From Liquidating Mixed Plastics Waste to Capturing Your Washing Machine’s Microfibers

Australia’s FOY Group drives waste-plastics-to-fuel pyrolysis efforts, while the Rozalia Project launches its nature-inspired Cora Ball

By Robert Grace

Even with the world awash in plastics trash, Australian entrepreneurs Stuart Clark and Paul Dickson can’t find enough of the stuff to keep the pipeline full for their innovative, new waste-plastics-to-road-ready fuel project. But they are forging ahead, with hefty funding and aggressive plans to build at least seven new hydrolysis plants around the world during 2017.

On the other hand, Rachael Z. Miller, a Vermont-based marine researcher, has found in our waterways staggering amounts of synthetic microfiber waste – originating primarily from our clothes shedding during the laundering process. She and her team have developed a simple, household product that Miller says can go a long way to help minimize the problem, and has just concluded a wildly successful
Kickstarter funding campaign that will help to bring the product to market soon.

These two scenarios highlight diverse ends of the spectrum of our world’s current plastics waste challenges. Both were clearly on display, along with a wealth of other such content, at the April 21 Plasticity Forum, held in Dallas during Earth Day Texas activities. (Plasticity California – the eighth edition of the international event – was held May 9 in Anaheim, collocated with SPE’s ANTEC 2017 conference, but occurred after the deadline for this issue.)

Down Under, Clark serves as managing director and Dickson as executive chairman of FOY Group Ltd., a publicly listed firm on the Australian Stock Exchange that is based in Chatswood, New South Wales. The company, previously known as Foyson, began life more than 25 years ago as a mining company, primarily exploring mineral sands Papua New Guinea.

**Don’t call it ‘incineration’**

FOY Group (www.foygroup.com.au) has taken well-known processes, such as pyrolysis, patented its own impurity-removal process, and combined these technologies in novel ways to create a new way of converting mixed plastics waste back into its original liquid state. Its proprietary process melts the plastic at 400 °C, in the absence of oxygen. After further processing, the resulting product is road-worthy gasoline and diesel fuel that can go straight into our vehicles, Clark told the Plasticity audience. The resulting fuel requires no blending, has low sulphur content, and is ready to be pumped straight into a car or truck and driven away. He stressed this is not incineration and should not be lumped together with that technology.

Clark explained the close links between a firm called Integrated Green Energy Ltd. (IGE) and FOY Group. He credits Bevan Dooley, an IGE director, for inventing the waste-plastics-to-fuel technology they are using. Dooley and Dickson have equity in both IGE and Foy, and all three men are directors of both firms. Clark said that Dooley, over the last 12 months, has led development of its “fifth-generation technology,” supported by Dickson’s funding.

In an interview in Dallas, Dickson explained that a “typical” FOY Group plant will consist of four production modules, with each module occupying a footprint roughly the size of a basketball court, and able to process 50 metric tonnes of mixed-waste plastic every day. Each 200-tonne-per-day plant also needs a tank farm, and other assets, meaning that FOY needs about four acres of land and US$22 million to construct each facility.

**Aggressive global growth plans**

FOY currently has just one plant – a single-module unit in Berkeley Vale, New South Wales (north of Sydney) – but the firm has big expansion plans for the coming year. Dickson said FOY will build a four-module plant in the Australian Capital Territory, where Canberra is based; one in Germany (not far from Berlin); four in northern England; and a large, 30-module facility in tiny Camden, Ind., (along with a separate recycling center), about 70 miles northwest of Indianapolis. In mid-April, Dickson said, the company secured A$120 million (US$90 million) in funding that is targeted exclusively for building the four U.K. plants.

For the Indiana project, FOY has entered into a business partnership with GEP Fuel & Energy Indiana LLC. GEP will first build a $90 million, custom-designed recycling center that will focus on processing only automobile shredder residue (ASR). The output from this process will be the input for FOY’s $210 million plant that will be able to handle 1,500 tonnes of ASR plastics waste per day and produce approximately 18 million gallons of fuel per year.

“The separate and discrete funding packages for the four U.K. sites and the Indiana site have been organized through Philadelphia-based Structured Growth Capital Inc., with the funding coming from a number of financial institutions,” Clark said in a post-conference interview.

Dickson noted that once the metal is extracted from the ASR, the remaining plastics waste usually is discarded. But this is precisely the type of material that FOY covets as feedstock. Clark said the company can handle all resin types except for PVC or anything that is Teflon coated. It also chooses to avoid consuming resins such as PET and polypropylene that already have a ready, successful recycling stream in place.

**Gaining local public support**

Each of its facilities require local permits, of course, most of which revolve around proving that FOY’s activities will comply with environmental emissions guidelines. Such regulatory approvals typically take up to nine months to complete in each plant location. The company does full health impact assessments (HIAs) and Dickson says FOY’s plants fall well within acceptable emissions limits. It also is vital, he added,
to engage with the local communities where they want to site plants, to earn their trust and gain their support. Clark said about 30 employees will be needed to operate each four-module plant on an ongoing basis.

FOY Group is creating wholly owned subsidiaries where it is planning to set up plants. In the U.K., this firm is called Integrated Green Energy UK; in Germany, it is Integrated Green Energy Germany. FOY owns all the intellectual property rights for its manufacturing modules, and Dickson said it will build in the U.S. the machines it plans to use in the Indiana plant.

“We want more facilities in the U.S.,” he said, citing especially the New York and Los Angeles areas, where there are high population densities (which translates into a lot of waste). “We’ve appointed a partner in China,” he added, indicating that FOY eventually will have plants in Taiwan, Hong Kong and on the Chinese mainland — but that is further down the road.

FOY Group’s biggest challenge, both Clark and Dickson reiterated, remains obtaining the necessary feedstock material. The problem is that, even though there are millions of tonnes of mixed waste plastics, much of it is commingled with other materials such as glass, metal, cardboard and even organic food waste. Extracting the desired plastics from these types of materials is often where the bottlenecks occur, they said.

Clark stressed that his company is not a charity looking for donations, but rather a business seeking public support for its technology, and looking for help in securing the necessary feedstock materials to allow it to keep generating road-ready fuel out of the trash that nobody else wants.

The Cora Ball & biomimicry

Plasticity Texas speaker Rachael Miller, co-founder and executive director of the Rozalia Project, said there is no shortage of the type of waste that she tracks — even if it can be nearly impossible to see with the naked eye.

Miller, who captains a 60-foot sailing research vessel called “American Promise,” is focused now on quantifying and addressing the pollution caused by the synthetic microfibers that shed from our clothing. A study by outdoor clothing maker Patagonia, she said, showed that an average of more than 81,000 microscopic fibers are shed by a single fleece jacket during each laundry wash cycle; depending on the item in question, that number can exceed 250,000 microfibers, the research showed.

Much too small to be captured by the filters in your washing machine — an appliance that Miller calls “the land/sea interface” of all our homes — or in the filters used by civic waste-water facilities, these fibers find their way in alarming quantities into our rivers and oceans, where they are consumed by plankton and small fish, which in turn are eaten by larger fish, some of which end up on dinner plates.

“We are eating our fleece; we’re eating our yoga pants,” she passionately told the Dallas audience. “Our clothing is falling apart, and turning into little pieces, and flowing out of our washing machines and into the public waterways.”

Troubling research findings

A 2015 study showed that one in three shellfish, one in four fin fish, and two-thirds of all species tested from fish markets in California had microfiber in them, and even if you do not eat fish, Miller noted, cows, pigs and chicken are fed fish meal. A recent paper estimated that Europeans could ingest up to 11,000 pieces of plastic per year — through shellfish consumption.
Rather than rely on anecdotal evidence, Miller led an effort last summer to sample the waters of the 315-mile-long Hudson River, from its source in the Adirondack mountains in upstate New York all the way to where the river empties into the Atlantic Ocean, between New York City and Jersey City, N.J. She and her team took water samples every three miles down the entire river, and assessed the results under high-powered microscopes.

Since the research is currently being peer-reviewed, she declined to share specific results, but did say they found significant amounts of microfibers at every point in the river, to include upstream from the local wastewater treatment plant, and even in unpopulated regions. This leads her to believe that some of pollution also may be airborne, but further research will be needed to determine the most likely sources.

**Partnering with a Vermont molder**

In one approach to try to address the waterborne challenge, the Rozalia Project (www.rozaliaproject.org) has worked with a small, Williamstown, Vt.-based injection molder called Progressive Plastics Inc. to develop a consumer product dubbed the Cora Ball. Roughly the size of a softball, the flexible, multi-colored, 3D-printed prototype consists of scores of “tentacles,” each with a host of very tiny, prickly, protruding spines. Miller said that Progressive Plastics, a low-key molder that doesn’t even have a website, is “very busy with their own designs and items. … They are zero waste and awesome.”

The Cora Ball design mimics the natural coral found in the sea – hence the product’s name. Water needs to be able to flow through the ball, while at the same time capturing the microscopic fibers that shed from our clothes with every load of laundry. While not designed to do so, the ball also has proven to be very effective at capturing human and pet hair. (See video at: [http://bit.ly/CoraBallVideo](http://bit.ly/CoraBallVideo).

Simply toss the Cora Ball into the washing machine and, after a few loads, clean it manually, much as you would a hairbrush, Miller said. The captured hair and microfibers get entangled, making it possible to easily extract them from the ball. For now, Miller says, this waste needs to go into the trash bin, though they also are working hard to find ways to upcycle the reclaimed fibers into some useful product.

Their research indicates that the Cora Ball succeeds in capturing roughly up to 35% of the microfibers in each wash load. So, by Miller’s calculation, if only one in 10 U.S. households used a Cora Ball, “we could keep the equivalent of 30 million plastic bottles out of our waters every year.”

**A crowdfunding hit on Kickstarter**

She launched a Kickstarter crowd-funding campaign, which she hoped would raise about $10,000, to allow the first mass-production of the Cora Ball. “We met that goal in three hours,” she said. By the time the campaign closed on April 26, the project had 8,635 backers who had pledged more than $353,000. “There is hope!” she proclaimed, largely reflected by the fact that this issue resonated with so many individuals who were willing to support it.

Plans now call for Progressive Plastics to start molding the Cora Ball by this July. Miller said that for the final product, they are “working on a soft plastic that we can source 100% recycled, is recyclable and withstands the extremes of laundry machines.”

Miller sees potential opportunities for innovation at various levels to tackle the microfiber problem. These could
involve engaging with the following groups:

- The textiles industry (chemists, extruders, weavers, designers) to develop materials that don't shed;
- Consumers (this is what the Cora Ball is doing);
- The laundry industry (washing, drying, detergent); and
- Wastewater treatment (seek ways to improve municipal and septic systems).

“Microfiber pollution is not just about plastics,” Miller said. “Though we are concerned with the persistence of synthetic fibers, we are also concerned with the chemicals associated with our natural textiles such as dyes, heavy metals and flame retardants. That is why the Cora Ball is an equal opportunity microfiber catcher. We don’t want manmade fibers in the bellies of fish.”

**ABOUT THE AUTHOR**

Robert Grace began his business journalism career with Crain Communications Inc. in 1980 in Akron, Ohio, and worked for Crain for seven years in London, England, before returning to Akron in 1989 as the founding editor of *Plastics News*. He also served as *PN*’s associate publisher, conference director and business development director. In May 2014 he launched RC Grace LLC, and in July 2016 became managing editor of *Plastics Engineering*. Contact him at bob@rcgrace.com.
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