

STRAW ALTERNATIVES

product	material	usage	hold up in drinks? (durability)	end of life	production process	origin	customer preference	bans	cost per straw	product viability
traditional plastic	PP (polypropylene)	single-use	will not wilt in your drink or at any point afterwards. Cannot be sufficiently cleaned or reused but one straw can last you a full day of drinks	will eventually break down to microplastics, but that process can take up to 500 years in the ocean and up to 1000 years in a landfill	polyethylene gas is polymerized in the presence of a catalyst	52% Asia (30% China)	cheap, easy to use, doesn't fall apart or hurt, BUT lots of environmental guilt in current media	affected by any single-use plastic ban (currently in the US: New York City, Seattle, CA, and FL)	1x	realistically, with the increase in bans and public awareness, traditional plastic is on its way OUT
industrial compostable bioplastics	PLA (polylactic acids: corn starch- or sugar cane-based)	single-use	won't wilt in a drink or turn to mush, can withstand hot drinks	must be composted in an industrial facility under special conditions (under 6 months once it gets there), cannot go into recycling stream, not marine degradable, takes up to 1000 years to degrade in a landfill (ASTM D6400 certified)	biological produce lactic acids, and then use chemical synthesis to make PLA, comes from renewable plants which absorb carbon (carbon neutral), no toxic emissions	NatureWorks is the largest producer (MN, USA), but also Central Europe	more expensive than PP but still fairly cheap, positive drinking experience, but very complicated to dispose of properly	in Europe, single-use plastic straws have to be made from EXCLUSIVELY sustainable materials, which may become a problem for PLA additives	2x	while they may seem like a better option, there are only 113 industrial compost facilities in the US. That combined with the extra effort of collection makes them unlikely to persist
home compostable bioplastics	PHA (polyhydroxyalkanoates)	single-use	won't wilt in a drink or turn to mush, can withstand hot drinks, doesn't affect taste	home compostable and will break down terrestrially in under 1 year , also passes testing for marine degradation in under 6 months (AS 5810, OK compost HOME, and ASTM D6691)	naturally made by microbes, and using genetic engineering and recombinant organisms, they can be synthesized from cheaper materials like molasses, sucrose, methane, etc. but more expensive process	super super new, one of the largest producers is Danimer in KY, USA and Yield10 Bioscience in Woburn, MA	gives you everything you like about plastic but with no environmental guilt, it will break down quickly and safely no matter where it ends up	provides a solution to single-use plastic bans rather than a work-around due to it's sustainable and biodegradable nature	2x	the biggest issue is material shortage. If money didn't matter, PHA would be the future, but right now research into industrial-level production and COST are the biggest limitations
paper	paper	single-use	depending on the brand, can be sturdy for a short period of time, but liquids tend to turn paper to mush over sustained use. The can also add an unwanted taste to your beverage because they do slowly start to break down as you use them. Plus they don't handle teeth well	paper products that are 100% paper (no plastic films) are both compostable and marine degradable (under 6 months for both). However, most do not hold technical certifications of any kind. The leading distributor in the USA (Aardvark) only sports a field test certification	wood chips are washed with sodium sulfide and sodium hydroxide to remove lignin and make the paper stronger. The remaining pulp is then washed to remove the sulfide and hydroxide. Self-sustaining process, but kills lots of trees	Aardvark is the largest manufacturer in the US, and they are based in Indiana, other large companies are from China	the strongest will still turn to mush after 2 hours maximum. And they don't hold up well to your teeth or saliva either. The also tend to add a funky taste to whatever you're drinking. In general, definitely not preferred	paper straws are the most widely-assumed solution to the current single-use plastic bans. There are no bans on paper straws	2x	people are already not huge fans of paper straws, and while production and degradation may be persistent, customer preference is not in paper's favor
avocado	avocado pits	single-use	perform better than paper, but slightly worse than bioplastics, can be used in hot or cold beverages, not effected by liquid but don't withstand teeth or chewing well	these straws are designed to break down in 240 days (8 months) of being exposed to elements or buried in the ground (ASTM D6400 certified)	discarded avocado seeds have molecules extracted from them that can be made into bioplastic. It's a fairly closed loop production process with a very low carbon footprint (60% avocado seed and 40% synthetic organic compounds)	Mexico (BioFase)	all the rage right now, especially because avocados in general have grown in popularity. However, they do have a bit of a funky taste	currently not affected by any of the in-place bans on plastics	6x	definitely has long-term potential, as it has public backing. However, cost and supply of avocados are currently large limiting factors
hay	hay or wheat stalks	single-use	the do well in terms of not getting soggy, but the have no resistance to teeth. They split vertically the instant you bite down. Good for hot and cold beverages	their website ESTIMATES decomposition in 2-4 months depending on conditions	bought from local farmers, cleaned, dried, and sterilized with no chemicals added	Hay! Is the largest company and is USA-based but their product comes from SE Asia	lesser know and media-visible than other alternatives, not the best texture, but do stand up to liquids	not current affected by any bans, but they do source their material from overseas...	20x	they seem like a good product, but don't seem to have the public's option on their side. Realistically, cost will most likely limit them
bamboo	bamboo	single-use to slightly reusable	sturdy and will hold up in your beverage, however don't hold up too well to cleaning (1 or 2 washes max), can be used for hot and cold drinks	biodegrades in 4-6 months	bamboo stalks are harvested, trimmed, sanded and thoroughly cleaned. Every straw is slightly different due to differences in stalks	Vietnam (Asia)	they look beautiful and are currently on the rise, but some people don't like the taste of wood in their mouth or the splinter potential. They are also rigid, which isn't necessarily preferred	not current affected by any bans, but they do source their material from overseas...	\$1 (depending on the pack and distributor)	these definitely have potential! But realistically, the effort put in to cleaning them and the cost make them non-effective in single-use situations
glass	glass	reusable	for sure! Assuming you don't push them in too hard and shatter them, a glass straw definitely holds up. However, they have the potential to conduct temperature	glass is recyclable when it breaks or can't be reused anymore, however in 2017 the US only had a 26% recycle rate for glass waste	glass straws are made from a material called borosilicate glass, which is the commercially strong glass used in Pyrex and on the space station. Tubes are cut then blown using traditional glass blowing techniques. The main ingredient in glass is silica, which is the most abundant mineral in the Earth's crust	most companies are currently USA based (Simply Straws and Strawsome)	these are great in theory, but they are easily breakable, and some people don't like having their teeth on glass. Plus, they are rigid and inflexible	not affected by any bans	\$2-\$3 wholesale, up to \$10 individually	has potential in the individual market, but not for single-use purposes. Also, the risk of it breaking in a drink doesn't appeal to many people. Cost and cleaning effort are also big limitations
hard plastic	acrylic (polymethyl methacrylate) or petroleum base	reusable	yup! Not going to be affected by the liquid, whether it's hot or cold and doesn't conduct temperature. However it is rigid and inflexible	hard, reusable plastics are recyclable , however the US only sported a 9% recycling rate in 2017. So while they are great for your lifetime, they essentially are the same as single-use plastics that have a longer lifespan	building blocks are added to molds and catalysts are added to speed up the linking of the blocks. However, these building blocks are fossil-fuel based, so it isn't the most environmentally friendly process	China	while they are inflexible, they don't hurt your mouth or teeth as much as metal or glass. They are good for use in tumblers and other cups as well	not affected by plastic bans because they are reusable	around \$1.50 each (varies depending on brand)	realistically, they are great for short time (like one human lifetime), but because they are meant to be recycled in the long-term and recycling in the US isn't great, they don't have a long-term future
silicone	silicone	reusable	the liquid won't affect the material at all, but the are meant to be flexible and can sometimes be too floppy	like other reusables, silicone is recyclable , but it requires a special facility. Should it end up in landfills, in can take centuries to break down (doesn't become microplastics like other plastics...but is that better or worse?)	the main ingredient is silica, which is an abundant mineral in the Earth's crust, however it must be combined with hydrocarbons that come from oil and natural gas so it's better in terms of resource usage but that's about it	China	they're great for those that like to chew on their straw, but they can be frustrating to clean. They are also seen by some as TOO flexible. Good for children and those with disabilities	not affected by plastic bans because they are reusable	\$1-\$3 depending on brand, up to \$8 individually	again, while they are great for short term periods when they are being reused, once they DO get thrown out, odds are they aren't much better than traditional plastic. Plus, silicone is MUCH more expensive a material
metal	stainless steel	reusable	definitely. They're metal after all. But they are rigid and conduct heat so they are not suitable for hot beverages	these can be recycled but again, in 2017 the US only recycled 32% of all ferrous wastes	the building blocks for stainless steel come from a variety of elements found in the Earth's crust. These blocks go through 8-12 hours of intense heat and multiple shaping processes to become a straw. In other words, it takes A LOT of energy	China produces 50% of the world's steel	the biggest thing with metal is it can hurt you. They are very inflexible and can cut your mouth. This can be fixed by adding a silicone tip, but it isn't preferred for most consumers	not affected by any bans	\$1-\$3 individually (more if you add silicone tips), and about \$0.50 wholesale	realistically, they last forever which is great in the case of reusing, but the problem exists in cleaning them. It's not going to work for big restaurants to clean thousands of straws a day. It's also more costly than plastic