FACULTY OF NATURAL SCIENCES

Recycling Labeling

A tour of labeling used to indicate how to recycle and if a product is made of re-cycled materials

Rich Knight
Biodiversity & Conservation
Biology
UWC
knight.rich[at]gmail.com

UNIVERSITY of the WESTERN CAPE

A place of quality, a place to grow, from hope to action through knowledge

What’s in a label?

Recycling symbols can be further divided into two separate categories.

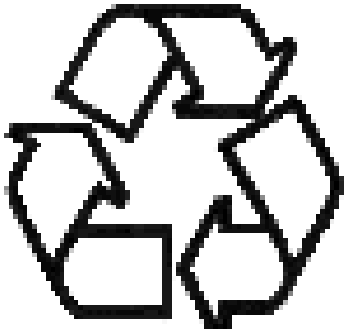
- 'Recyclable' symbols marking products made from specific materials that are suitable for recycling depending on whether there is a collection mechanism in place within the local community for those particular materials.

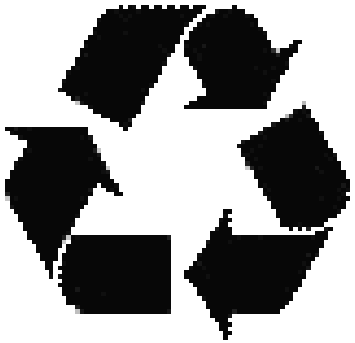
- 'Recycled' symbols designating products containing recycled materials.

Key milestones in labeling

- While specialized symbols for aluminum cans and steel cans are being utilized by individual manufacturers. There is a trend in the evolution of recycling symbols that can be summarized as follows:
- First, birth of the intended universal recycling symbol.
- Second, divergence of the original recycling symbol into a 'recycled' symbol and a 'recyclable' symbol, with variations of each.
- Third, proliferation of industry-specific recycling symbols of the 'recyclable' variety together with use of unique symbols by individual companies, and by other regions of the world.
- Lastly, additional symbols will continue to appear as new variations and categories of recycled and recyclable products are developed.

'Recyclable' symbols



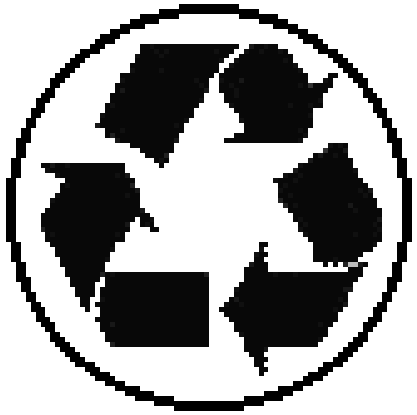


- The upper symbol in outline form is accepted as the traditional, or universal recycling symbol while the lower one was a modification.
- Paper products typically display the outline form, often with lettering such as- 'This product can be recycled' or 'Recyclable'.
- When identified with one of the symbols, products, containers or packaging materials are referred to as recyclable products, or products that are able to be recycled.
- A product marked with either symbol can be recycled if the regulations and/or ordnances of the local community provide for its collection.
- Although the symbols are used on products distributed nationwide, the laws governing collection of these products for the purpose of recycling are determined locally and vary widely from locality to locality.

'Recycled' symbols

- A product, which may be a container or package, marked with this symbol was manufactured with at least some materials that have been recycled. Generally, additional information is conveyed with the symbol such as- 'Printed on recycled paper'.
- When a percentage is indicated within the symbol, that percentage of the product has been made from recycled materials.

These last two symbols are 'recycled' symbols and are portrayed in a graphical style consistent with the original recycling symbol promulgated by the American Forest and Paper Association and its forerunners, including the American Paper Institute and the Container Corporation of America. These symbols are typically used on paper and paperboard products. On these products you will usually see the 'recycled' symbol with an explanation denoting the percentage of recycled content. However, even paper and paperboard products already made from recycled materials can be considered recyclable.



- A third 'recycled' symbol is also in use. This symbol differs from the first two by having solid black arrows within an outer black circle. The outer black circle denotes that at least some content came from recycled material. This symbol is also seen with arrows of a particluar color.

'Recycled' symbol for paperboard

CARTON MADE WITH

MINIMUM 25% POST
CONSUMER CONTENT

- In recent years a new 'recycled' symbol specific to the use of recycled paperboard has been developed.
- The graphical portion is a registered trademark and is controlled by the 100% Recycled Paperboard Alliance, an association of paperboard manufacturers.
- Displayed on folding cartons or paperboard containers such as cereal boxes.

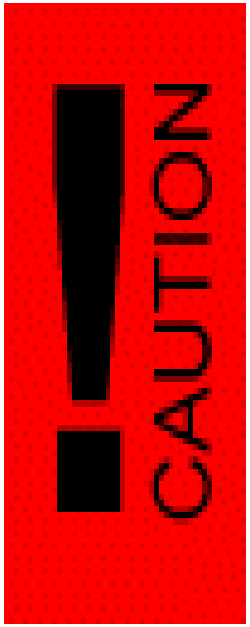
'Recyclable' symbol for glass

- The Glass Packaging Institute (GPI) has also developed a 'recyclable' symbol for use on glass packaging that can be recycled.
- Although most glass containers can be considered recyclable, the symbol nevertheless encourages the systematic identifying, and reusing, of recyclable materials.

Corrugated Packaging

- Corrugated Packaging Council (CPC) has developed a 'recyclable' symbol for use on corrugated packaging that can be recycled. The symbol may be used without specific permission on all corrugated products that are readily recyclable.
- Corrugated product coated with a material that is not repulpable (not convertible to pulp), then it is not readily recyclable.
- A wax or asphalt coating, for example, prevents it being recyclable.
- The symbol is merely a general statement that the corrugated product on which it appears can be recycled.
- It is not meant to imply that any content was already recycled or a product of recycling.
- The CPC is a non-profit organization that develops and coordinates industry-wide programs to address corrugated packaging issues. It is sponsored by the Association of Independent Corrugated Converters (AICC), and the Fibre Box Association (FBA).

‘Recyclable' symbols for plastic bottles, containers and packaging



- PETE
- HDPE
- PVC
- LDPE
- PP
- PS
- Other
- R- resins: ALREADY RECYCLED
- Symbols without Acronyms

Recyclable' symbols for plastic bottles, containers and packaging

- Plastic bottles, containers and packaging typically have a symbol that indicates the type of plastic resin from which the item was made. The resin coding system was introduced in 1988 by the **Society of the Plastics Industry** (SPI).
- The symbols imprinted on plastic bottles, containers and packaging are a variation of the original three wide mobius arrows. They have been modified to a simpler and thinner version.

.

(NOTE: C_6H_5 in the molecular formula comprises a benzene ring. Benzene is generally considered a carcinogenic substance.)

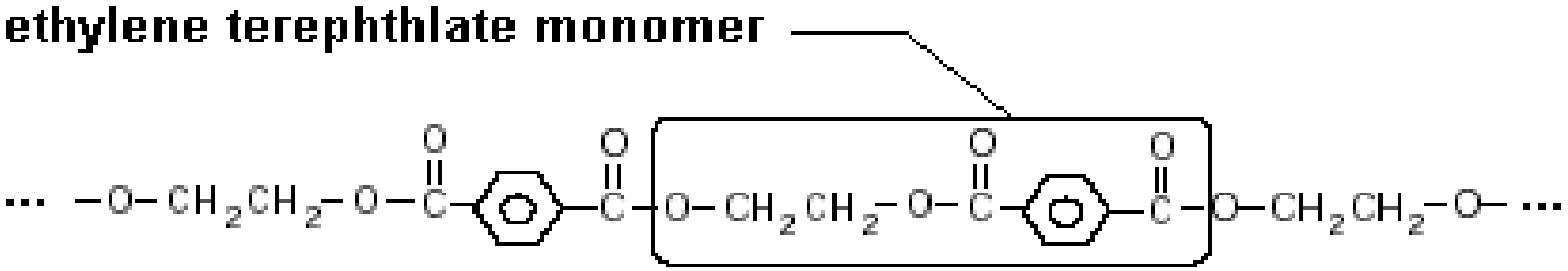
Recyclable' symbols for plastic bottles, containers and packaging

- SPI has promulgated a guide for the correct usage of the symbols. On a bottle, the symbol can usually be found on the bottom, moulded into the plastic itself as a raised impression and thus not always easily seen.
- The symbol includes a number within the mobius arrows, and usually, but not always, the chemical resin below the mobius arrows in acronym form. Although presence of the symbol implies that the plastic item is recyclable, the symbol is actually only intended to identify the plastic resin from which the item was made. Recyclability is ultimately determined by the local governing ordnances concerning what materials are collected for recycling.

Polyethylene Terephthalate (PETE or PET, and PETG)

MOLECULAR FORMULA:

$(\text{-CO-C}_6\text{H}_4\text{-CO-O-CH}_2\text{-CH}_2\text{-O-})_n$



Polyethylene Terephthalate (PETE or PET, and PETG)

PETE is an acronym that is used specifically by manufacturers to mark and identify plastic bottles or containers made from polyethylene terephthlate for the purpose of recycling.

The acronym PET is more generally utilized within the chemical industry to designate the plastic material polyethylene terephthalate, which can also be written as poly (ethylene terephthalate).

PET is the acronym accepted by standards organizations including American Society for Testing and Materials International, (ASTM International- formerly just ASTM), and the International Organization for Standardization (ISO).

PETE is used in reference to a recyclable container made from PET PET refers directly to the plastic material polyethylene terephthlate

Polyethvlene Terephthalate (PETE or PET, and PETG)

Properties: toughness, strength, heat resistance, barrier to moisture and gas. Density: 1.35-1.38 g/cc

Statistic: In 1999 PET accounted for 48% of plastic bottle resin sales, making it the most widely used resin in plastic bottles.

Description: PET, also referred to as polyester, is a popular packaging material for food and non-food products because it is inexpensive, lightweight, resealable, shatter-resistant and recyclable. PET is clear and has good moisture and gas barrier properties. Its color may be green. The flakes and pellets of cleaned postconsumer recycled PET are in heavy demand for use in spinning carpet yarns and for producing fiberfill and geotextiles.

Polyethylene Terephthalate (PETE or PET, and PETG)

Packaging applications: Soft drink bottles, water bottles, beer bottles, mouthwash bottles, peanut butter containers, salad dressing containers, juice bottles, vegetable oil bottles

Recycled products: Fiber, tote bags, new PETE containers for both food and non-food products, fabric for clothing, athletic shoes, luggage, upholstery, furniture, carpet, fiberfill for sleeping bags and winter coats, industrial strapping, sheet, and film, and automotive parts, such as luggage racks, headliners, fuse boxes, bumpers, grilles and door panels

More information: National Association for PET Container Resources (NAPCOR)

Polyethylene Terephthalate (PETE or PET, and PETG)

Although the acronym PETE was adopted by manufacturers to identify packaging made from PET, primarily in resposnse to a potential trademark dispute, a recycling symbol that includes the designation PET rather than PETE has been identified on packages of products imported from outside of the US.

Polyethylene Terephthalate (PETE or PET, and PETG)

PETG is the acronym for polyethylene terephthalate glycol, a co-polymer of PETE.

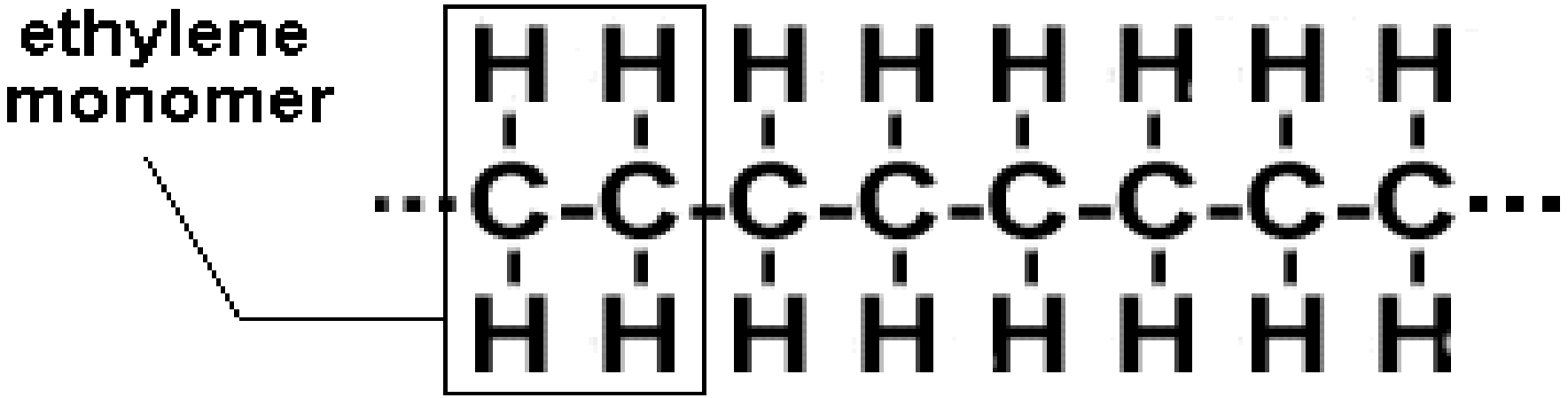
PETG has excellent clarity and is commonly used for containers of products such as shampoos, detergents, soaps, oils and pharmaceutical items.

It is a clear amorphous plastic with good resistance to impact.

High Density Polyethylene (HDPE)

MOLECULAR FORMULA:

$(-CH_2-CH_2-)_n$



The C=C double bond in an ethylene monomer is transformed into a C-C single bond in the polymer.

High Density Polyethylene (HDPE)

Properties: toughness, strength, stiffness, ease of forming, ease of processing, resistance to moisture and chemicals, permeability to gas. Density: 0.94-0.96 g/cc

Statistic: In 1999 HDPE accounted for 47% of plastic bottle resin sales, making it the second most widely used resin in plastic bottles. HDPE and PETE together accounted for 95% of plastic bottle resin usage.

High Density Polyethylene (HDPE)

Description: Bottles made from HDPE come in both pigmented and unpigmented resins.

The unpigmented resin is translucent. It also has good stiffness and barrier properties. Thus, it is ideal for packaging products having a short shelf-life such as milk.

HDPE's good chemical resistance allows it to be used in containers holding household or industrial chemicals. The pigmented resin has even better crack resistance and chemical resistance than the unpigmented resin.

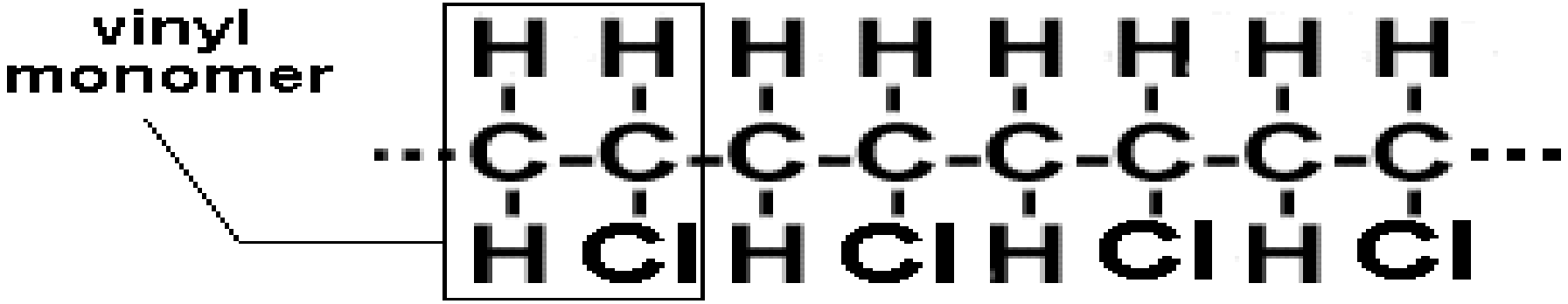
High Density Polyethylene (HDPE)

Packaging applications: Milk containers, juice bottles, water bottles, bleach, detergent, and shampoo bottles, trash bags, grocery and retail carrying bags, motor oil bottles, butter and margarine tubs, household cleaner bottles, yogurt containers, and cereal box liners

Recycled products: Drainage pipe, liquid laundry detergent bottles, oil bottles, pens, benches, doghouses, recycling containers, floor tile, picnic tables, fencing, lumber, and mailbox posts.

Polyvinyl Chloride (PVC, sometimes V)

MOLECULAR FORMULA: $(-CH_2-CHCl-)_n$



The C=C double bond in each monomer is transformed into a C-C single bond in the polymer.

The V in the first (and original) symbol actually stands for vinyl, however, the plastic resin is usually referred to as polyvinyl chloride (PVC) and therefoere the symbol has evolved to the resin designation of PVC.

Polyvinyl Chloride (PVC, sometimes V)

Properties: toughness, strength, ease of blending, ease of processing, resistance to grease, oil, and chemicals, clarity. Density: 1.32-1.42 g/cc

Statistic: In 1999 PVC accounted for 2% of plastic bottle resin sales.

Description: Vinyl, or polyvinylchloride, has stable electrical and physical properties. It has excellent chemical resistance and good weatherability. Its flow characteristics make it well-suited for injection molding.

Polyvinyl Chloride (PVC, sometimes V)

Packaging applications: Window cleaner bottles, cooking oil bottles, detergent bottles, shampoo bottles, clear food packaging, wire and cable jacketing, medical tubing, with additional significant usage in household products and building materials, particularly siding, piping, and windows

Recycled products: Binders, decking, paneling, mudflaps, roadway gutters, flooring, cables, speed bumps, and mats

Polyvinyl Chloride (PVC, sometimes V)

More information: The Vinyl Institute, Vinyl products

NOTE: The Cl (chlorine atom) in the molecular formula renders PVC a potentially toxic material when it is burned. The burning of PVC can result in the creation of dioxins, a material that is considered highly carcinogenic.

Low Density Polyethylene (LDPE)

MOLECULAR FORMULA: $(- CH_2 - CH_2 -)_n$

Properties: toughness, strength, flexibility, ease of sealing, ease of processing, barrier to moisture. Density: 0.91-0.93 g/cc

Statistic: In 1999 LDPE accounted for just 1% of plastic bottle resin sales.

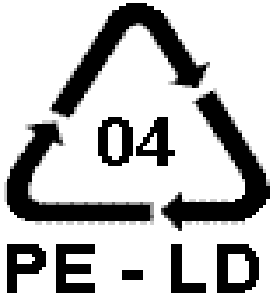
Low Density Polyethylene (LDPE)

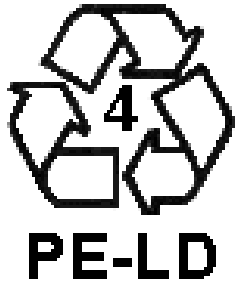
Description: Because of its toughness , flexibility, and transparency, LDPE is commonly used in applications where heat sealing is necessary. It is also widely used in wire and cable insulation and jacketing.

Packaging applications: Squeezable bottles, breadbags, frozen food bags, tote bags, clothing, furniture, dry cleaning bags, and carpet

Recycled products: Film and sheet, loor tile, garbage can liners, shipping envelopes, furniture, compost bins, paneling, trash cans, lumber, landscaping ties

Low Density Polyethylene (LDPE)





Plastic bag manufacturers have adopted somewhat different symbol identifications for LDPE bags as shown at the left.

(NOTE: The molecular formulas for LDPE and HDPE are the same. The difference in the plastics is the density of the molecular chains. The density varies in the manner in which the polymeric chains form. In HDPE the chain is essentially one long continuous chain, allowing the strands to fold back upon one another and densely occupy space. In LDPE the chains have multiple branches, which interfere with a neatly organized packing of chains. Instead the packing is more disorganized, occupying more space and thus resulting in a lower density.)

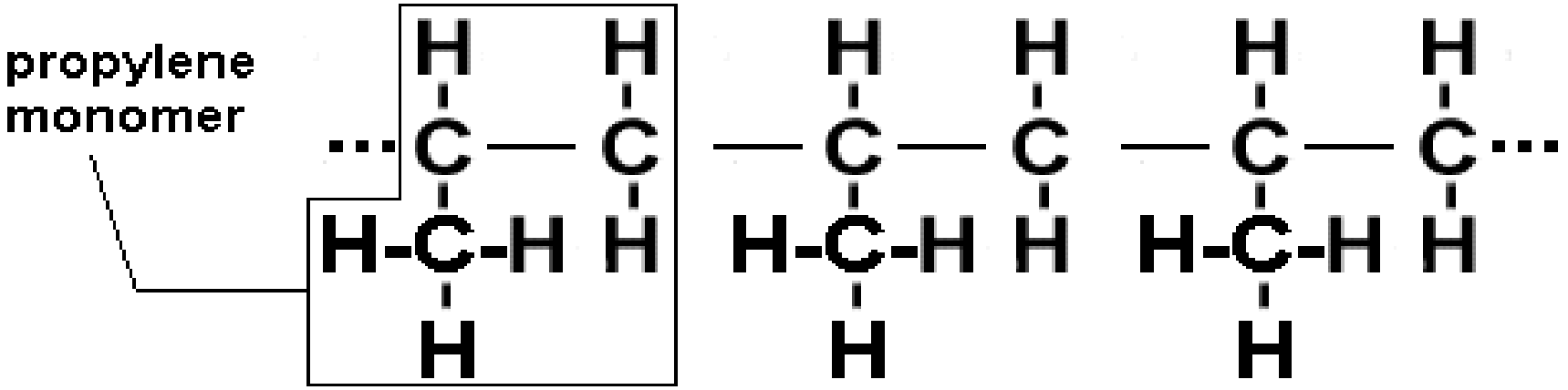
Low Density Polyethylene (LDPE)

- Plastic bag manufacturers are also making their products using low low density polyethylene, a symbol for which appears to the left.
- Low low density polyethylene has a molecular density even less than low density polyethylene.

Polypropylene (PP)

MOLECULAR FORMULA:

$(\text{-CHCH}_3\text{-CH}_2\text{-})_n$



The C=C double bond in each monomer is transformed into a C-C single bond in the polymer.

Polypropylene (PP)

Properties: toughness, strength, resistance to heat, grease, oil, and chemicals, barrier to moisture. Density: 0.90-0.92 g/cc

Statistic: In 1999 PP accounted for 2% of plastic bottle resin sales.

Polypropylene (PP)

Description: Polypropylene has the lowest density of the resins used in packaging. It is strong and is resistant to chemicals. Since it has a high melting-point it can be utilized in applications requiring that a container be filled with a hot liquid.

Packaging applications: Yogurt containers, syrup bottles, ketchup bottles, caps, straws, medicine bottles

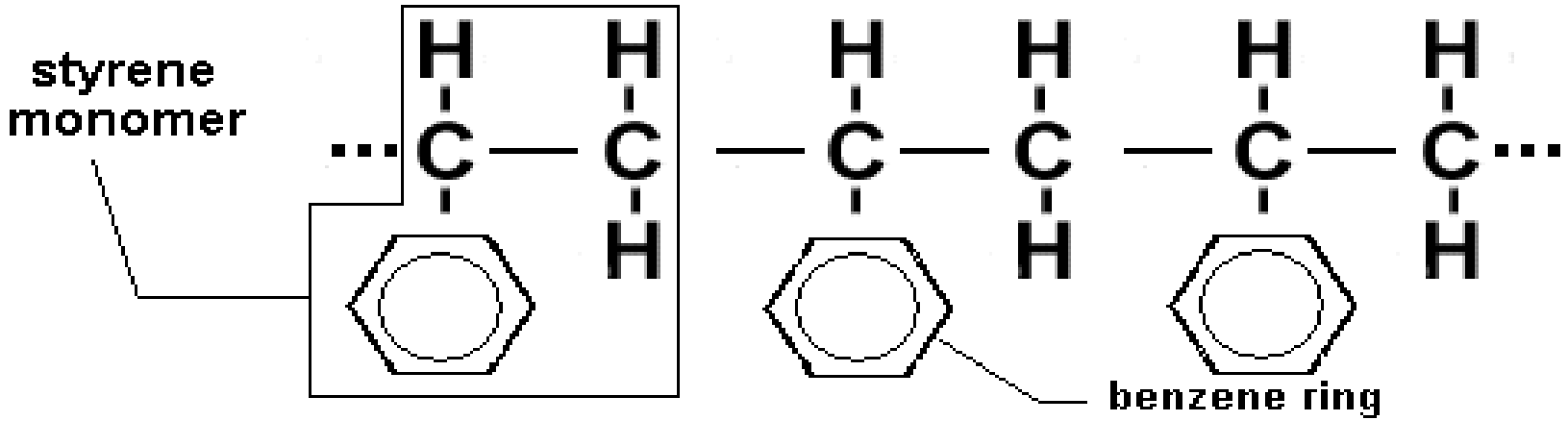
Recycled products: Signal lights, battery cables, brooms, brushes, auto battery cases, ice scrapers, landscape borders, bicycle racks, rakes, bins, pallets, and trays

Polypropylene (PP)

An alternative recycling symbol for polypropylene utilizing the original design for the mobius arrows, but inverted, is shown to the left.

Polystyrene (PS)

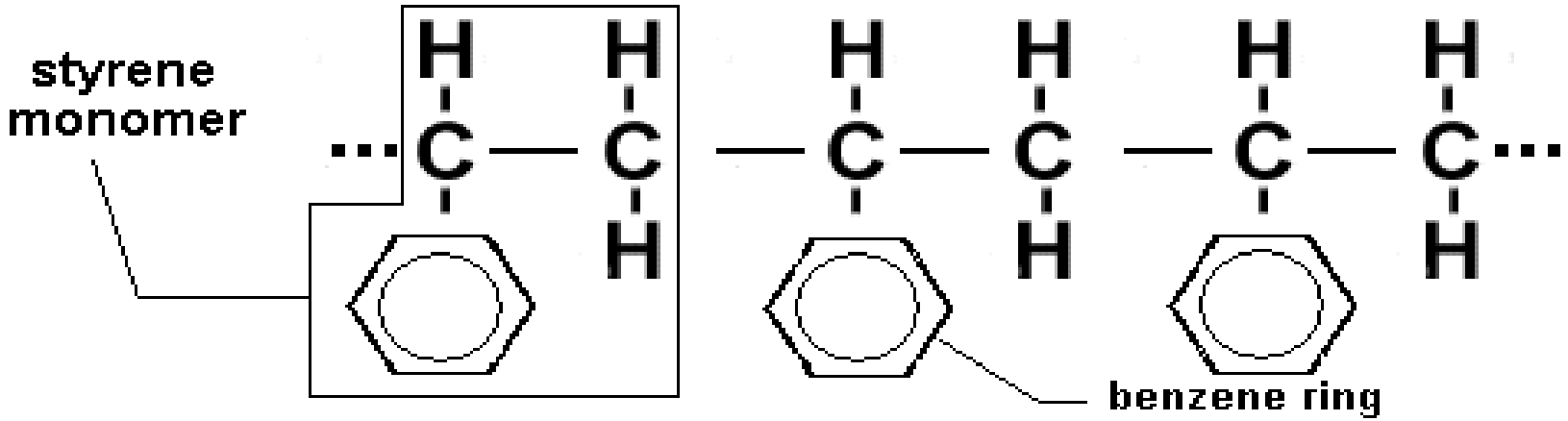
MOLECULAR FORMULA: $(-CHC_6H_5-CH_2-)_n$



The C=C double bond in each monomer is transformed into a C-C single bond in the polymer.

Polystyrene (PS)

MOLECULAR FORMULA: $(-CHC_6H_5-CH_2-)_n$



The C=C double bond in each monomer is transformed into a C-C single bond in the polymer.

Polystyrene (PS)

Properties: ease of forming, clarity, low heat transfer, good thermal insulation. Density: 1.03-1.06 g/cc

Statistic: In 1999 PS usage as a plastic bottle resin was essentially nil.

Polystyrene (PS)

Description: Polystyrene can be made into rigid or foamed products. It has a relatively low melting point.

Packaging applications: Plates, cups, cutlery, meat trays, egg cartons, carry-out containers, aspirin bottles, compact disc jackets

Recycled products: Thermal insulation, light switch plates, egg cartons, vents, rulers, foam packing, carry-out containers

More information: Polystyrene Packaging Council (PSPC), Alliance of Foam Packaging Recyclers (AFPR)

Other Plastics

Description: The category of "Other" includes any resin not specifically numbered 1, 2, 3, 4, 5, or 6, or combinations of one or more of these resins.

Packaging applications: The large water bottles, certain food product bottles
Recycled products: Plastic lumber, custom-made products

Resin Symbols without Acronyms

You may come across recycling symbols that only indicate a number without an acronym for the plastic resin. The plastic resin of containers or packing labelled in this manner can be identified by this number and although not as informative compared to an acronym listed below the symbol, it is certainly a workable means of identifying and classifying recyclable plastics.

An alternative recycling symbol for plastic resins may be encountered embodying the original mobius three-chasing arrows together with a number in the centre. These symbols may appear with or without a descriptive acronym.

R-resins: ALREADY RECYCLED

You may ask, all those plastic bottles that are recycled, or those newspapers, what happens to them?

Generally, a product that is recycled is remanufactured into a new product that has less demanding specifications for the new use of the recycled product.

In the case of paper products, the white copy paper may end up as newsprint. Newsprint may end up as toilet paper.

Plastic materials may be recycled into a packaging material of less stringent requirements.

R-resins: ALREADY RECYCLED

Thus, resins that have become a recycled product, are further identified with an R in front of the previous designation in order to denote that the material has already been recycled.

The symbols identifying these products are shown above. As an example, RHDPE is the acronym interpreted as recycled high density polyethylene.

R-materials still have potential for further recycling.

Acrylonitrile Butadiene Styrene (ABS)

Properties: resilient, low density, rigid, impervious
Description: Acrylonitrile butadiene styrene was not part of the original resin identification system.
Applications: Pipes, car bumpers, toy building blocks, golf club heads, enclosures

(NOTE: The three components of ABS, acrylonitrile, butadiene and styrene are considered probable human carcinogens.)

Origin of the recycling symbol

The recycling symbol represents a Mobius loop consisting of three-chasing-arrows in the shape of a triangle having rounded vertices.

Each arrow twists and turns itself, and all three arrows chase each other. It is a consummate representation of recycling.

The mobius loop itself was discovered in 1858 by August Ferdinand Möbius (1790-1868), a German mathematician and astronomer, and has been a mathematical marvel of simplicity, singularity, and continuity ever since.

Origin of the recycling symbol

- The original recycling symbol was designed in 1970 by Gary Anderson, a senior at the University of Southern California at Los Angeles. It was submitted to the International Design Conference as part of a nationwide contest for high school and college students sponsored by the Container Corporation of America. The contest was a result of continuing growth of consumer awareness and environmentalism and a response to the first Earth Day

Meaning of the recycling symbol

Each of the three arrows can represent one step in a three-step process that forms a closed loop, the recycling loop. The first step represents collection of materials to be recycled.

This step takes place when recyclable materials are placed into your curbside recycling bin or taken to a local collection center. The collected materials are then cleaned and sorted for sale to a manufacturing facility. The manufacturing process is the second arrow in the recycling symbol.

The recyclable materials are manufactured into new products for retail or commercial sale. The third step is the actual purchase and use of the products made from the recycled materials. The loop is now complete.

Three R's- Reduce, Reuse and Recycle

The 'Green Dot' (Der Grüne Punkt)

The green dot (in German- der grüne punkt) was orignally developed by Duales System Deutschland AG, a privately owned non-profit German company, in 1991.

It has since been adopted by other countries of the European Union including Austria, Belgium, France, Germany, Ireland, Luxembourg, Portugal, Spain and Sweden.

It has also been adopted in the non-EU countries Latvia, Norway, the Czech Republic, Hungary and Poland.