Engineering for the Environment

Environmental Waste InternationalBy Mark Golombek

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The company is also poised to introduce a revolutionary tire recycling technology to the world. Business in Focus spoke with Daniel Kaute, EWS's CEO and President, about the company's reverse polymerization technology which is making a significant difference in the recycling of used tires.

Environmental Waste International Inc. began in 1992, taking over the development of a process researched in the late 1980s by Dr. C. L. Emery, who was looking into the potential uses of microwave technologies. Since then, the company has engineered systems that use its patented reverse polymerization process to break down organic materials for both the sterilization and volume reduction of waste streams and, excitingly, the recycling of tires.

This all began in 1994 with a prototype, the TR330, designed to prove that a continuous feed system would work and to calculate the amounts of by-products generated. The knowledge of operational parameters gained through the construction of this, and the pilot plants that followed, enabled EWS to design and build units for commercial use. These were built for biological wastewater sterilization, food waste sterilization and dehydration aboard ships.

Years of research and development have now led to the full industrial scaled TR series systems for recycling tires.

The proprietary microwave delivery system of the TR900 breaks down waste materials to simple

molecules. As Dr. Kaute explains, "By imparting energy directly inside the tire, it is triggering a process which is called reverse polymerization – basically taking rubber apart into its constituents. One of these is carbon black, which is quite valuable on the market." Other tire components recovered are oil, gas and steel. Steel, used in the tires as reinforcement, can go right back to the steel mills as scrap material.

The trademarked Reverse Polymerization process directly applies high-energy microwaves to the waste material in a nitrogen environment, breaking apart the molecular bonds in the rubber. Oxidation is undesirable as it leads to the formation of potentially dangerous by-products and the nitrogen environment is vital to preventing this.

At EWS' state of the art facility, complete scrap tires enter the processing area and are fed up a conveyor to an in-feed. The tires then pass through the microwave field tunnel where they are broken down. The by-product gases are drawn and passed through a condenser to collect the oil, and remaining gaseous hydrocarbons are then scrubbed to remove sulphur.

The carbon and steel remain on the conveyor and are then, after emerging from the microwave tunnel, separated via a water separator tank. The carbon is collected for further processing or shipping, and the steel is washed and ready for scrapping.

Breaking the tires down into their base components in this way is far cleaner than traditional methods of tire recycling such as grinding or incineration since nearly all of the tire's by-products are reclaimed without sending either hazardous emissions up a smokestack or residual waste to landfill. Incineration "of course produces a terrible carbon footprint and creates a lot of bad things that you don't want to deal with," explains Dr. Kaute. Although the products of crumbing can be used, the applications are quite limited. "There are only so many playgrounds on the earth," he says. "Or you put it back into its constituents which can then be re-used to re-formulate rubber. So, it's true recycling and the resulting by-products can be used in many different applications."

One of the most valuable products of the reverse polymerization process is carbon black. Sixty percent of carbon black produced worldwide is used in the production of new tires; twenty percent goes into other automotive rubber applications; and the other twenty percent is used to fashion non-automotive rubber, plastic, etc. It can also be used in various applications in the manufacture of electronics. Carbon black is widely used as a pigment in plastics, toner cartridges, and paints. It is also used to block light transmission in food and beverage packaging.

Since carbon black is usually produced through the incomplete combustion of heavy petroleum products such as oils and tars, recycling it from tires takes the strain off of the demand for those materials. "This is like a double dip carbon footprint savings which is very good for the environment," says Dr. Kaute.

Oil and gases are recovered from the process in a 60:40 ratio. The gas is a mixture of methane, ethane, propane, butane and nitrogen and the oil is similar to a synthetic crude oil. The system is self sufficient as the oil and gas that it produces are used to generate electricity and can actually provide more energy than the plant needs to power itself.

The Reverse Polymerization process extracts a tire's oil and other valuable by-products. The plan is

to recycle about 300,000 tires annually which will result in over 272 tonnes of steel; nearly 908,500 litres of oil; and over 907 tonnes of carbon black. The process recycles 100 percent of the scrap tires fed into it.

"My company is, at the moment, concentrating on the tire revolution," says Dr. Kaute. "If you use the tires as fuel, then you are putting a whole lot of carbon dioxide back into the atmosphere. This is not very good for our carbon balance and it's not very good for the environment in terms of the emissions created. By putting it back into its constituents, we save the carbon dioxide emissions of incineration to a great part and we also save the carbon dioxide emission created through virgin carbon black production."

Getting to this point has not been without its challenges, however. "The scaling of this technology was the biggest difficulty, because it's one thing to have a lab bench and suddenly when it's big it doesn't work anymore. This is why it is so important. It shows that our technology works on a grand scale. This is a big achievement of the team before my arrival to have been able to finance it, build it and show that it works."

So far, EWS doesn't seem to have much in the way of competition. "There are a few people that are trying to imitate us but no one is a big player with our technology." When asked about the importance of sharing this technology with other companies, Dr. Kaute replied, "Absolutely; if there is someone who wants to license the technology we are certainly open to that. Some have approached us and we are open to having other people use our technology if they go through the right channels."

The government, as part of its green initiatives, is involved with some funding to get the project off the ground commercially and other partners are being sought. "We welcome outside help," Dr. Kaute says, "be it for the commercialization of our technology or for development of new applications. We are willing to cooperate with other partners who are complementary and who bring something to the table that we do not have."

Last year saw EWS receive the "Tire Technology International Award for Innovation and Excellence" in the category of environmental achievement in Cologne, Germany. Awards like this from globally recognized groups help create awareness of the company and its new technologies.

EWS is working on other projects though currently the bulk of its efforts are devoted to making the tire processing line commercially successful. "There are quite a few possible areas that we can work in; our technology is an enabling technology that can be applied to, for example, the oil sands, but at this time our focus is on the tires. Let's get the tire technology right and then we can focus on other endeavours and partnerships."

Though the company has developed a revolutionary and environmentally friendly alternative to the traditional methods used to recycle tires, Dr. Kaute remains modest. "We are not saving the world by reducing the carbon footprint through our tire recycling facilities – but we are doing our small part and we are making a difference."