Polyethylene Recycling

Don Bailey
The Lerio Corporation, 1501 Telegraph Road, P O Box 2084, Mobile, AL 36652

The above topic could fill volumes This presentation is not that large, and the following may serve as an outline·

1) We have a problem that will not go away.
2) We have tried several ideas.
3) We have new ideas.
4) We have some ideas for results.

THE PROBLEM

By now, we all know about the problem. Polyethylene is a wonderful material. Many of its attributes make it useful. It is lightweight, durable, and low cost. Those attributes make it hard to get rid of, too.

It floats, making it stay on top of the water when it washes into streams, rivers, and oceans. Sea turtles eat it, birds get tangled in it, and man finds it repulsive in the environment.

And, it is low cost, which makes its collection and recycling less attractive. The majority of plastics that are going to the landfill are doing so because they cannot be recovered at a profit.

Polyethylene recycling bears about as much similarity to soda bottle recycling as aluminum can recycling does to scrap iron It is a different world.

In 1989, about 20 billion lb per year of plastics were estimated to be going into landfills. The EPA said that 25% or 5-billion lb of it should be recycled by 1992. To do so would require at least the following:

1) About 50 recycling facilities with 1-million lb per year capacities. There are only a few that size in the world.
2) About 500 6-inch pelletizing extruders.
3) Hundreds of millions of dollars for capital.

According to the proceedings of the University of Florida Plastics Recycling Fair (1990) if all the reclaimed resin could be converted into products, any one of the following could be done:

1) Converted into 15-lb fence posts, a fence could be zig-zagged across the United States every four miles from the Gulf of Mexico to Canada, every year.
2)A car stop could be made and assigned to every registered vehicle every year in the United States.
3)Each year 625,000 three bedroom homes could be built.
4)A continuous bench could be built down the median of every major interstate highway in the United States every year.

IDEAS WE HAVE TRIED

Post Consumer. Most of the major container manufacturers have tried pilot programs to use post-consumer polyethylene for producing nursery containers. The most successful material is reprocessed pellets from dairy bottles. Wellman, Eaglebrook, and others produce this type of material for resale (Resource Recy-

cling Update). The cost is a few cents more than prime virgin resin (Plastic News), and its main regular use is in multi-layer detergent bottles, which have a center layer of post-consumer resin for promotional reasons, or similar products.

Reprocessed dairy-bottle resin is also used for sheet-vacuum formed nursery pots (Plastic Recycling Update). The alternative material for that process would be virgin dairy-bottle resin. So, the reclaimed resin is competitive for that application. However, for most nursery container production, injection and blow molding, the economics of post-consumer polyethylene are such that the collection, cleaning, drying and reprocessing are more than the material is worth.

To contrast polyethylene with soda bottles consider the following.

Polyethylene	Soda Bottles
Moderate service life (bottles) to "long" service life (films)	Short service life (soda bottles)
Moderate degradation to near total degradation in service	Little degradation in service
Paper labels, glue, tape, present in scrap	Polymer labels, no glue
Dirty, "in weather" handling	Food package handling
No deposit support	Supported by deposit laws
Cost to reclaim about 35¢/lb	Cost to reclaim about 30¢/lb
Virgin resin 35¢/lb	Virgin resin 65¢/lb

Nursery Containers. Recycling nursery containers into nursery containers has been done. Costs of collecting, shipping, grinding, cleaning, and reprocessing with new polymer to maintain quality have made pilot samples very high. No major manufacturer believes recycling nursery containers can be done in quantity without a higher cost in the end product. New EPA standards and permit requirements for wash water will raise the cost even more

Who would pay the costs?

Greenhouse Films. Greenhouse film can be reclaimed and used in injection-molded nursery containers. However, most of the film is low density polyethylene, which is soft. Outdoor growing containers need to be stiff. Therefore, the film produces a less desirable product. A container made from 100% low density film would be as soft as a soft laundry basket. Therefore, only a small percentage in the container is practical.

In a recent pilot project test, a quantity of carefully collected greenhouse film was received in large rolls to test for nursery container production.

Some of the minor problems were the following:

- Tape
- Dirt, rocks
- Chemical residue
- Leaves, sticks, twigs

The major problem was ultraviolet light and oxidation degradation

What we would really would like to do in many cases is to get a maximum service life out of film and them recycle it. However, it may be so degraded that it has no value.

Evidently, most greenhouse film at the end of its service life today is either landfilled, burned, or buried.

Product Recycling no Solution. We need to recognize that recycling is good because it can give us two or more uses for the same raw material. We also need to recognize that product recycling will not reduce disposal in the long run.

If the producers of polymers pour 50 billion pounds of polymer into the huge general market funnel every year, then no matter how many times these polymers run around and around the lip of the funnel as recycled products, they will eventually exit the funnel to some form of disposal

SOME NEW IDEAS

Chemical Recycling. The prospect of chemical recycling is the most interesting development in recycling yet. Regardless of the method used, chemical recycling reduces polymer waste to basic chemical building blocks for reuse as polymers, fuels, or other chemicals

The raw materials are not lost when the polymer goes to disposal. Chemical *recycling plants will probably be huge, complex, high volume, and very expensive*; but the chemical industry is probably best able to deal with the technology and volumes involved.

The following processes are among those under way:

- *Selective dissolution.* Mixed polymers are dissolved and separated by polymer type, yielding high quality pure polymer (Lynch, 1989).
- *Refinery recycling.* One hundred barrel-per-day refining units produce hydrocarbon products from mixed plastic slurries (Leaversuch).
- *Cracking.* Refinery recycling uses catalytic cracking units like those used for crude oil
- *Prolysis* Polymer waste heated in the absence of oxygen yields oil or gas.
- *Depolymerization.* Chemical breakdown of the polymer chain yields monomers or building blocks for other polymers.
- *Electrokinetic.* An electric arc reduces polymers to industrial gases.

Alternative Fuel. Polyethylene is an excellent candidate as an alternative fuel. Carbon dioxide and water vapor, the combustion byproducts of polyethylene, are the same as those of candle wax. The only impurity would be chemical stabilizers, which are only present in parts per million.

Polyethylene burns very hot and has 18,000 to 19,000 BTUs/lb. No. 6 fuel oil (Bunker "C") has approximately 20,000 BTUs/lb. Natural gas is also a hydrocarbon that burns with carbon dioxide and water vapor as byproducts. It has 60,000 BTUs/lb. In some paper mills, polyethylene is being burned with wood bark to produce steam for electricity.

Soil Disposal In an effort to find an economical method of disposal, some people have made a small particle of highly densified polyethylene containing calcium carbonate for weight and are producing a micronugget shape to blend with soil mix The process is low cost, and additives may be included for water retention, pH adjustment, and fertilization. The calcium carbonate prevents floating

At the present, no tests have been made for soil problems with a polyethylene nugget component, but polyethylene is inert and degradation in the soil would be

very slow. Also, dirt, tape, glue, leaves, and twigs would not affect this disposal method.

SUGGESTIONS

Proactive. Be proactive, not reactive. Do not wait for the government to mandate disposal methods Establish a research and development budget. Get a consultant to review the situation in your area. Make a disposal plan.

Focus. Focus on one item as an association or local group. Identify one item and find solutions for disposal of that item (greenhouse film, for example).

Realism Plastics are often less costly than more traditional materials, even if the true disposal costs are included. Be realistic about those costs. There is a real cost to proper recycling and disposal It cannot and should not be ignored The problem will not go away by itself

POTENTIAL MARKETS FOR POST-CONSUMER & OTHER FILM

AAA Polymer, Inc
68 Freeman Street
Brooklyn, NY 11222
(718) 389-2498
Rich Kralstein, Manager
Broker
Film only HDPE, LDPE, mixed

Alpha Poly, Inc
1025 Line Street
Camden, NJ 08103
(609) 541-7659
FAX (609) 963-1380
Carl Corbin

Aureus Enterprises,Inc
2833 West Sixth Street
Wilmington, DE 19805
(302) 421-9883
FAX (302) 655-4791
Gilbert J Sloan
Jonathan L Sloan
Most plastics, film

Avanguard Industries
13301 Beaumont Highway
Building 13
Houston, TX 77049
(713) 458-6566
Jerry Clark, Marketing Manager
Processor/Reclaimer
Film LDPE

Bata Plastics
2204 Port Sheldon Road
Jennison, MI 49428
(616) 669-0330
Gus Unseld, Broker
Post-industrial film

Beresford Packaging, Inc
155 Myles Standish Blvd
Taunton, MA 02780
(508) 822-6872
Jill Beresford, Director
Processor/end user
HDPE grocery sack program

Browning Ferris Inudstires
600 Avenue C at Stewart Avenue
Westbury, NY 11590
(516) 222-1050
Robert Raylman, Hauler
Film, mixed plastics

CVM, Inc
60 Brunswick Avenue
Edison, NJ 08817
(201) 248-8080
Robert W Voigt
Broker/Processor
HDPE, mixed thermoplastics,
PET, PVC, film

Chambers Development Company, Inc
William Penn Plaza
2790 Mosside Boulevard, Suite 810
Monroeville, PA 15146
(412) 856-0373
Maxine Horner
Broker/Hauler/Processor
Most plastics, film

Coastal Plastics
Dartmouth, Nova Scotia
(902) 469-8681
Rachael Martin, General Manager
Processor/end user
LDPE grocery sacks

LITERATURE CITED

1990 Florida Plastics Recycling Fair c/o Charles L Beatty Rhines Hall, Rm 101, University of Florida, Gainesville, FL 32611.

Plastics News. October 28, 1991, Crain Communications, Inc 965 East Jefferson, Detroit, MI 48207.

Plastics Recycling Update. Resource Recycling,Inc P O Box 10540, Portland, OR 97210

Lynch, J. C. 1989 Separation of commingled plastics by selective dissolution New developments in plastic recycling Society of Plastic Engineers, Regional Technological Conference, October 30-31, 1989 Society of Plastic Engineers, 14 Fairfield Drive, Brookfield, CT 06804-0403

Leaversuch, R.D. Chemical recycling brings real versatility to solid waste management Modern Plastics New York McGraw-Hill

RESOURCE INDIVIDUALS

Speed, David AAA Recycling, Rt 1, Box 108, Wilmer, AL 36587.

Amidon, A Amidon Recycling Consulting Services P O Box 410, Hancock, NH 03449-0410, Phone (603) 525-4916