Recycling mixtures of plastics is becoming technically feasible, but what do you do with the product?

New Life for Old PLASTICS

By IVARS PETERSON

Within a decade, most of today's sleek, shiny, new cars will probably end up in a scrap heap. Some of these hulks will slowly rust away—abandoned and forgotten. A larger number will be stripped, dismantled and shredded. But a rapidly rising fraction of this scrap consists of plastics, and scrap processors aren't yet sure what to do with this residue.

The trend toward building lighter cars will continue to increase the proportion of plastics in a car, and "the problem for the shredder people will get worse," says Albert Spaak, executive director of the Plastics Institute of America in Hoboken, N.J. Part of the answer may lie in institute-sponsored research on new methods for recycling plastic scrap. By 1990, with the proper technology, Spaak predicts, shredded cars could yield more than a million tons of reusable plastic.

Each one of the 7 million or so automobiles discarded every year in the United States represents more than a ton of steel and smaller amounts of cast iron, copper, zinc, aluminum, lead and a mixture of plastics. Scrap processors have developed sophisticated methods for profitably recovering materials like zinc, iron and steel from a junked car. The 300 or 400 pounds of shredder material left over after removal of the metals consists largely of a mixture of chopped up fibers and plastics. Presently, most of it ends up in landfills.

The plastic residue, after being cleaned and melted, is a black material—a mix of the many different polymers that go into a car. It lacks the strength and flow characteristics of comparable, "virgin" plastics. Starting last year, the Plastics Institute sponsored a series of research projects at several universities to explore how to improve the properties of this shredder residue.

According to preliminary research results presented recently at the "Recycling: Opportunities and Constraints" conference in Washington, D.C., several additives, including fresh polyethylene and short glass fibers, boost the material's performance. Other studies show that processing methods can be developed to blend the fibrous, black starting material into a more uniform state.

"It's rather exciting to see some of the results that we've had so far," says Spaak. "It looks like there's promise. We're zeroing in now on the better ones." The institute expects to issue a full report on its work next year.

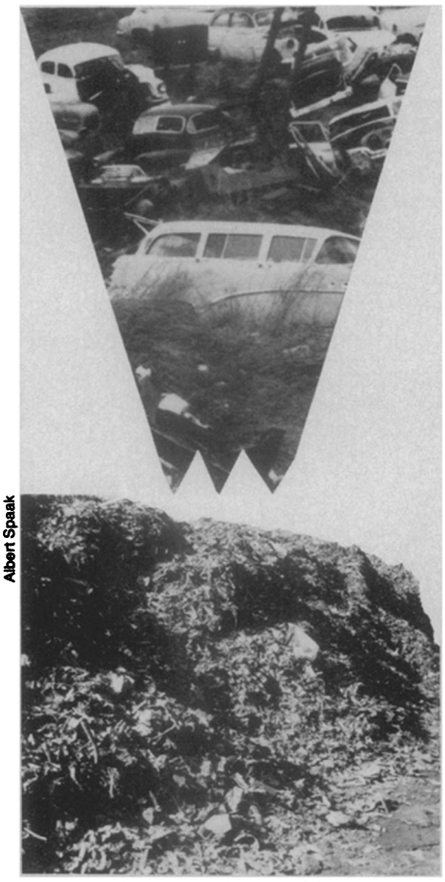
The trickier problem is finding a use for the recycled plastic. "It becomes primarily a marketing problem," Spaak says. "What do you do with this material?" Without a market, there's no incentive for going to the trouble of processing the shredder residue.

The example of polyethylene terephthalate (PET) soft-drink bottles illustrates the difficulty. There are no serious technical problems in cleaning the bottles and turning them into a clear plastic material ready for reuse, says Spaak. However, the recycled material's quality generally isn't high enough for bottle production. Other uses need to be found.

"It takes years to develop new markets to use all those bottles that are being made now," says Spaak. One plastics producer is looking at turning recycled PET into fibers that can be used as fill for pillows or as insulating material in sleeping bags or coats. Chopped up, it could also be added to fiberglass and built into boat hulls. Auto-shredder residue, after proper treatment, could be molded into durable products like window shutters, suggests Spaak.

Of all the plastics regularly discarded, the Plastics Institute chose to look at shredder residue first because the residue has a fairly high concentration of polymers to start with. Companies interested in the material can also easily arrange to get it. In contrast, recovering plastics from household trash is a much more difficult problem. Even so, other countries are much farther ahead in developing techniques for "getting value out of garbage," says Spaak.

In West Germany, researchers have developed a process that cleanses the assortment of plastics found in domestic rubbish and sorts it into specific types of plastic according to its density. However, without an efficient method for separating plastic from the rest of domestic garbage, the process works best for sorting out waste from industrial or business sources



Albert Spaak

Auto-shredder residue

that typically use large quantities of plastic items. For instance, trash from fast-food restaurants or from airlines often contains a high proportion of polyethylene and polystyrene. Japan is one of the few countries that actually make an effort to get householders to separate plastics by hand from other materials before the garbage is collected.

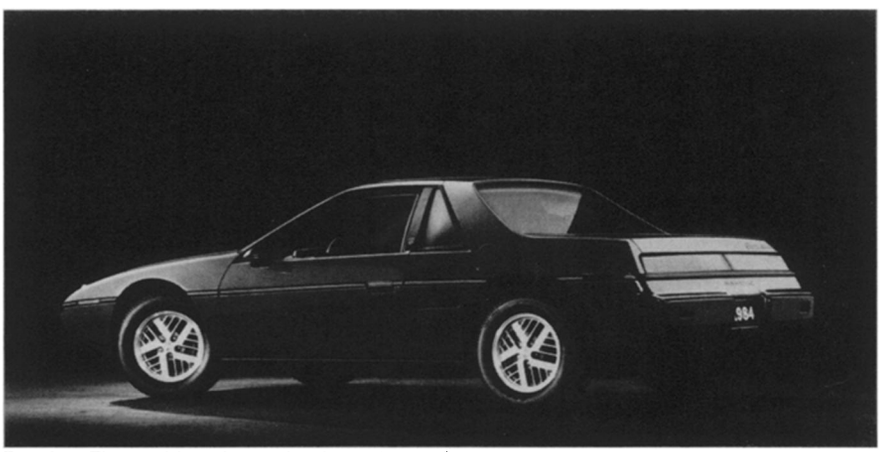
The development of plastics recycling in the United States may also be threatened by programs designed to generate heat or power from burning garbage. These incinerators provide local governments an attractive way of getting rid of their garbage while earning revenue from the sale of generated power. To ensure a steady fuel supply for their incinerators, many municipalities now require all solid waste, including paper and plastic scrap, to go to the plants.

This trend already worries the paper recycling industry and may become a problem for companies interested in developing uses for recycled plastic. Without a reliable source of supply, few companies would want to take the risk of getting into the recycling business. Recent research at the Plastics Institute, paralleling studies by paper recyclers, shows that more energy can be saved through recycling than is gained by burning plastic scrap.

Another problem facing recyclers generally is that products are rarely designed and manufactured with recycling in mind. Automobile manufacturers, for example, use a mix of many different polymers in their vehicles. A few cars, like the new Renault Espace, Pontiac Fiero and a recently announced Honda sports car, even feature bodywork made from polymers. To make recycling easier, Michael B. Bever of the Massachusetts Institute of Technology suggests the possibility of making at least the entire interior of a car from essentially one kind of polymer treated in different ways for its various applications.

"That would make our lives so much easier," says Spaak, "but I don't think it's a possibility." Too many automobile parts require particular properties that can't be met by one type of plastic, he says. However, Spaak doesn't discount the possibility of future large-scale production of small, electric-driven vehicles molded from plastic. This much plastic shouldn't be thrown away without an effort made to recycle the material, he says.

In general, the value of plastic materials that can be remelted and reused has not been fully realized, says Spaak. "Scrap plastics should be recycled as a material resource." Plastic producers already recycle most of their own scrap. Treating the plastic in automobile-shredder scrap is a first step toward recycling the plastics that get to consumers and are usually thrown away. Someday, the term "plastic" may no longer be synonymous with the word "disposable." □



Pontiac Fiero with polymer bodywork

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cumstances." The reduced mortality levels they observed among exercisers, the researchers conclude, "should imply increased life expectancy for the active men."

"The types and amount of exercise likely to achieve optimum cardiovascular health are uncertain," the researchers write. However, they do mention the importance of "constancy of habit," whether the activity be walking, climbing or "regular sports play."

A second study of some 6,000 men and women, aged 20 to 65 — also published in that issue of JAMA — reports that persons with "low levels of physical fitness" are about 50 percent more likely to develop hypertension than are "highly fit persons." In an accompanying editorial, Norman M. Kaplan of the University of Texas Health Center in Dallas says the study "provides some very suggestive evidence that physical fitness provides protection against the development of hypertension ... Like my mother's chicken soup, regular isotonic exercise should not hurt," Kaplan says. "Who knows, joggers may even live longer."

Though he did not specify chicken soup, cardiologist/marathoner Nequin says that since his operation and recovery, he eats "anything I can get my hands on," adding quickly that he watches his cholesterol and fat intake. But, he emphasizes, there are "no guarantees" against heart disease, particularly in cases where there is a family history of heart problems.

Jokl concurs. "The most important thing is to pick the right parents," he says. "Exercise cannot remove plaques in the coronary arteries, nor scars in the myocardium." Still, Jokl notes that physicians' thinking about exercise and health has shifted about 180 degrees since around the turn of the century. Published reports and lectures around that time warned of the "ill effects of exercise," primarily upon the hearts of adolescents. Such thinking prevailed for several decades into this century, and it has been "only recently," Jokl says, that "the resources of scientific medicine were...brought to bear upon the study of the problem of heart and sport. Many current athletic records have been established by adolescent boys and girls," Jokl writes in the ANNALS OF SPORTS MEDICINE. "There can be no doubt that the medical prophets of doom ... possessed more eloquence than knowledge."

Part of the previous concern involved the "enlarged heart" of many athletes. Now, after more than 10 years of study, "cardiologists have new information that the large heart of athletes is not the same as a diseased enlarged heart," Jokl says. The growth of the athlete's heart — primarily seen in those participating in endurance sports such as distance running—is "adaptive, to facilitate exercise," he says. Moreover, he adds, such growth is "reversible": If the athlete refrains from exercise for a period of time, the heart—which can weigh up to 500 grams in the endurance athlete—will return to its smaller dimensions.

Finally, Jokl notes that sudden cardiac death during exercise "never happens to an elite [Olympic or world class caliber] athlete." Such performers, he says, are almost always in superior physical condition, and had to be that way to achieve their position in the upper echelons of athletics.

But the rest of the population, like Nequin, should heed any symptoms that might arise during exercise. "Denial is very typical," Nequin says. "Even people who have had an actual heart attack generally delay about three hours before going to a doctor. Being a physician helped—I had an idea I had a problem, but I still waited until there was no choice but to go in [to see a doctor]."

The denial is usually followed by the emotional depression of accepting that you have heart disease, he says. "But that only lasted until my cardiologist took me out to dinner...and paid.

"I feel luckier than most people," Nequin says. "Now I know my problem and exercise to the limits of my problem. It *is* ironic that I run a cardiac rehabilitation program and that this happened to me."

The coincidence, he concedes, is not dissimilar to that surrounding Fixx's death. "Jim Fixx," Nequin told his audience, "could have been giving this lecture." □