Raw

Raw materials are biologically based and unprocessed, used without any mechanical, chemical, or biological manufacturing processes, and naturally biodegradable. Most clothing and accessories today are created with human-made synthetics like plastics that are manufactured with petroleum oil and harsh chemicals, making them far from eco-friendly.

THE CHEMICALS, ENERGY, AND POLLUTION OF SYNTHETICS

In our modern society, engineers and scientists have developed some amazing processes to transform raw materials into versatile products that enhance our lives in many ways; however we often use these products without considering their impact on our health, or on the environment. This is definitely the case when it comes to synthetic, human-made materials.

One of the best ways to explain what raw materials are is to contrast them with the opposite, and for that we should consider plastics, the quintessential non-raw material. Unlike raw materials, which are inherently renewable and biodegradable, plastics are the exact opposite. Making plastics relies on non-renewable resources (like fossil fuels) and the finished products are not biodegradable.

Wonder what this has to do with sustainable fashion? Well, you'll find plastics and their derivatives all over your conventional wardrobe:

- Polyester, acrylic, aramid, microfiber, monocrylic, nylon, olefin, Spandex, vinyl, and Zylon textiles (yup, they're all made from fossil fuels)
- Plastic buttons, zippers, and Velcro
- Plastic used for earrings, necklaces, bangles and bracelets
- Various textiles and plastics used to make belts and scarves
- Trim, embellishments, and textiles used to make handbags and purses

Whenever you use synthetics rather than raw materials, you're supporting a chemical-dependent, energy-intensive industry. And that means a pretty big eco footprint.

THE CHEMICAL INTENSITY OF PRODUCING PLASTICS AND SYNTHETICS

The first and perhaps most important problem with synthetics is that they are so dependent on chemicals for their creation. These chemicals are toxic to people working with them, to the environment near manufacturing plants, to end users (consumers like you), and to the environment when they're discarded. Compared to raw, synthetics are simply harder on the planet.

When you get right down to the basics, plastics and synthetics are made from raw materials that are far from eco-friendly. What are the components of plastics and synthetics? Well, they're made from fossil fuels such as natural gas and crude oil, combined with a whole lot of chemicals. Here is a basic breakdown of the process of turning fossil fuels into the plastics we know and have come to depend on.[i]

Raw

1. **Prepare raw materials:** This involves taking raw materials, such as crude oil or natural gas, and extracting the hydrocarbon monomers such as ethylene, vinyl chloride, styrene, and propylene. These are the chemical or organic compounds needed to make plastics.
2. **Polymerization:** The monomers are put through a process called polymerization in production plants. This process involves using chemicals to bond the monomers into chains called polymer resins. Other elements may be added during this process, including oxygen (to make polyester or polycarbonate), chlorine (to make polyvinyl chloride or PVC), fluorine (to make Teflon), or nitrogen (to make nylon).
3. **Nurdle production:** Polymer resins are then made into pellets, often called nurdles – small bits of plastic that are the foundation of all plastic making.
4. **Product creation:** Turning pellets or nurdles into products involves melting them down. This process can use one of four different types of production:
    a. **Extrusion:** This process involves taking the pellets, melting them down, and pushing them through small openings into a die or shape. Cool air or water then solidifies the plastic into the finished shape. This process is used to make things like plastic film and bags.
    b. **Injection molding:** In this process, the pellets are melted and poured into a mold. The plastic cools in the mold until it is solid. This process is used to make yogurt containers and similar items.
    c. **Blow molding:** This involves blowing air into hot plastic to form tube-shaped plastics, such as soda bottles.
    d. **Rotational molding:** Using a closed mold, the machine rotates two directions at the same time while heating and melting the pellets inside. This process is used for products such as hollow toys.

During the finishing process of making plastics, additives may be added to alter the structure of the plastic or change how it performs mechanically, physically, or chemically. Here are just a few of the reasons manufacturers add chemicals to plastics:

- Protect plastics from degrading in light, heat, or from bacteria
- Change plastic color
- Provide a foam structure
- Add flame retardancy
- Improve appearance
- Reduce friction or tack

While the additives may improve the performance of the plastics, most of them are toxic and unhealthy for those working with them, as well as for the planet. The following tour of just three of the most notorious chemicals used in the plastic making process will give you an idea of just how dangerous the process of plastic making is.

Phthalates

This is a family of human-created chemical compounds that are used to make plastics, solvents, and even personal care products. They're found especially in plastics with the numbers #1, #2, #4, and #5.[ii] [iii]

- **Human health hazards:** Phthalates have been called the feminizing chemicals because they have been linked to early onset of puberty, disruption of male reproductive system, interference with natural hormone system, genital defects, and lower sperm count and testosterone levels in men. Phthalates have also been linked to obesity and diabetes.

- **Environmental hazards:** Just as phthalates disrupt the hormone systems of humans, they also disrupt reproductive and hormone systems in fish and animals. This can have profound impacts on fish populations.

Bisphenol-A (BPA)

BPA is a chemical that has historically been used to line food tins, dental sealants, and plastics such as those used to make baby bottles. But scientists are providing some alarming reports about what this chemical is doing to our bodies and the environment.[iv] [v]

- **Human health hazards:** Being exposed to BPA can result in reproductive abnormalities, low sperm counts, enlarged prostate glands, precancerous changes in breasts and prostates, and the development of diabetes. In the US, 93% of the population has BPA in their bodies.

- **Environmental hazards:** Levels of BPA in animal bodies is on par with that in human bodies – about 93%. BPA causes many of the same health problems in animals as it does in humans.

Yet despite the overwhelming evidence of the hazards of BPA, governments have been slow to respond. The US is considering banning BPA from products for babies (such as bottles and toys) but this has been a fight for lobbyists.

Dioxins and Polyvinyl Chloride (PVC)

Perhaps the greatest plastic-related chemical evils come from the production and use of polyvinyl chloride products, and the resulting dioxin byproducts. PVC is actually a class of plastics that is often called vinyl. It's the second most common type of plastic in the world, and you know it best as the flexible, malleable plastics you find all over your home:

- Vinyl records

- Chew toys for children and pets

- Window and door frames
- Children's swimming pools
- Siding and gutters
- Plumbing parts
- Food wrap
- Auto dashboards
- Medical instruments
- Baby bottles
- Shower curtains
- Diaper covers
- Drinking straws
- Mattress covers
- Car seats and strollers
- Pleather

What's dangerous about PVC is that the production and destruction of PVC results in the generation of a class of chemicals known as dioxins. These chemicals are created while producing chlorine salt used to make PVC, during the actual production of PVC plastics, and when PVC is burned.

Dioxins have been called the most dangerous human-made substance known to science because of the incredible toxicity to humans and the environment.[vi] Here are the basics of the problems with dioxins:

- **Human health hazards:** Dioxins are known *potent* carcinogens, but they also cause reproductive, endocrine, and immune system damage in humans. The EPA has estimated that some humans in the US have experienced dioxin exposures 200 times above safe levels, especially those who eat a lot of fish, meat, or dairy.[vii]
- **Environmental hazards:** Dioxins are found in whales, polar bears, and nearly every human on the planet, yet there is no safe level of dioxins for health. As with humans, dioxins cause reproduction, development, immune system, and endocrine system dysfunction in even low doses (parts per trillion). And since they persist in the environment – they don't break down over time – once they're deposited into our air, soil, or water, they stay there for hundreds of years.[viii]
- **Climate change:** Making the chlorine that is used in the production of PVC is incredibly energy-intensive. In fact, chlorine production consumes 1% of the world's total electricity

or 47 billion kWh of energy annually, which is equivalent to the output of eight medium-sized nuclear power plants![ix]

But it doesn't end there. The production of PVC also involves many other toxins, including:

- **Phthalates:** See above.
- **Vinyl chloride**: A building block for PVC that, as a gas or liquid, can escape from manufacturing plants. It's a known carcinogen and can cause nerve damage, immune reactions, and other serious health problems.
- **Organotins**: These are compounds that are often found in PVC. They are highly toxic and persistent in the environment.
- **Lead**: This is used as an additive in making some PVC products. We know it is highly toxic to humans and animals alike.

As if that weren't enough, PVC is extremely difficult to recycle. So that means most of it ends up in landfills where it poisons water and soil causing health and environmental challenges for generations to come. Alternatively it's burned, at which time it releases even more dioxins into the environment.

PVC isn't the only plastic with chemical problems. Toxins found in LDPE and HDPE plastics include BHT, Chimassorb 81, Irganox PS 800, Irganix 1076, Irganox 1010, and polychlorinated biphenyls (PCBs) all of which have negative impacts on both human and environmental health.[x] These chemicals have been linked to cancer, endocrine disruption, immune system suppression, and development disorders in children.[xi]

As you can see, the production of plastics is incredibly chemical-intensive. Synthetics of all types – including textiles used in conventional fashion – have similar hazards for human health and the environment. That's why Hearts stays away from synthetic materials and prefers raw instead.

THE RESOURCE AND ENERGY WASTE OF PLASTICS AND SYNTHETICS

Another significant environmental problem with synthetics and plastics is that they rely on the unsustainable fossil fuel industry. Not only are these products made from natural gas and crude oil, the manufacturing process also requires a lot of energy. Check out these statistics:

- **Quantity of oil used to make plastics:** 4% of all the world's oil is used as feedstock to make plastics.[xii]
- **Energy used to make plastics:** 4% of the world's oil is consumed for energizing the plastic-making industry.[xiii]
- **Economics of energizing chemical and textile manufacturing:** It requires 84% more energy to produce one dollar of GDP from chemical manufacturing than the national

average! Textile mills are somewhat more efficient, requiring only 42% more energy per dollar of GDP than the national average.[xiv]

As you can see, non-raw materials like plastics and synthetics increase our dependency on foreign oil. More importantly, they generate greenhouse gas emissions and contribute to climate change.

TRASH HAZARDS RELATED TO THE PRODUCTION OF PLASTIC AND SYNTHETIC PRODUCTS

In addition to the chemicals and energy that go into making synthetic and plastic products, these industries also generate a big waste problem. Remember how plastics are made? If you recall, most plastics products are constructed from tiny resin pellets of plastic known as nurdles. They're small and lightweight, and so they can end up littering the planet as they travel from one plant to another. How? To start, these nurdles are often transported by sea, with many of them flying off the ships or being spilled into the water. And once they've been spilled, they're virtually impossible to clean up.

Nurdles represent plastic waste at the beginning of the production cycle, but the end of life for plastics also creates trash problems. We as consumers go through a lot of plastics and synthetics and many do not recycle. That means additional plastic from land-based waste ends up in the environment, on land, or at sea. Since plastics can take up to 1,000 years to biodegrade, they don't return to the land like raw materials do. Instead, they litter land and sea and create eco hazards:

- **Eyesore**: Of course, one of the most obvious problems with plastic waste is that it's ugly! Who wants to look at plastic bags and discarded dolls littering our streets and highways?

- **Hazards to wildlife:** Pieces of plastic pose choking and suffocation hazards for animals. More than 180 species of wildlife have been documented as having ingested plastic debris, including marine mammals, birds, fish, and turtles.[xv]

- **Size of plastic waste problem:** Over 300 million tons of plastics are produced worldwide every year[xvi] and 10% of all landfilled waste is plastic.[xvii]

Because most plastic waste doesn't break down very quickly and because it's lightweight, it just floats in our oceans. One of the most important impacts of the plastics industry is their contribution to plastic marine gyres – giant, swirling masses of plastics that form islands throughout our seas.

- **Five ocean gyres:** Scientists suspect that there are five plastic gyres: one in the North Pacific the most well known), one in the South Pacific, one in the North Atlantic, one in the South Atlantic, and one in the Indian Ocean.

- **Largest plastic ocean gyre:** Experts estimate the size of the garbage vortex in the Pacific Ocean to be equivalent to the size of Texas.[xviii]

- **Ratio of plastic to ocean:** The Pacific Ocean Garbage Patch contains approximately 46,000 pieces of plastic litter per square mile of ocean. That's six pounds of marine litter for every single pound of plankton in the ocean according to the United Nations (UN) Environment Programme.[xix]

- **Toxic soup:** As nurdles and plastics break down in the ocean, they release the chemicals with which they were made. As a result, they slowly poison wildlife and bioaccumulate in our food chain.
- **Sea life fatalities:** Every year, 100,000s of sea birds, sea turtles, whales, and other marine mammals die from consuming or being strangled by plastic bags.[xx]

So not only is plastic waste ugly to look at, it's trashing our oceans and our land and posing significant dangers to the wildlife, too.

THE ENVIRONMENTAL CHALLENGES OF COMPOSITE CONSUMER PRODUCTS

Plastics and synthetics aren't the only problem with non-raw materials. The issue of composites is also an environmental challenge. Composite products are those that are made from more than one type of material which are fused together – such as glass, textiles, plastics, metal, or wood.

These, too, are not preferable to raw consumer goods. That's because composite products are very difficult or impossible to separate into their component parts. As a result, most of these products cannot be recycled, and that means they're often thrown into the landfill where they likely won't break down for many years. This represents a huge waste of resources and additional pollution and waste hazards.

CHOOSING RAW MATERIALS FOR THEIR MANY HEALTH AND ECO BENEFITS

Surely there are better ways to create consumer goods! Hearts believes raw materials are one of the best ways to overcome these health and environmental problems.

But what are they? Raw materials are natural materials that have not been processed using mechanical, chemical, or biological manufacturing methods. As you've already seen, creating synthetic materials requires reengineering and substantially changing to the substance of the material. But with raw materials, none of that is required.

Sometimes called unprocessed materials or biotic materials, raw materials are simply collected and then shaped or polished for use in the fashion industry. As such, they are much more sustainable than chemically-produced materials like plastics. Consider all of the benefits of raw materials.

- They're often renewable
- They're usually biodegradable
- They are easily recyclable
- They are created without harsh chemicals
- They require little to no energy during the manufacturing process

- They don't rely on fossil fuels and therefore reduce our dependency on foreign oil

There are numerous raw materials that can be used to create eco fashion, but here's a list of some of the biotic materials found in Hearts' fashion; acai berries, tagua nuts, porcupine quills, and wood.

ACAI BERRY SEEDS

The acai berry is one example of a biotic material that has been harvested for thousands of years by Amazonian people groups. It was also recently discovered as a high-antioxidant berry with a myriad of health benefits, spurring a growth in cultivation of this berry. The cultivation of acai berries is a growing industry.

Acai palm trees can generally be grown and cared for without transforming existing land, so they are highly sustainable.[xxi] The most important species of the acai palm grows on the floodplains of forests in Eastern Amazon where riverine farmers plant and tend to them. Berries are harvested by climbing up 40 foot tall palm trees to collect the branches which hold the berries. They are then squeezed for their juice to create a variety of health products.

The acai berry juice industry piles up millions of acai berry seeds. Hearts' innovative designers are now creating low-impact fashion pieces using these elegant seeds, including accessories such as earrings, bracelets, necklaces, rings, and buttons for sweaters and scarfs. The beads come in rich earth tones and are often painted using vegetable dyes to create a variety of hues. They also can be polished into interesting shapes and sizes.

TAGUA NUT

Often referred to as the vegetable ivory, tagua nuts are an interesting raw material used for a variety of eco jewelry pieces today. Grown in Latin America, including the Amazon and Ecuador, the tagua is essentially the endosperm of a variety of palm trees. These trees grow naturally in rainforests rather than on plantations, which means old growth forests do not need to be cleared to grow them. A single mature tree will produce between 15 and 16 heads every harvest (there are three per year) throughout its 35 to 40 year life.

Resembling a small avocado, tagua nuts are cut open and then dried in the sun for 4 to 6 months, so they require no electricity or fossil fuels to create. They are then carved much like elephant ivory. That makes the tagua nut a highly sustainable, cruelty-free alternative to elephant ivory.

Eco fashion accessories made from tagua nuts come in a range of curious shapes and sizes and are being adapted in many creative and colorful ways. No two nuts are the same., and tagua is incredibly durable and hard so that anything made from it will last a long time. Plus, because tagua is a natural ingredient, it can be composted to prevent additional waste going to landfills.

FOSSILIZED SHARK'S TEETH AND PORCUPINE QUILLS

Other raw materials found in modern ethical fashion include things like fossilized shark's teeth and other fossilized artifacts, as well as porcupine quills. Collected from the natural environment

without the use of mining techniques, these materials are biological and used as they are found. No processes are necessary to transform fossils or quills into materials usable in the eco fashion industry.

WOOD

It's no surprise that wood is a natural raw material that is useful for creating many fashion items. When used without manufacturing processes, wood can be turned into eco jewelry and embellishments for apparel in its raw form. Assuming it is collected from sustainably managed forests, wood used for fashion is incredibly eco-friendly.

GREEN LIFESTYLE CHANGES YOU CAN MAKE TO INTRODUCE MORE RAW INTO YOUR LIFE

- **Look for raw materials:** Whether you're eco shopping for jewelry or the next piece of furniture, look for raw materials. Those that are not composites, or that easily disassemble are also good.
- **Say no to phthalates:** Don't buy plastics #1, #2, #4, and #5, and look for personal care products that are free of phthalates that go by other names, including: butyl benzyl phthalate, di-n-butyl phthalate, di-(2-ethylhexyl) phthalate, diethyl phthalate, di-isodecyl phthalate, di-isononyll phthalate, di-n-hexyl phthalate, and di-n-octyl phthalate.
- **Look for products labeled BPA-free:** Whether you're buying for you or your kids, always look for BPA-free plastics, especially if they're going to hold food or drink.
- **Avoid PVC plastic altogether:** This plastic is dangerous during every stage of its life – including after you bring it home to your family. So avoid this flexible plastic whenever possible.
- **Recycle your plastics:** Be sure to be clear on your local recycling center's recycling rules and recycle as much of your plastics and synthetics as possible.
- **Talk to your politicians about getting chemicals out of your products:** The only way industry is going to stop producing toxic synthetics and plastics is if consumers demand them. And that means talking to your political representatives as the local, state, and federal level. Flex your voting power and actively play a role in electing political figures who support growth in ecological betterment.

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