

PLASTIC

MATERIAL + DEGRADATION

world 2015

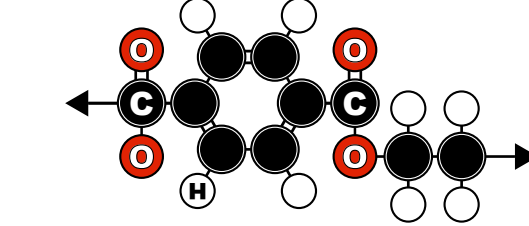
Water Bottles

gear, bearing, seat belt, truck tarpaulin, electronic part

5 / **10** Y

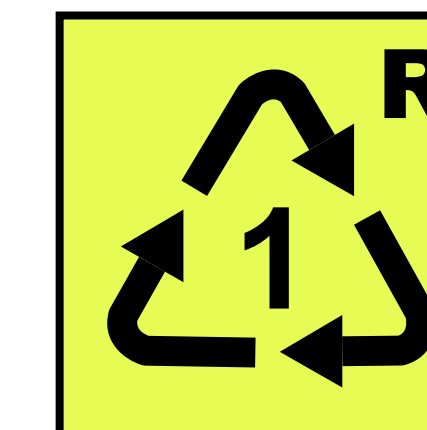
[]ⁿ

C₁₀ H₈ O₄



Polyethylene Terephthalate

PET /E

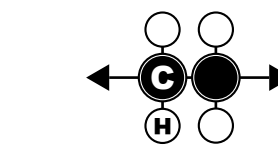


Shampoo Bottles

milk bottles, grocery bags, milk jugs, recycling bins, playground equipment

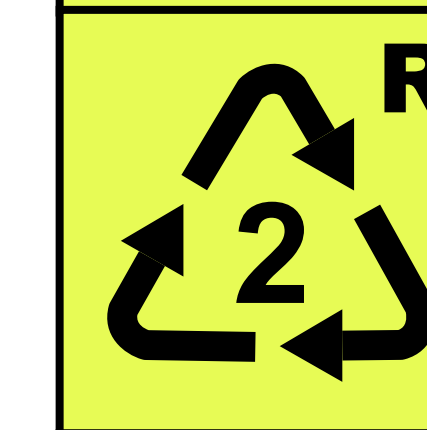
100 Y

C₂ H₄



Polyethylene High density

HD **PE**

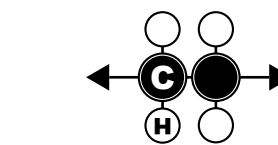


plastic Bags

laboratory equipment, six pack rings

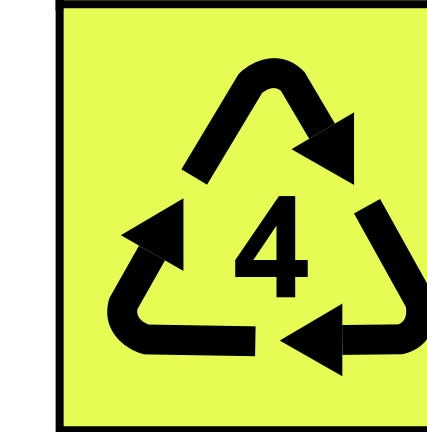
500 / **1.000** Y
photo degradation - with UV-light!

C₂ H₄



Polyethylene Low density

LD **PE**



TYPE	USAGE	
	production, world 2015, mio t	
1 PET	33	8.1 %
2 HD-PE	52	12.8 %
4 LD-PE	64	15.7 %
3 PVC	38	9.3 %
5 PP	68	16.7 %
6 PS	25	6.1 %
PA PP&A fibers	59	14.5 %
PU PUR	27	6.6 %
others	16	3.9 %
additives	25	6.1 %
407		100 %

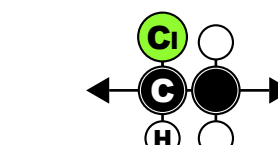
Pipes, Windows, Toys

floor covering, hose

NO Y

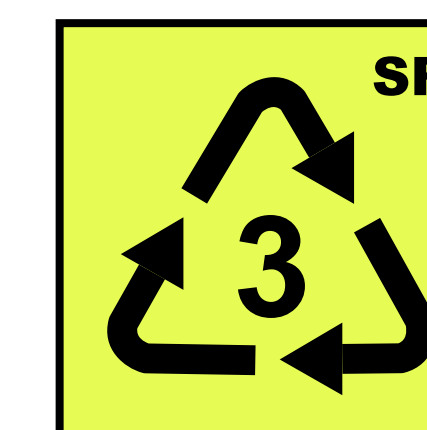
if -> gives off toxic materials, resistance to acid, base, fat, alcohol, oil

C₂ H₃ Cl



Polyvinyl Chloride

PVC



One-way Packaging

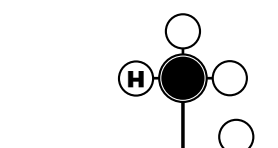
garden furniture, suitcases, clothing, caps and closures, fishing rope

NO Y

resistant to photodegradation

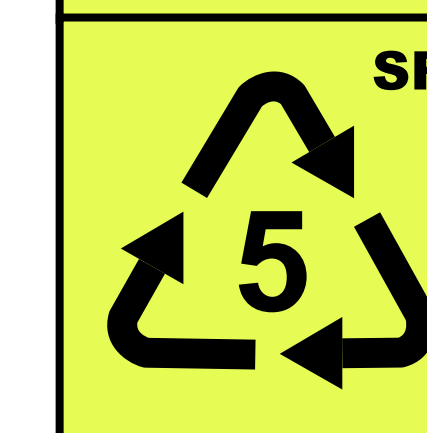
hinges, cases, automotive industry [spoiler, housings, seat covers], medical devices,

C₃ H₆



Polypropylene

PP

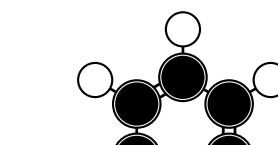


P+C

NO Y

resistant to photodegradation, doesn't react with acidic or basic solutions

C₈ H₈



Polystyrene

PS



Packaging - Styrofoam

boards, pellets, food container

Construction - Styrodur

Insulation Panels

Expanded

with: hydrocarbons eg. pentane C₅H₁₂ - flammability hazard

E **PS**

Extruded

with: hydrofluorocarbons CH₂ F C F₃ - GWP: 1400 x CO₂

X **PS**

SECTOR	USAGE	
	production, world 2015, mio t	
Packaging	146	35.9 %
Building/Construction	65	16.0 %
Textiles	59	14.5 %
Other	47	11.4 %
Consumer and instit. prod.	42	10.3 %
Transportation	27	6.6 %
Electrical/Electronic	18	4.4 %
Industrial machinery	3	0.7 %
407		100 %

SECTOR	WASTE	
	disposal, world 2015, mio t	
Packaging	141	46.7 %
Building/Construction	13	4.3 %
Textiles	42	13.9 %
Other	38	12.6 %
Consumer and instit. prod.	37	12.3 %
Transportation	17	5.6 %
Electrical/Electronic	13	4.3 %
Industrial machinery	1	0.3 %
302		100%

Socks - Nylon

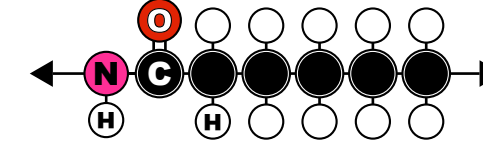
parachute, Kevlar, toothbrush bristles, ropes, clothing, adhesives

strings [instrument + tennis], machine parts [gears, bearings], electronics,

NO Y

sensitive to degradation by acids

eg. Nylon 6
C₁₈ H₃₅ N₃ O₃

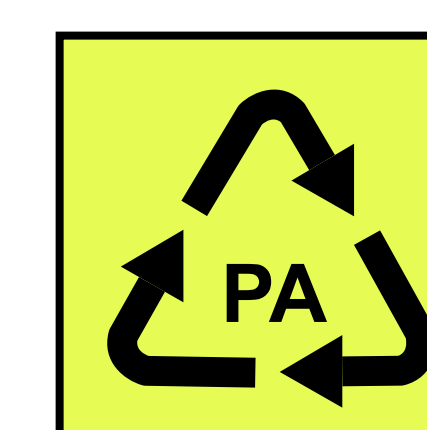


Polyamide

Polyphthalamide eg.

PA

PPA



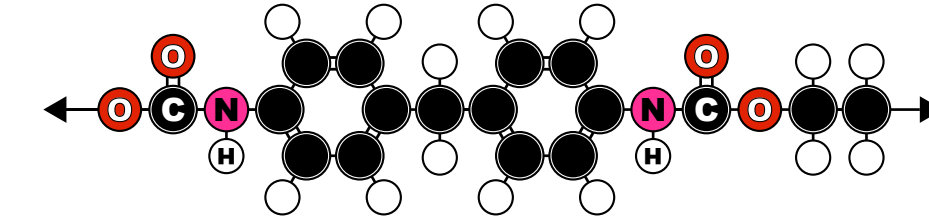
Foam

spray polyurethane foams (SPF), building panels, sponge, mattress, shoe soles,

soccer ball, bushings for skateboards, adhesives, primer, cosmetics, car seats + dashboards

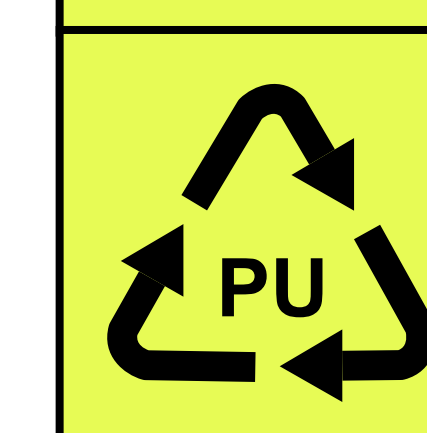
NO Y

eg. MDI 4,4 + Polyol
C₁₅ H₁₀ N₂ O₂ + C₂ H₆ O₂



Polyurethane

PU



MATERIAL	YEARS	
	degradation, years / months	
glas Bottle		+1.000.000 Y
aluminum Cans		200 / 250 Y
Batteries		100 Y
rubber Boot Sole		50/80 Y
Tin Cans		50 Y
Nylon Fabric		30/40 Y
Leather shoes		25/40 Y
Lumber		10/15 Y
Plywood		1/3 Y
Wool Clothing		1/5 Y
Cotton		1/5 M
Cardboard		2 M

data source [g01]
R. Geyer, J. R. Jambeck, K. Lavender Law, et. al; Science Advances, 2017
Production, use, and fate of all plastics ever made; table S5, fig. 1, fig. 3; table S6, fig. 2, fig. 4
[PAPER] https://advances.sciencemag.org/content/3/7/1730/362tab-figures-data
data sources [g02 - g04] see: http://www.terracirculab.com/index.php?d=plastic