current condition for the major ground rubber markets. Ground scrap tire rubber (also referred to as crumb rubber) was the Promised Land for both the scrap tire industry and for opponents to the use of scrap tires as fuel.

Tire Derived Fuel (TDF) is the original and remains, by far, the largest market for scrap tires, accounting for over 50 percent of the scrap tires generated nationwide. The argument against TDF is that tires are too valuable, and the rubber properties too beneficial as raw materials, to simply use them as a fuel. The goal should be to take advantage of these properties in higher value-added markets. Tire recycling companies also see the production and sale of ground rubber as the ultimate goal, since the return on investment for ground rubber is greater than for any other tire-derived product.

To be sure, tire rubber has several distinct properties that make it suitable for a number of higher value-added applications. Tire rubber is resilient, long-lasting and non-hazardous. Yet, to those opposed to the use of tire rubber in these higher value-added applications, ground tire rubber has been labeled as being toxic, carcinogenic, mutagenic and a hazardous material. To say there is a difference of opinion on tire rubber recycling options would be an understatement. So which is it? Does tire rubber have hazardous properties making it unsuitable for some applications? Or is it a benign resource begging to be re-used? Finally, what are the current market conditions impacting the ground rubber marketplace?

To answer these questions, let's begin with the tire itself. Many of the issues and concerns can be explained and better understood by looking at how tires are made.

Tire manufacturing process

Tires are manufactured from many different materials, including natural and synthetic rubbers, textiles and steel. Depending on the expected use, as well as the specific function and performance of a tire model, different rubber formulations are used for the various tire components. The variables include different polymers, fillers and low molecular weight ingredients. Generally, the rubber components are made using a combination of chemically reactive and unreactive materials, as shown in Table 1.

The tire production process consists of three primary steps: Preparation of the component materials, production of the components, and building of the tire (Figure 1). The majority of the chemical materials are added to the rubber mix during a step called "compounding," which occurs during preparation of the component materials.

During the tire making process, reactive materials are mostly consumed during the curing process. This means the ingredients become part of the chemical matrix of the final product and cease to exist as separately identifiable materials. Very little, if any, of these materials are found in the finished product. Since they are consumed, most of the reactive chemicals – labeled by individuals and organizations as concerns in tire rubber because of their classifications as mutagens, carcinogens, or reproductive toxicants – are not present in the finished tire at significant concentrations. Therefore, it is incorrect to infer that the toxic properties of the

Table 1 | Typical tire raw materials

Unreactive materials
Polymer
Carbon black (filler)
Silica (filler)
Mineral oil (plasticizer)
Resins
Waxes
Zinc oxide (activator)
Processing aids (fatty acids, esters, glycol derivatives)

Reactive materials
Silanes (coupling agents)
Adhesives
Accelerators and vulcanizing agents (cross linking)
Sulfur (cross linking)
Stearic acid (activator)
Retarders (cross linking)
Antioxidants

Source: Rubber Manufacturers Association, 2008

individual chemicals used in tire manufacturing are the same as the recycled tire ground rubber end-product.

Leachate and heating issues

Beyond the toxicity issues related to the component parts of tire rubber, several other questions have been raised about tire rubber. Specifically, questions have arisen regarding what can "leach" out of tire rubber when this material is placed outdoors. The most frequent and troubling questions concern whether lead and other heavy metals leach from tire rubber and if elevated rubber surface temperatures result in dangerous levels of air emissions. These are good and important questions to ask and, fortunately, a series of studies have looked into these questions.

A large number of leachate studies have been performed on scrap tires. In 2008, for example, Dr. Dana Humphrey, dean of the University of Maine's College of Engineering, published a compendium of all the known leachate studies. In short, the leachate from scrap tires passes primary clean drinking water standards, though some iron and manganese can leach, possibly impacting secondary clean water drinking standards (color and taste). Considering that both iron and manganese are readily available in the environment, the overall conclusion was that the leachate from scrap tires poses no human health risk. No elevated levels of lead were found in civil engineering leachate studies.

The concern about elevated surface temperatures is being raised for two higher-end ground rubber products: Synthetic turf sports surfacing and playground cover. In both cases, it's true – the surface temperature of these products can become elevated when exposed to direct sunlight. What needs to be pointed out is that the surface temperature of a synthetic turf surface is elevated whether or not tire rubber is used as the infill material. The conclusion here is that it is not the presence of rubber that is the critical factor. Rather, it is the artificial grass component of the surface that retains most of the heat. Heat stress remains a concern for all athletes. Most sports programs already have instituted heat stress prevention into their training regimen, whether they train on natural grass or a synthetic surface. Furthermore, manufacturers of synthetic turf surfacing systems have recognized this concern and soon will be introducing the next-generation systems, which incorporate a circulating cooling-water system inside the turf surface.

Surface heating is a recognized problem in playground applications as well, with several episodes of children receiving burns from these surfaces being well-publicized. As unfortunate as this is, the problem with elevated temperatures on playground surfacing is not just limited to rubber products. Virtually all playground surfaces exposed to constant radiant heat have the same basic problem. In response to these situations, those responsible for maintaining these playgrounds now are working to cover play areas with some form of shade, in addition to posting warnings about the surface temperature.

Lead to believe

Children's exposure to lead continues to be a very serious topic. Here again, there were several well-publicized stories about lead contamination, especially in the synthetic turf surfacing products. In one New York City case, lead levels, as well as levels of other heavy metals, were literally off the charts. Once again, tire rubber was blamed as the source of these reported elevated levels of lead. Yet, the Big Apple's Department of Health (DOH) conducted testing at 94 inner-city synthetic fields and did not detect any levels of lead. At a February 2009 public hearing held in New York City, a NYC DOH representative stated that the case in which elevated lead and other heavy metals were found was an isolated incident and very likely came from an outside source. In all other cases where lead was detected in artificial turf, and tire rubber was blamed, it was discovered that the source of lead came from the plastic blades of artificial grass. This situation has since been corrected, and manufacturers of artificial grass are no longer using lead compounds.

As a conclusion on the potential human health risk that ground tire rubber poses, there is an overwhelming volume of compelling, scientifically-valid information that supports the use of tire rubber and answers the questions being raised. In late 2008, the RMA released its most comprehensive literature search, to date, entitled *Review of the Human Health & Ecological Safety of Exposure to Recycled Tire Crumb found at Playgrounds and Synthetic Turf Fields*, which undertook critical analysis on reports that raised many of these concerns. Furthermore, several states, such as California and Connecticut, continue to research the topic of potential health concerns, and all continue to reach the same conclusions.

A markets outlook

Prior to 1992, the only source of ground tire rubber was via a byproduct of the retreading industry known as tire buffing – shavings generated from a used tire carcass being prepared to receive a new tread (hence the term "re-treading"). The buffing process generates relatively uniform-shaped, elongated particles of rubber. While tire buffings continue to be an integral part of the overall ground rubber market, today, they represent less than 20 percent of the overall ground rubber supply. By definition,

buffings have no impact on the scrap tire situation since a tire being prepared for retreading is a used tire, not a scrap tire.

In December 1991, the Federal Inter-Modal Surface Transportation Efficiency Act (ISTEA) was passed, including a provision that mandated the use of rubber modified asphalt in a prescribed percentage of federally-funded highway projects. Almost immediately, the demand for ground rubber exceeded the supply of buffings, setting off a frenzy across the country to build ground rubber producing facilities. The only problem was that the rubber-modified asphalt mandate was unfunded and opposed by nearly every state's department of transportation. Suffice it to say, this mandate didn't cause a single pound of scrap tire ground rubber to be used in any highway applications. Instead, it caused a situation of over-abundance of supply with virtually no demand. Within three years, the mandate was repealed and the ground rubber production infrastructure began a market correction that took many years

It is incorrect to infer that the toxic properties of the individual chemicals used in tire manufacturing are the same as the recycled tire ground rubber end-product.

By 2000, the ground rubber market was in balance, with the supply of the raw material nearly equal to the demand for the material. Freed from the hard feelings generated by the ISTEA mandate, rubber modified asphalt was slowly, but steadily, gaining acceptance. Around that time, new markets for ground rubber began to emerge. By 2004, the market demand for ground rubber increased to 10 percent of the overall market for scrap tires. Between 2005 and 2008, there was a 46-percent increase in the sale of ground rubber. And, by the end of 2008, the demand/use of scrap tire ground rubber was 17 percent of the overall market for scrap tires, becoming the second largest (overall) market for scrap tires.

This rise in demand was a function of the increases in ground rubber being used as a cover for playgrounds (for which there are three applications: Loose fill, molded tiles and pour-in-place surfacing), infill for synthetic turf fields, as a mulch material around plants, and a series of bound, molded or extruded rubber products. Considering the way the ground rubber market started, this market condition was very encouraging. The future appeared bright and favorable for continued expansion until a series of events took place that began to cast a pall on these market niches.

In 2007, when concerns surfaced about potential human health impacts from the use of ground rubber in turf fields and playground applications, it made the sale of these higher value-added products much more difficult and, in some cases, caused lost sales opportunities. Today, the sale of these higher-valued products is being impacted, like many other products, by the down-turned economy. For example, because of tighter school and municipal budgets, the purchasing of playground cover is down. Secondly, mulch, as well as many of the bound, molded and extruded rubber products sold into the housing, landscaping and automotive markets, are, too, being affected by the current economic situation. Infill, which may be the bright spot save for addressing potential danger to athletes and environment, is sold into the professional, collegiate and high school sports industries; also down. And, to complete the quandary, the level of ground rubber supply is still expanding while the demand for ground rubber is not.

This market condition, where supply gets ahead of demand, seems to occur on a somewhat regular basis. Typically when this happens, the industry experiences a market correction not long thereafter – losing the inefficient, or poorly managed, ground rubber producers in the process – then it finds itself in a period where supply and demand are very much in line. Next is a short period of expanded production by the companies that have survived the last correction, supplying ground rubber to the markets of the failed companies. It is usually around this time that would-be entrepreneurs start to perceive the ground rubber market as a major potential for growth and profit, and this leads to any number of new entrants joining the production side of the ground rubber equation; thus, the cycle begins again. However, what is consistently overlooked is the demand side of the equation. The tire recycling industry has historically been, and probably always will be, a demand-pull driven marketplace. Subsequently, a few short years later, we find ourselves amidst another market correction.

So, what's next?

Given the tremendous impact of the current economy, three or perhaps four of the major niche markets for scrap tire ground rubber (molded products for the automotive industry, mulch and playground cover) appear to be the markets that face the greatest likelihood of diminishing sales over the next year to 18 months.

Should the economic conditions fail to improve in 2010, the still-strong market for infill material could also be seriously impacted. These factors, combined with increased pressure from competing materials and continuing concerns about potential human health impacts (in spite of the compelling, overwhelming volume of scientifically-valid information), could result in another market correction in the ground rubber production infrastructure. These factors could reduce the level of ground rubber demand back to 2004/2005 levels, too. The impact on the overall scrap tire markets, and on the ground rubber infrastructure, would be a devastating and disappointing retreat from a long sought-after and highly desirable market.

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The RMA report, *Review of the Human Health & Ecological Safety of Exposure to Recycled Tire Crumb found at Playgrounds and Synthetic Turf Fields*, can be downloaded from the RMA Web site, at www.rma.org. Additionally, the RMA is sponsoring the third annual Scrap-to-Profit Conference, scheduled for June 3-4, 2009 in Buffalo, New York. The conference will focus on discussion of the higher-value added products for ground scrap tire rubber. Information on the conference can be obtained at www.scraptoprofit.com.

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