
PLASTIC -
THE BENEFITS
ARE CLEAR
WarwickSASCo
Moulding The Future of Medical Plastics

What is plastic?

Plastic, by dictionary definition, is simply a material that can be moulded and reshaped. In industrial terms it is synthetic or semi-synthetic compounds. The building blocks of plastic– monomers – are naturally occurring and can come from plants, natural gas or oil bi-products. Plastic uses monomers to create long chains or polymers.

Some of the first plastics such as cellophane were created using plant related cellulose. The synthetic polymers that characterise modern plastic are derived from petroleum compounds.

The invention of plastic helped the environment

In the 19th century, billiard balls were made of ivory. A substitute was urgently needed and in 1869, John Wesley Hyatt created an artificial ivory coating from cellulose.

He later trademarked the material 'celluloid'. It prevented the demise of the elephant, helped to protect Hawksbill turtles from being slaughtered for tortoiseshell and provided a substitute for coral – in fact, plastic was hailed as a saviour of the environment. Today, the use of plastic packaging over paper has reduced deforestation dramatically.

1838

Cellulose discovered by French chemist Anselme Paven isolated from plant matter.

1855

The first artificial cellulose is discovered by Alexander Parkes. He later patents it as Parkesine and unveils it at an exhibition in London. The age of industrial plastics has begun.

1869

John Wesley Hyatt and his brother produce an artificial coating for billiard balls. In 1870, it goes into mass production where it can be coloured and moulded. It's trademarked 'celluloid'.

1872

PVC is first synthesised by German chemist, Eugen Baumann.

Plastic made modern medicine possible.

Plastic is complex, but it helps to save lives

Despite the many myths surrounding this versatile material, the evolution of plastic has transformed our lives and enabled vast improvements in food safety, transport and storage.

In our field of medical and healthcare products, plastic has revolutionised the sterile environment in hospitals and operating theatres. Health crises such as the 2014 Ebola outbreak and the 2020 Covid-19 pandemic have shown how vital plastic products are in controlling infection in emergency situations. But in simpler everyday ways, the use of plastic helps to save millions of lives worldwide each year.

Warwick SASCo has been a pioneer in medical plastic manufacturing for over 40 years. We're asked a lot of questions about our use of plastics and we've spent years weighing up the advantages and downsides of many forms of plastic – and the alternatives – in terms of sterility, suitability and sustainability.

Understanding the use of plastic as a material is complex but it is essential in today's healthcare industry. We believe that by responsibly disposing, reusing and recycling plastic, it can play an important part in helping to protect the environment rather than damage it. The information in this document should make that a little clearer.

1891

The Count of Chardonnet developed Rayon as a substitue for silk.

1907

Bakelite invented by Leo Baekeland searching for a replacement for shellac. The first fully synthetic plastic. Bakelite was an ideal electrical insulator. A timely discovery for a rapidly growing electrification in the US and the world.

1912

A Swiss chemist seeking to create a waterproof tablecloth invents cellophane. Transparent and hygienic, cellophane goes on to revolutionise the food industry.

1926

Harrods sells first plastic tableware.

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Could plastic be the solution, not the problem?

The use of plastic in our daily lives is an emotive issue. We see pictures of beaches strewn with plastic bottles and litter and we're told that our oceans are awash with it. We're encouraged to use paper or re-usable cotton bags because they are greener than the standard High Density Polyethylene (HDPE) carrier bag.

We're told that plastic takes decades to degrade and that replacing it with paper, metal, glass or cardboard is better for our health and for the environment. We're told that plastic is the enemy.

But what is the truth?

There are dozens of myths surrounding plastic and numerous studies into our use of it. Interestingly, many of those studies have shown that plastic isn't the problem – but it could be the solution.

Plastic – the myths

Alternative materials are better for the environment.

Producing a polyethylene terephthalate (PET) drinks bottle uses 50% less energy than an aluminium can or a glass bottle. Producing a plastic bag uses 70% less energy and 96% less water than a paper bag and creates less air pollution. And by re-using plastic, we can reduce its environmental impact still further.

1930s

The industrial age of plastic begins.

1930

Scotch Tape introduced by 3M.

1933

ICI develops polythene widely used in medical equipment, medicine and food processing.

1937

First production of polystyrene by IG Farben in Germany.

Plastic can't be recycled

Every plastic is fully recyclable. PET can be mechanically recycled 12 times and then chemically processed (dissolved and reformed to make new PET). Polypropylene (PP) is also easily recyclable.

Plastic doesn't degrade

In 2019, a study examined three types of carrier bag – biodegradable, oxo-biodegradable and HDPE plastic – and showed that all materials had disintegrated into dust after nine months. Thin, single-use plastic takes around the same amount of time to decompose as a leaf.

And at the end of its life, like many other products, most plastic can be safely incinerated, producing only carbon dioxide and water as by-products.

Plastic isn't the issue. The problem is how we dispose of it.

1948

George de Mestral invents Velcro patented in 1955.

1946

Silicone is first used as a material implanted in the human body by surgeon Dr Frank Lahey undertaking bile duct repair. It is used today for orthopaedic joint implants, pacemakers and neurostimulators.

1948

Introduction of 12" long playing records made from polyvinyl chloride PVC.

1949

The first intraocular lens made from acrylic or polymethyl methacrylate (PMMA) is used in cataract surgery by Harold Ridley. PMMA remains inert in the eye.

Plastic is bad for us

Low Density Polyethylene (LDPE), PET and PP are inert and food contact safe. Thanks to plastic, we can eat food from all over the world knowing that it's protected against microbiological contamination. Plastic packaging protects. It separates foods and extends shelf life. It is a light material reducing transportation weights helping save fuel and reduce emissions.

Plastic causes litter

Plastic litter, just like any other kind of garbage, is caused by people and not the material itself. We need to take responsibility for disposing of our litter sensibly, re-using it and recycling whenever we can.

Plastic increases waste

It doesn't. If you replace plastic with alternative materials you simply get other kinds of waste – and in fact, 1kilo of waste plastic replaces 3-4 kilos of other material waste. Because plastic has replaced wood, paper and cardboard in many applications, the overall amount of waste has actually reduced since the 1990s.

If we replaced all plastic packaging, it would lead to 55 million tons more waste each year in the US alone.

Our oceans are full of plastic waste

While it's often said that eight million pieces of plastic find their way into our oceans every day, studies have shown that plastic waste in the open sea amounts to 20-50g per km^2. To put that into perspective, it's a piece of plastic the size of a lego brick in a volume of water the size of an Olympic swimming pool.

1949

Launch in US of Tupperware made from low density polyethylene.

1949

Lycra based on polyurethane invented by Dupont. The first 'elastic plastic' that leads to many medical applications such as flexible bandages, dressings and orthotics.

1950s

A post-war age of consumerism where many products are manufactured using plastic.

The polyethylene bag makes its first appearance.

1955

The world's first plastic disposable syringe developed by Roehr Products, replaces re-usable glass syringes.

Plastic in medicine – sterile, sustainable and suitable

- Polyethylene, the same plastic that makes the humble carrier bag, is used in the manufacture of replacement joints like the knee or hip. Its flexibility and low rate of wear means that an implant can last for 30 years or more.
- Acrylic plastic is used to make the intraocular lenses used in cataract surgery. It's more transparent than glass, and less brittle. It's also well tolerated by the body.
- Silicone material is frequently used to manufacture artificial tubing to replace the body's internal pipework. It's flexible, biologically inert and and is compatible with bodily fluids without side effects.
- Carbon fibre reinforced plastic is a composite that's layered to make prosthetics. The combination of extreme strength and lightness ensures high performance for athletes and everyday disability.

Warwick SASCo products in healthcare services.

1957

First production of polypropylene by Italian company Montecatini for industrial use.

1958

Polycarbonate launched, used in laboratories, protective wear and screen displays as an alternative to glass.

1958

Lego patents its colourful children's blocks.

1959

The Petri dish, named after its inventor, German bacteriologist Julius Richard Petri, is manufactured from clear polystyrene plastic that is still used today.

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The medical case for plastic

How plastic revolutionised healthcare

Many materials have helped the progress of science and medicine. Metal, glass and ceramics have helped us develop advanced treatments, medical and laboratory apparatus and new prosthetics.

However, no material has accelerated healthcare in the way plastic has. The properties of various forms of plastic have made this material central to everyday healthcare and the continued advances in medical science and technology.
In many ways plastic has made modern medicine possible.

Flexibility and design

Plastic has the ability to be formed into infinite shapes and stay flexible and strong. Its unique diversity of properties is evident in the wide range of uses from visors, tubing to IV bags to X-ray film. Metal and glass can be shaped but they don't bend or retain their shape like plastic. The pliant, elastic nature of plastic materials means it offers a quieter working environment in hospitals and care environments.

Durability

Plastic is tough and resistant to damage, damp and other environmental factors. Using modern production processes, plastics have been developed that resist corrosion as well as breakage. Plastic has helped to create containers that keep contents stable and hygienic, and ensure increased laboratory, hospital and patient safety.

Sanitation and sterility

By far the biggest impact that plastic has made in healthcare is in helping to create a stable sterile environment for laboratories

1960s

Polypropylene introduced in to hospitals to replace stainless steel.

1962

Sir John Charnley introduces a cemented socket made from Ultra-high molecular weight polyethylene (UHMWPE) into total hip arthroplasty surgery. The polyethylene socket replaces metal on metal bearings.

1965

The high tensile strength of Kevlar means that it's used in many applications including bullet-proof vests. Modern medicine is experimenting with Kevlar for artificial cartilage.

1966

New production techniques make large, heavy-duty liquid containers. Uses include blow-moulding of fuel tanks.

and hospitals. Plastics can tolerate a wide variety of common sterilisation methods including heat and steam, chemical, gas, gamma radiation and newer techniques such as plasma. Plastic itself can be used to seal products and devices ready to use in any situation where avoiding cross contamination is paramount.

Viruses and bacteria are multiplying and mutating at a far greater rate than we are developing controls to stop them. Hepatitis C, CJD, HIV and now Covid-19 have heightened awareness of re-infection. Where there is increased risk of cross-contamination, for example in neurosurgery, single use plastic items are often the only option.

Plastic is also a vital material for the wider environment of hospitals and institutions. Equipment, ceilings, furniture, walls and floors can all be easily cleaned and sterilised using plastic coatings and fittings.

Plastic and technology

Plastic is a key component in technology used in healthcare settings. Every computer, screen monitor, scanner is cased in plastic and uses plastic components.

1967

Polychloride (PVC) used for engineering and construction materials.

1969

Neil Armstrong lands on the moon. Not achievable without a spaceship and spacesuit made with plastic parts.

1977

British Standard BS5452 introduced for hospital hollow-ware.

1970s

The first running blade is designed by Van Phillips, an American inventor and amputee.

What are the alternatives?

Despite all the advantages of plastic in the healthcare environment the use of plastic has come in for criticism as being environmentally unfriendly and unsustainable. Yet it's important to compare this to alternative materials and current solutions to consider the implications.

Below is a table outlining the various properties of materials and their suitability for the sterile environment. To this we must consider the production, processing, transport and safe storage. Disposal of other materials still has a significant environmental and carbon footprint. Other materials still face the same sourcing, recycling and reprocessing challenges.

	Plastic	Metal	Paper	Maize, bamboo & other natural fibre
Sustainable resource	✓		✓	✓
Low cost	✓		✓	✓
Easy to clean	✓	✓		
Resistant to chemicals	✓	✓		
Resistant to corrosion	✓		✓	✓
Withstands high temperatures	✓	✓		
Light-Weight	✓		✓	
Noise reduction	✓		✓	✓
Colour	✓		✓	
Printing	✓		✓	
Durable	✓	✓		
Drop test	✓			
Protect contents	✓	✓		✓

1981

Warwick SASCo founded – blue polyware trays and bowls widely used in hospitals worldwide.

1982

Dentist Barney Clark received the first plastic heart transplant in Seattle, USA.

1988

Recycling symbol adopted and processing information introduced.

1990

ICI launches Biopol, the first biodegradable plastic used for food packaging.

Metal, paper, bamboo and glass.
All materials that can be considered for medical use, each have their own different issues with regard to processing, energy use and environmental impact. This has to be considered alongside suitability for the sterile environment, patient safety and economic viability. It's not as simple as a coffee shop switching to recycled paper for cups.

2000

Composite polymer used to encase nanotechnology.

2016

First polymer bank note launched in UK.

2020

Covid 19 pandemic highlights the importance of PPE made from flexible, disposable plastic.

Future

Developments in the pipeline include: 'plastic blood', implantable polymers for neurological applications and 3D printed body parts.

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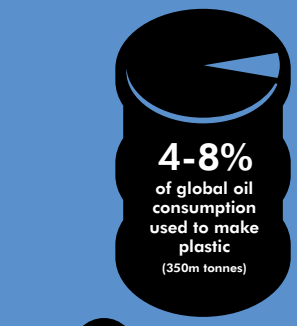
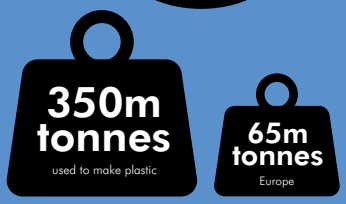
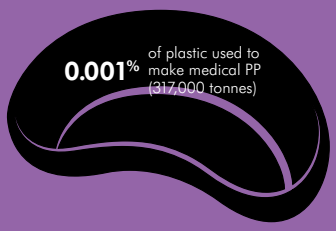
Oil Data



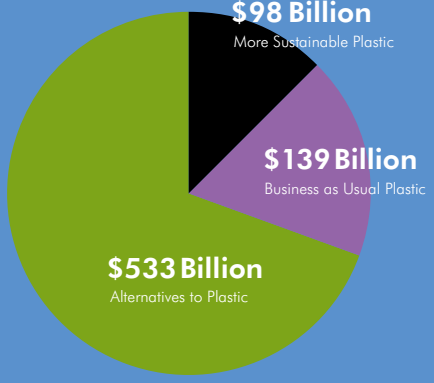


Plastic Data



Recycling

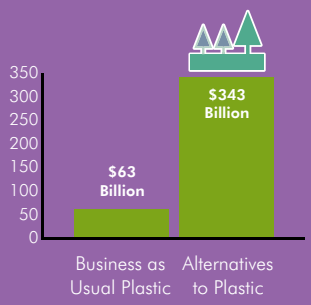
What is the environmental cost associated with the materials we use in consumer products and packaging?



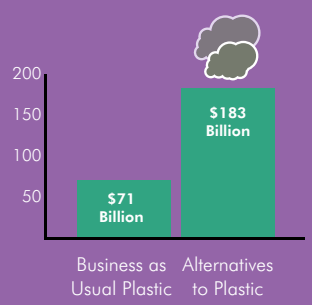
The cost of using alternative materials is approximately four times that of using plastic (in a business as usual scenario). We're producing more and more consumer goods, so choosing the material that creates the least impact is important.

The costs to society and the economy

Damage to the health of humans and ecosystems



Climate change



All dollar values are in USD.

Source: Trucost Plastics and Sustainability: A Valuation of Environmental Benefits, Costs and Opportunities for Continuous Improvement.

All plastics aren't equal

Plastic is a general term that covers a wide range of polymers, all of which have very different qualities. Each plastic has the potential for recycling and implications for the environment.

Polyethylene Terephthalate (PET)
Also known as polyester. The most common polymer accounting for 18% of plastic production. Around 60% of production is used in clothing and approximately 30% for drink bottles and packaging.


High Density Polyethylene (HDPE)
A robust, solvent-resistant plastic used for heavy duty products including furniture, construction and electrics.


Polyvinyl Chloride (PVC)
A highly adaptable chemical-resistant thermoplastic used for water, gas and sewage pipes, medical devices and cable insulation.


Low Density Polyethylene (LDPE)
One of the first polypropylene plastics. Flexible, weldable and pliable. Used for IV tubing, breathing apparatus, computer components and various moulded laboratory equipment.


Polypropylene (PP)
Remains one of the most durable, flexible and chemical-resistant plastics. Introduced in hospitals in the 1960s to replace stainless steel products. Its high melting point makes it the most versatile plastic and ideal for sterilizable healthcare products. It can be recycled easily.


Polypropylene – the sustainable solution?

Recycling of polypropylene is emerging as an important and economically viable option on a large scale. Relative to production from oil and gas, energy use can be reduced by 88% when plastic is recycled. Polypropylene has the most potential as a truly sustainable product.

Warwick SASCo was the driving force in developing polypropylene products for use in healthcare. This led to the formulation of British Standards BS5452, BS2588 and BS3215.

Given its inherent flexibility, PP can be recycled back into many different products, including clothing fibres and food containers. Pure polypropylene is our material of choice for manufacture.

5

PP

Warwick SASCo Polypropylene products

36 month shelf life

Can be sterilised and re-used up to 1000 times

Can be decontaminated and recycled

The future of plastic is clear

As a company that has designed and manufactured products for over 40 years, we are ideally placed to consider the benefits of plastic as well as its impact on the environment. We have been a key player in the revolution of plastic in healthcare and with our finger on the pulse, constantly seek the sustainable solutions our buyers are looking for.

We continue to improve the quality of our manufacturing. In partnership with our suppliers we are exploring innovative processes and new materials that have greater potential for recycling and reusability. There are some exciting developments that could emerge in just the next few years.

Changes in materials, coupled with new processes and additives, are designed to enhance the biodegradability of oil-based plastics. Water soluble plastics formulated from vegetable oil will be introduced in coming years. New plastic-eating bacteria will speed up the biodegradability of plastic degradation.

Warwick SASCo is already working with suppliers and material innovators to bring new materials to market.

Plastic will continue to have an important role in the future of healthcare products and be central in developing new technology and medical devices. As a market leader of products sold in over 70 countries, we want to inform a wider audience about the advantages of plastic in healthcare and discuss the potential for re-use and recycling.

More than ever the future looks more promising made from plastic. Warwick SASCo is in a position to see that more clearly than most.

For more detailed information about any of the issues raised here, or more specific data on our products please contact us.

Today carbon fibre reinforced plastic is commonly used for limb replacement and orthotics and can create high performance blades for paralympic athletes.

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