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Vinyl Recycling— Often Asked Questions

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AS our nation struggles with the ever-pressing municipal solid waste disposal problem, attention has recently turned to recycling plastic packaging containers. Although the weight of plastic materials in the municipal solid waste stream is only 7 or 8 percent, they do occupy a significant volume, even when crushed. With less land area available for landfills and concern over groundwater contamination, other options are being sought.

Vinyl plastics, also known as polyvinyl chloride or PVC, are desirable packaging materials in that they can be produced as transparent packaging and can be manufactured with a molded-in handle. They are used to package many different products including bottled water, mouthwash, hair shampoo, household detergents, and window cleaners.

As vinyl bottles are used in numerous applications, the container's shape and size can vary widely. This is in marked contrast to the well-recognized, 1-gal high-density polyethylene (HDPE) jug used for water or milk, or even the 2-liter beverage containers made of polyethylene terephthalate (PET).

Manual Sorting

Initially, it was believed that manual sorting plastic containers would be

adequate. This involves workers at a sorting line identifying vinyl containers by their clarity and characteristic blow-molding scar, which resembles a smile. PET containers, which are the only principal clear container that could be confused with vinyl, have a "bullet dot" molding scar. More recently, The Society of the Plastics Industry, Inc. (SPI) established a voluntary coding program in which plastics are identified by a recycling code—a number and letters relating to the material's composition. This coding system has now been adopted by 27 states and will be required on all packaging sold in those states.

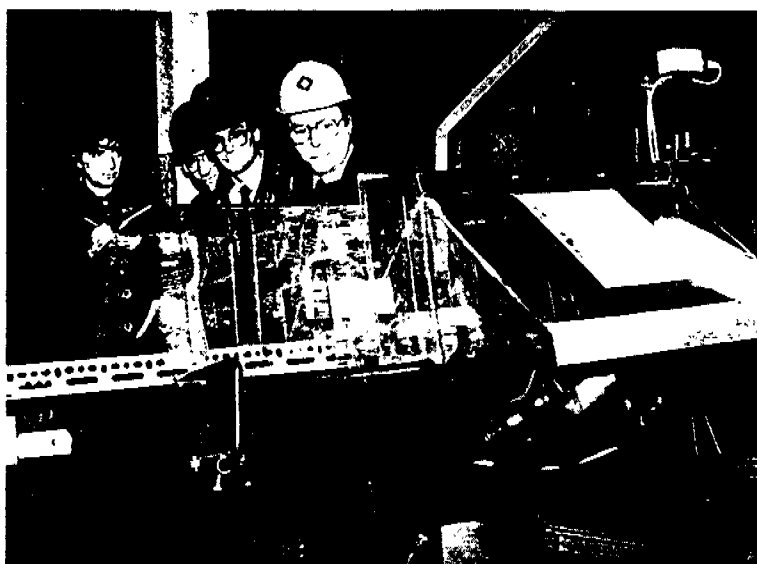
However, manual sorting, using visual inspection techniques, is at best, only about 90 percent effective. The reasons for this are the speed at which sorting must be conducted and fatigue on the part of workers. The presence of small quantities of another plastic in vinyl, or vinyl in some other plastic mate-

rial, can lead to serious problems in fabricating products from recycled materials.

Automatic Sorting Devices

As a result, recent work has aimed at developing automatic sorting systems. A commercial processor using an automatic system will produce homogenous products, the end result will promote increased recycling of post-consumer vinyl materials. Short-term vinyl products such as packaging materials will be converted into many long-term, second generation uses. This will help reduce the demand for landfill space.

Because vinyl is only a small segment of the solid waste stream (between 0.3 to 0.5 percent), it has not received high priority in plastic recycling programs. That, coupled with the many types of vinyl containers that need to be sorted, did not lend itself to easy collection. However, that appears to be changing as more communities move to total



■ **AUTOMATED** plastics sorting. This device using gamma ray fluorescence to detect and separate vinyl bottles from other rigid plastic containers was developed by the Center for Plastics Recycling Research at Rutgers.

plastics collection programs. There are several questions that are frequently asked about vinyl recycling.

Can vinyl scrap be recycled? Yes. Since vinyl is a thermoplastic material, there is no processing barrier to its effective recycling. For example, scrap produced in pipe, siding, sheet manufacture, and blowmolding plants has been ground and recycled back into the original process for many years.

Can post-consumer vinyl packaging materials be recycled? Experience has shown that post-consumer waste, i.e., rigid bottles and blister packaging can be recycled. This requires separating and sorting materials from other plastics followed by clean-up, grinding, detergent washing, melt filtering, and drying. To date, it has not been proven technically feasible to recycle flexible vinyl film, such as used in meat packaging. Incineration or landfilling remain the best disposal methods for this type of product.

Does the SPI code on the bottom of plastic containers indicate the relative recyclability of different plastics? No. It has been erroneously stated that the numbers appearing on the coding system indicate the ease with which a material can be recycled. In actuality, the codes only indicate the material from which the bottles are made and this is for sorting purposes only. In this system, vinyl containers are marked with the number "3" and the letter "V." Numbers are used because they are relatively quick to identify and read and are distinguishable from any manufacturer's markings.

Is vinyl packaging being reclaimed commercially today? Although vinyl reclamation is in its infancy relative to other plastics recycling (e.g., PET soda bottles and HDPE milk jugs), several companies and municipalities are already engaged in vinyl reclamation. Some obtain PVC directly, such as R2B2 and Wheaton Plastics. Some localities collect the entire plastics bottle

stream (Somerset County, New Jersey and Anaheim, California) and subsequently sort the vinyl manually. Others receive PVC inadvertently in HDPE and PET collection programs. Manually sorting PVC from other containers, however, is still the rule. Automatic sorting devices though, are expected to replace manual work for large volume collectors and recyclers within a year.

What automatic sorting devices will be commercially available? In the U.S., two devices are expected to make their commercial appearance in 1991. The first is based on gamma ray fluorescence to detect and separate vinyl bottles from others in a highly automated rigid container sorting line. It was developed by the Center For Plastics Recycling Research (CPRR) at Rutgers University in New Brunswick, New Jersey. The second system uses electromagnetic radiation to identify the chlorine atom and thereby separate vinyl from an undifferentiated solid waste stream. It was developed by National Recovery Technologies, Nashville, Tennessee. A commercial prototype will be in operation early in 1991.

Additionally, several companies are developing sorting technology for ground, mixed plastic materials. One example is the Herbolt Refakt method, using hot belt separation.

Is it necessary to separate vinyl from other plastic recycling processes? Depending on the desired end product, separating vinyl from other plastic materials may not be necessary. For high quality extrusion or blowmolding processes the recycled vinyl should be pure. However, with the growing trend toward composite packaging material, commingled or mixed plastics will always be part of the waste stream. Based on research carried out at Rutgers' CPRR, such materials can be processed into synthetic lumber. The process employs a technology developed by Advanced Recycling Technology in Belgium, Superwood in Ireland,

and Recycloplast in West Germany. Potential applications for commingled products include thick gauge extrusions or molded products, such as fencing, landscape architecture, traffic barriers, parking lot stops, picnic tables, and benches.

Does PVC degrade in the commingled recycling process? Since PVC is stabilized in its original form after recovery from a recycling operation, more stabilizer may be needed to boost the processing latitude of the commingled material. However, some studies have shown that as much as 10 to 25 percent of the commingled plastic can be recycled vinyl without the need for additional stabilizer.

What are the applications for recycled PVC? A recent study completed by the University of Toledo indicates that recycled PVC could be used in building and construction products. These include downspouts, fencing and corrals, hand rails, house siding, sewer pipe, septic systems, telephone cables, and window frames. Other potential uses include floor and machinery mats and refuse containers. The study also indicates that recycled vinyl could be used for fabricating bottles for household chemicals, flower pot covers, bud vases, garden hose cores, office accessories, stadium bleacher covers, and truck bed liners. Moreover, the study shows that there exists a potential demand for recycled PVC that is far greater than the supply of vinyl bottles presently being manufactured.

While plastic recycling is still in its infancy, tremendous progress has been made in only a few years. As markets are developed and we gain more experience and knowledge, plastics recycling will become a normal part of solid waste management. □□□

Further information relating to vinyl plastics in recycling can be obtained from The Vinyl Institute, Wayne Interchange Plaza II, 155 Route 46 West, Wayne, New Jersey 07470.



A Division of The Society of The Plastics Industry, Inc.

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NRT process sorts PVC from other plastics

Vinyl Institute lauds effort in recycling

By Adam Lashinsky
PLASTICS NEWS STAFF

WASHINGTON—The Vinyl Institute and National Recovery Technologies Inc. last month unveiled a process they claim will thrust PVC recycling into the modern era.

NRT, a private recycling technology concern in Nashville, Tenn., developed the vinyl separation process with about \$400,000 in funding from the Environmental Protection Agency, the Vinyl Institute and Reprise Ltd., a Stockport, England, joint venture between Britain's PVC Group plc and European Vinyls Corp. of Brussels, Belgium.

In an Oct. 31 news briefing at the National Press Club, the vinyls group and NRT also announced that XL Disposal Corp., a suburban Chicago waste management firm, would house the proprietary sorting process beginning in the first few months of 1991.

"We're taking a disposable product and converting it to a durable. These products will not end

up in the waste stream for many years," said Vinyl Institute Executive Director Roy Gottesman, citing figures that PVC accounts for less than one-fifth of 1 percent of disposed plastic packaging.

"Essentially, the NRT technology moves vinyl one step closer to being a full player in the solid waste management process," Gottesman said.

Edward Sommer, NRT executive vice president and technical director, said he anticipates his company's sorting unit would cost \$100,000-\$150,000 for high-volume users.

The company's device separates PVC from other waste by identifying the chlorine atom in vinyl disposables and ejecting the PVC over a barrier with a burst of air, leaving other plastics—most often high density polyethylene and PET—to flow down a conveyor belt to separate recycling areas.

Reporters and industry officials at the briefing watched the process on a videotape, but as part of the Vinyl Institute's agreement with NRT, interested parties will be able to view the process at XL's Crestwood, Ill., facility.

Begun in 1981, NRT first got involved in vinyl separation by winning a \$50,000 Small Business Innovation Research grant from the

EPA in 1988. A year later it grabbed a second-phase, \$150,000 award and simultaneously was approached by the vinyl industry group to develop its technology.

Under their agreement, the Vinyl Institute can place NRT's demonstrator processing unit where it chooses for two years.

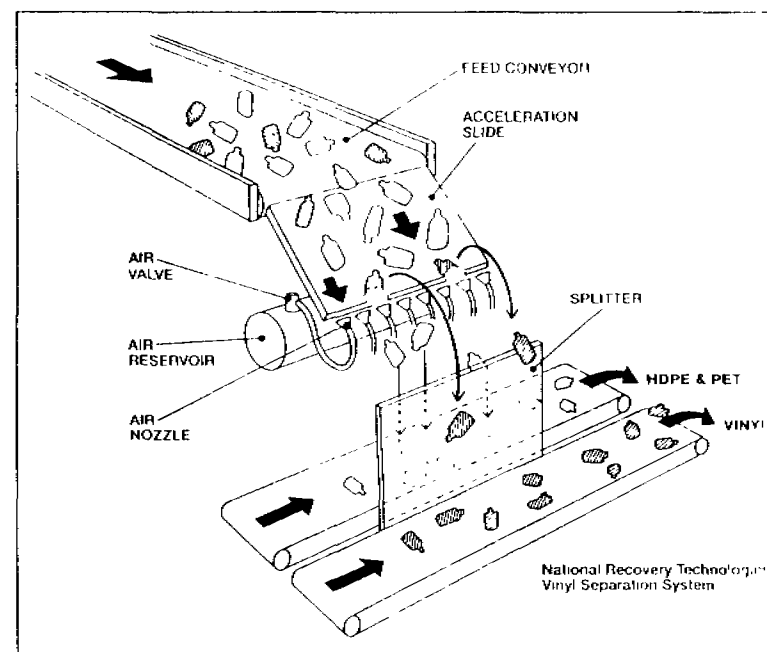
NRT's Sommer said the 18-employee company had doubled in size in the last year and is moving to a new facility in Nashville, having outgrown its old one. He declined to discuss the private firm's sales figures.

XL Disposal currently houses NRT's mainline sorting process, which separates numerous recyclables. In addition, Sommer said NRT is building a unit for Addington Resources Inc. of Ashland, Ky.

Larry Thomas, president of the Society of the Plastics Industry Inc.—of which the Vinyl Institute is a division—praised NRT's "integrated approach."

Speaking after the briefing, Thomas said that Sommer and his colleagues "have really advanced the cause of recycling."

An example of NRT's integrated approach will be Reprise Ltd.'s facility in England. The British site already sorts numerous waste items and is set to incorporate the new technology to screen out PVC



National Recovery Technologies Inc. has a new PVC sorting method that identifies chlorine atoms in PVC and ejects the containers over a divider onto a separate conveyor with a burst of air.

in January.

"We're waiting to bolt on the NRT application," said Duncan Makin, managing director at PVC Group, one of the joint venture's parent companies.

The Vinyl Institute's Gottesman cited figures from a recent Univer-

sity of Toledo study that demand for recycled vinyl could reach 100 million pounds a year.

Given that about 200 million pounds currently exists in the waste stream, demand for recycled PVC could outstrip supply, Gottesman said.

Reprise with permission.

From Sortation to Marketing, the Vinyl Loop Gets Stronger

A new recycling recruit has been found for the parade of plastics. Although it's not yet quite time to step off, that parade is destined to make itself heard.

As the search for solid-waste solutions continues, the push to collect and recycle plastics grows.

The latest recycling recruit is a material that composes less than 1 percent of the solid-waste stream: polyvinyl chloride, the world's second-largest selling thermo-plastic. Post-consumer polyethylene, the world's largest-selling thermo-plastic, is recycled from PET and HDPE bottles and containers.

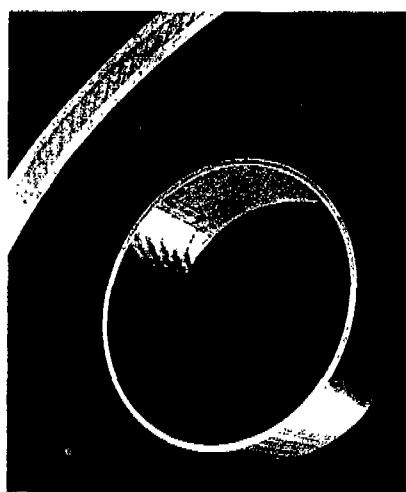
Vinyl is now recycled in commingled plastics — for use in wood-substitute lumber, picnic tables and park benches — because it is difficult to sort from a mixed post-consumer plastics stream. Industrially, the vinyl scrap produced in pipe manufacture or bottle blowing has been recycled for years. The scrap is ground and recycled into the same products from which it came.

Virgin PVC is used commercially in food, drug and pharmaceutical packaging because it produces a high gloss, glass-like clarity and bright color. It is used in both rigid plastic containers and clear film wrap.

Ongoing research by Occidental Chemical has demonstrated the ability to produce a high-quality, generic vinyl product from recycled vinyl packaging. However, this research is in its infancy, and the economics of recycling vinyl are not yet quantifiable.

Though the industry has been marketing vinyl as a recyclable material, potential recyclers are ironing out the wrinkles — sorting it from the waste stream and finding substantial markets.

While large quantities of HDPE and PET containers are easily identified and collected, vinyl containers are not. Hand sorters have difficulty distinguishing the variety of barbecue sauce, peanut butter, bottled water, mouth-



Recycled vinyl is sandwiched between layers of virgin PVC in foam-core pipe. (The Vinyl Institute)

wash, dishwashing liquid, window cleaner and other rigid-vinyl packages.

PLANNING STAGE. One firm on the cutting edge of solving the problem is National Recovery Technologies. The Nashville-based manufacturer of municipal-waste processing systems plans to introduce a prototype automated PVC sorter by the end of the year. The electromagnetic scanner would identify and help remove rigid, post-consumer vinyl containers from a mixed-plastics waste stream.

Rigid vinyl containers contribute an estimated 240 million pounds, or 0.2 percent, annually to the solid-waste stream.

"Theoretically you could reclaim (all of the vinyl) and it could be every bit as good as virgin material," said Roy Gottesman, executive director of the Vinyl Institute. However, it is not economically feasible to collect, separate and clean products like the flexible, clear film used to package meat and fruit, he added. Rigid vinyl containers are economical to clean, grind and recy-

cle into a generic vinyl product such as the foam in foam core pipe.

Automated sortation technology, according to Gottesman, would recover at least 50 percent of rigid post-consumer containers, or up to 0.1 percent of the solid-waste stream. Thus, 120 million pounds previously destined for landfills would be recycled as pipe, window frames, truck-bed liners, flower pots and more.

The institute has joined the Environmental Protection Agency in sponsoring NRT's research to develop vinyl-sortation technology.

NO HANDS. "This new project will enable plastics-waste processors to separate (rigid vinyl containers) from other plastics in the waste stream without having to employ labor-intensive hand sortation that relies on container coding or container shape," said Gottesman.

While an automated sortation line is under development, hand sorters rely on the subtle, voluntary Society of the Plastics Industry coding or on common, identifiable package shapes. The SPI code is molded into the container and features the letters PVC and a number 3 inside a reuse logo.

Ed Sommer, executive vice president and director of research for NRT, said the new sortation technology is based on electromagnetic scanning like that introduced in Europe five years ago.

Existing European technology is expensive for American waste processors. The Italian and Belgian companies which cooperatively introduced mechanical sortation and separation are selling the only complete material-recovery facilities, said Gottesman.

Charles Roos, president of NRT, predicted his company's system will be cost-effective to integrate into existing

sortation lines, many of which his company manufactured. NRT has worked with cities such as Chicago, New York and Miami to establish sortation systems for municipal solid waste.

"Our initial incentive was to remove vinyl before incineration," said Sommer. Burning vinyl was held responsible for the corrosion of incinerators and thought to create hazardous by-products such as dioxin.

In 1987, the Vinyl Institute co-sponsored a study conducted by the New York State Energy Research and Development Authority, which revealed that the presence or absence of vinyl in municipal-waste incinerators has no effect on incinerator production of dioxin. Gottesman said incineration is a safe option in disposing of the PVC plastic.

However, the Institute says public opposition to incineration and a growing interest in recycling have spurred research in recovering vinyl for recycling.

THE MARKETS. "Because of the number of applications in which vinyl is used — and the number of potential applications for recycled vinyl — we expect that demand will exist for recycled vinyl once steady sources of supply are established," said Sommer.

The institute is concurrently funding and supporting programs to complete the integration of vinyl into the recycling process. In 1989, it began working with Vermont Republic Industries to identify potential markets, and has worked with the Center for Plastics Recycling Research at Rutgers University on commingling programs.

In Europe, recycled PVC bottles are made into profile extrusions — window frames, for example — and coextruded foam core pipe. In the United States they have been used in truck-bed liners and flower pots as well as foam core pipe. Other applications are being developed.

Occidental Chemical, a major supplier of vinyl resin, is breaking ground with a new national buy-back offering for PVC. "Recycling, in general, does



not succeed unless economically viable," said William Carroll, director of commercial development. He predicted, "The market for recycled resins will be good."

Carroll said non-food packaging is a possible reuse for vinyl. In January, Occidental planned to grind and wash the post-consumer vinyl it had collected for further testing.

Research and development is a Catch-22. Occidental needs a ready supply of recyclable vinyl products to research applications and develop markets. The post-consumer vinyl supply is limited because markets have not been developed and collection is slow.

Occidental hopes to stimulate the supply with a buy-back schedule similar to that for PET plastics — 6 cents per pound for mixed colors and clears, and 8 cents for true colors.

B.F. Goodrich, which has an 18-20 percent share of the vinyl market, is also researching uses for post-consumer vinyl. "Once we've learned the ABCs of re-processing, we will take it to our customers who could use it as a feed-



(Barney Taxel)

stock and show them how it could be done," said D'Lane Wisner, senior marketing manager, packaging and medical.

In the research and development department, a lab-scale chlorine scanner is used to identify PVC containers for scientists who are determining how to recycle them and into what products.

Though re-use as food packaging is still sensitive, Wisner said, "The end use is unlimited. Any place that rigid vinyl is used today is potentially an end-use (for recycled post-consumer vinyl)."

Like other plastics companies, B.F. Goodrich is not getting into the recycling business, but realizes recycling may be key in preserving the plastics market in light of the solid-waste problem.

Other companies such as Vermont Republic Industries are exploring the markets for recycled post-consumer vinyl. It now works with the industry to identify recyclable commercial vinyl such as pipe, vinyl siding and packaging. These products are either cleaned and returned to their original uses or cleaned and ground for reprocessing in-

to pipes and drain tile.

"We've never had any trouble finding a market (for the reground vinyl)," said Albin Voegelé, president of Vermont Republic Industries. The St. Albans, Vt.-based company supplies recyclable commercial vinyl to processors in the United States and Canada. In 1989, the company cleaned and returned 1 million pounds of reusable material to the marketplace, and processed 350,000 million pounds for recycling.

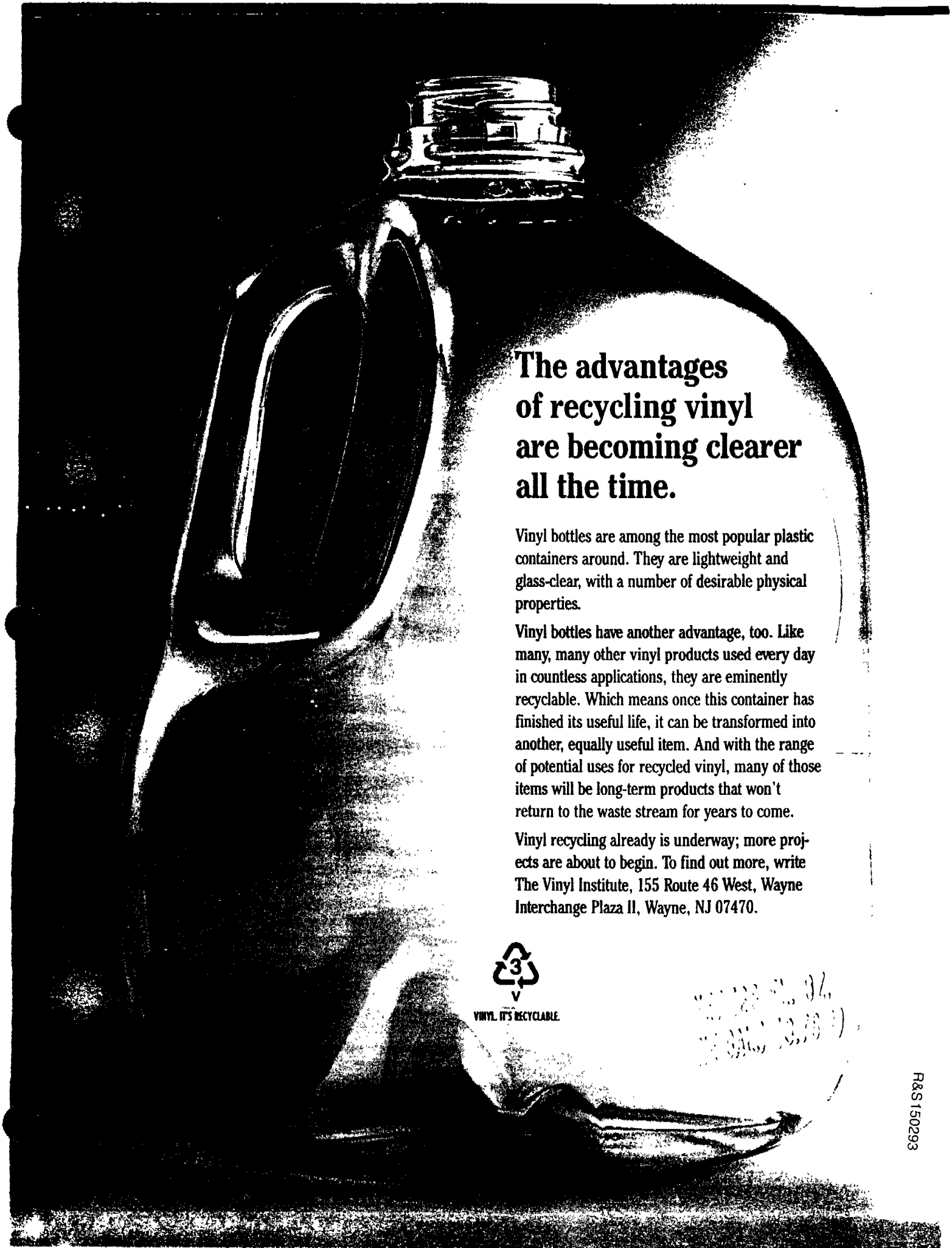
"Once the sortation is in place, we could easily handle post-consumer PVC," said Voegelé. When sortation technology becomes part of the separation line, Vermont Republic Industries would process and bale the rigid, post-consumer vinyl containers collected by municipalities and sell the plastics to companies such as Occidental Chemical.

Occidental is one of about a dozen companies in the United States that manufactures the PVC resin used in packaging and construction applications. While 60 percent of this vinyl goes into long-term uses such as pipe, vinyl siding, windows, wall coverings and flooring, the remaining 40 percent finds its way into the solid-waste stream in a shorter time frame. It is this vinyl the sortation method would begin to address.

Once sorted, processed and remanufactured, recycled products such as landscape timbers would have long-term durability and would not reappear in the waste stream for many years.

Rigid, post-consumer vinyl is expected to follow with the development of vinyl sortation and markets. As consumers become more recycling-aware and environmentally conscious, collection is expected to follow. An optimistic Gottesman said, "Consumers have already demonstrated that they are willing to include plastics in their recycling efforts." — *Paris Wolfe*

The author is an associate editor of Recycling Today.



The advantages of recycling vinyl are becoming clearer all the time.

Vinyl bottles are among the most popular plastic containers around. They are lightweight and glass-clear, with a number of desirable physical properties.

Vinyl bottles have another advantage, too. Like many, many other vinyl products used every day in countless applications, they are eminently recyclable. Which means once this container has finished its useful life, it can be transformed into another, equally useful item. And with the range of potential uses for recycled vinyl, many of those items will be long-term products that won't return to the waste stream for years to come.

Vinyl recycling already is underway; more projects are about to begin. To find out more, write The Vinyl Institute, 155 Route 46 West, Wayne Interchange Plaza II, Wayne, NJ 07470.



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