

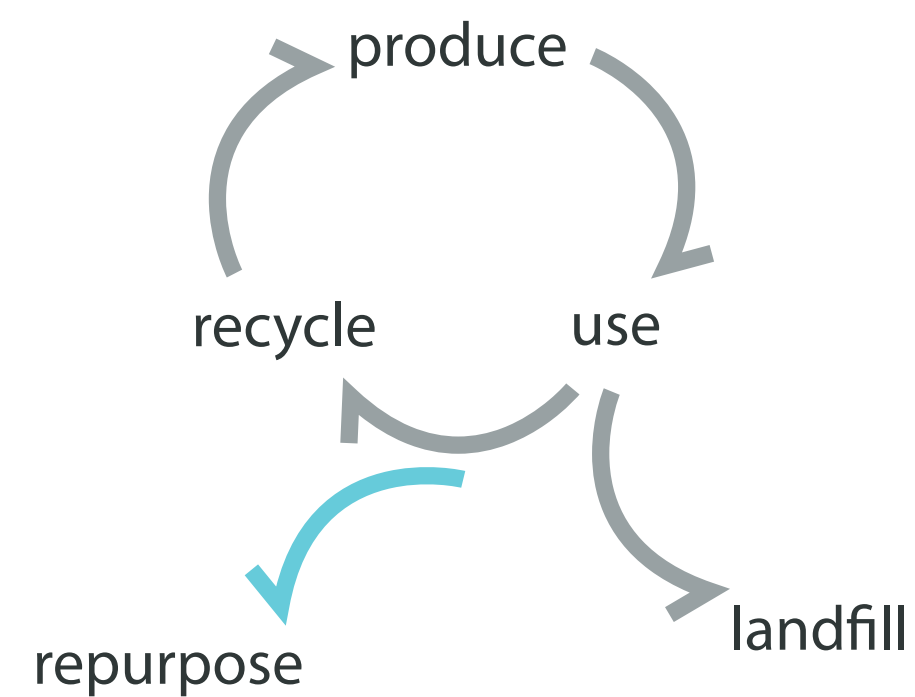


problem

currently, a superfluous amount of plastic grocery bags are produced and consumed around the world each year. a relatively small portion of these bags are collected and recycled. however, the integrity of the high density polyethylene is compromised each time they are recycled. because of this, the amount of plastic bags recycled remains minimal. each year, more and more bags are used a single time, then sent to landfills.

proposal

alternative step to current practices



hypothesis

layers of repurposed HDPE (high-density polyethylene) grocery bags can be thermally fused to create materials with physical properties comparable to those of commercially available HDPE vapor retarders. properties tested include vapor permeability and durability.

fabrication

0.5-mil polyethylene grocery bags were used for all materials. bag handles were removed and seams were cut so that the bags lay flat. layers of bags were placed on top of one another and fused using a standard household iron. the bags were placed between two layers of waxed paper before fusing to prevent melting to the iron. the waxed paper was then peeled off of the polyethylene sample and reused in subsequent material fabrications.



layer



protect



fuse



link

terms

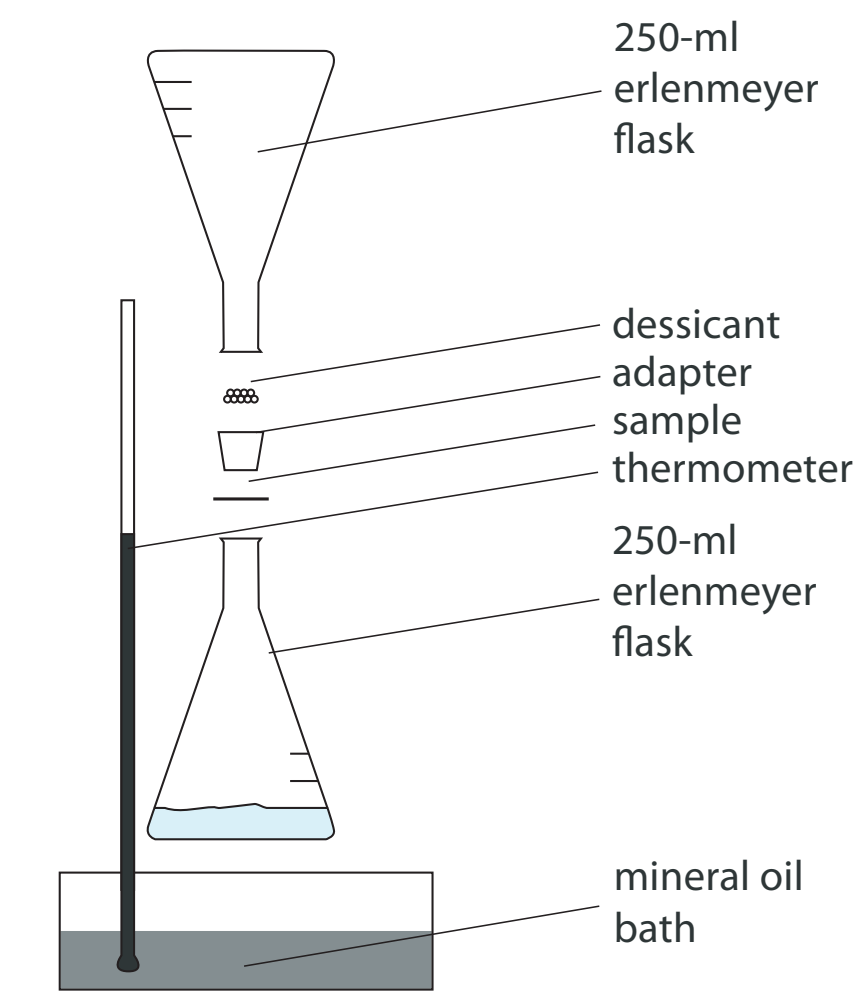
high-density polyethylene (HDPE): polyethylene thermoplastic made from petroleum. its chemical structure gives the polymer stronger intermolecular forces and tensile strength and higher melting point than lower-density polyethylene.

mil: unit of length representing 0.001 inch.

vapor retarder: a layer of material intended to resist the diffusion of water vapor through a wall assembly; also known as vapor barrier.

moisture barrier: a membrane used to resist the migration of liquid water through a floor, wall, or roof.

vapor permeability

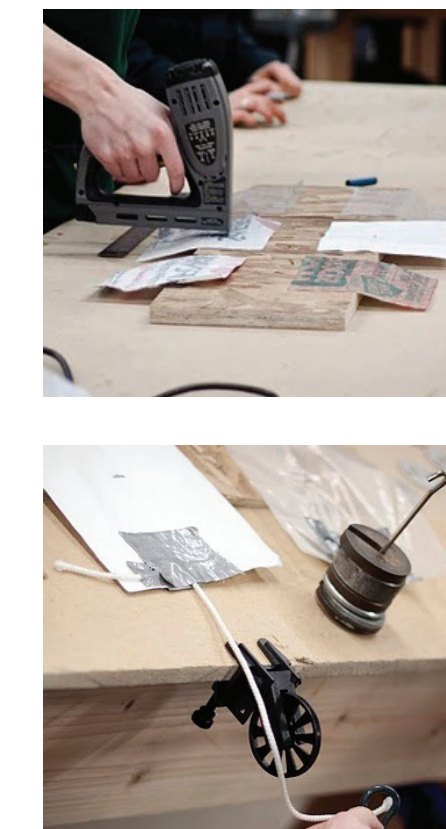
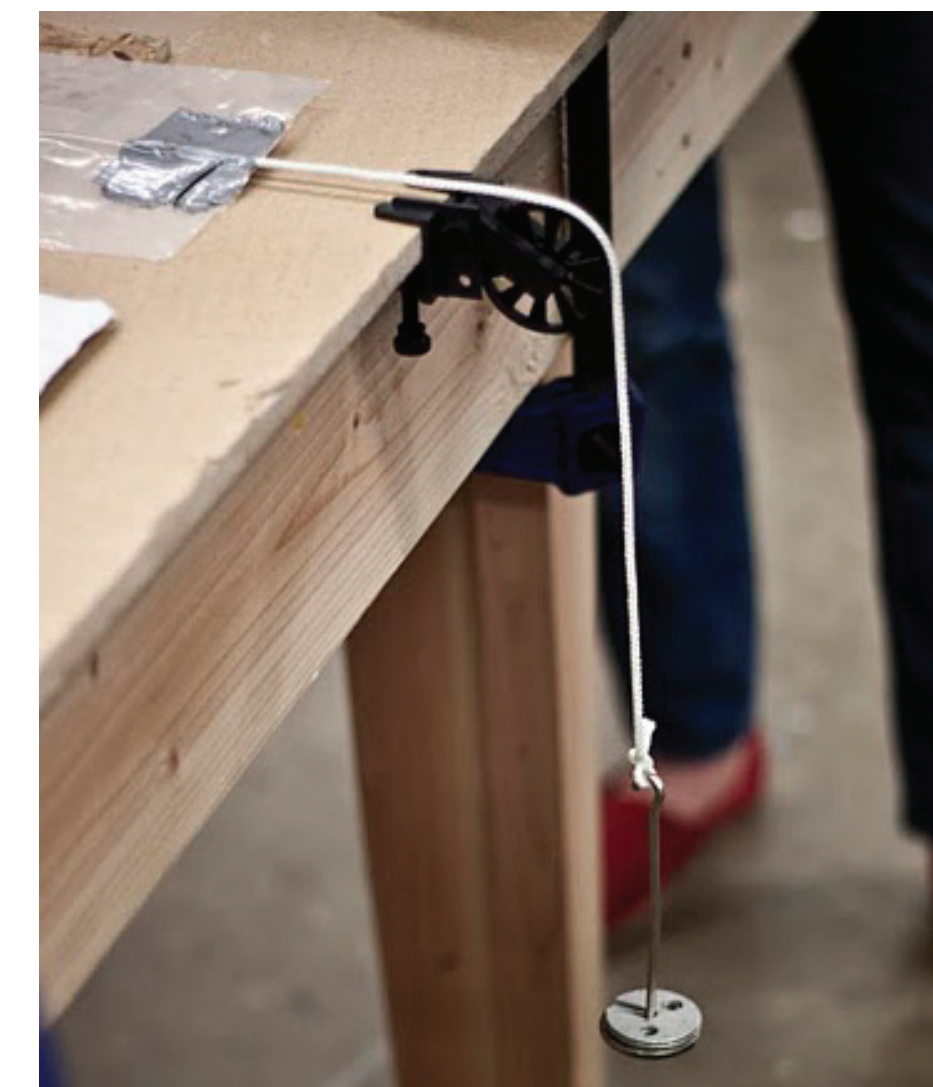


material	initial mass (g)	final mass (g)	water absorbed (g)
2-mil fused PE	4.2	4.2	0.0
4-mil fused PE	4.0	4.0	0.0
6-mil fused PE	4.2	4.2	0.0
husky 2-mil PE	4.0	4.0	0.0
tyvek	4.0	4.5	0.5

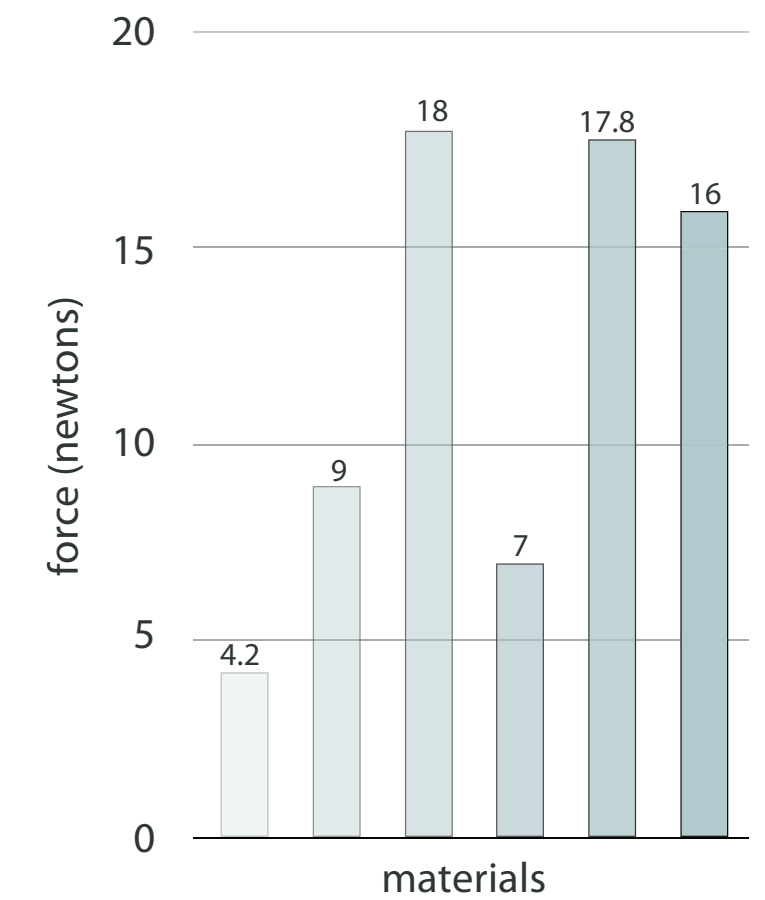


a vapor pressure differential was established within a closed system to assess vapor impermeance of various samples of polyethylene.

tensile strength

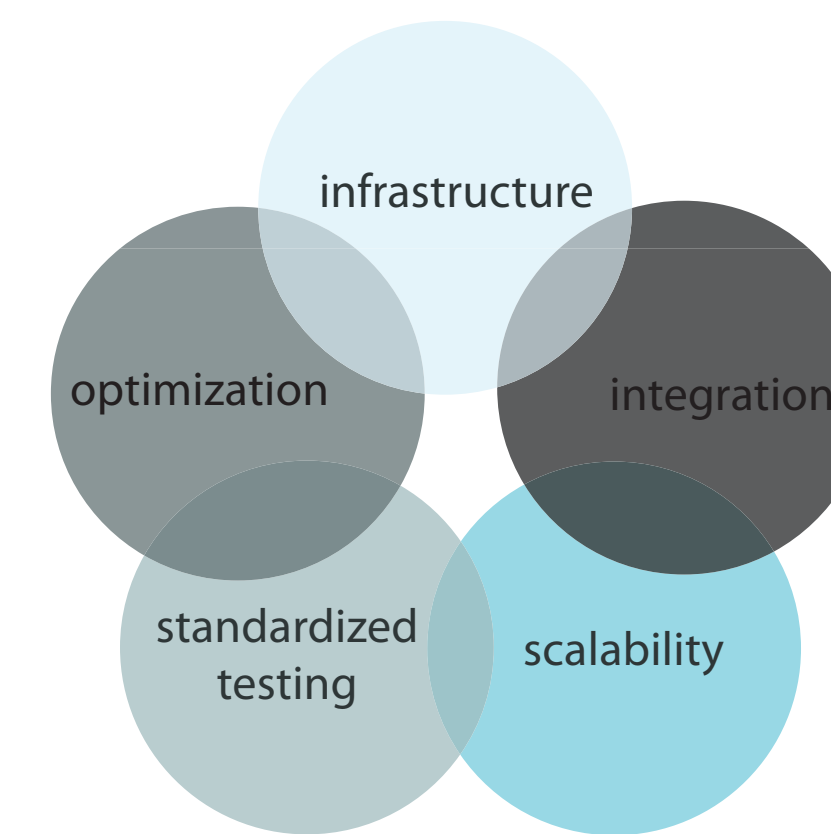


- 2-mil standard PE
- 6-mil standard PE
- tyvek
- 2-mil standard PE
- 4-mil standard PE
- 6-mil standard PE



tensile strength was assessed by varying the downward force imparted on a sample of polyethylene stapled to a piece of OSB sheathing.

future work



- if the proposed material is to be widely integrated into construction sites, more bags will need to be collected. increased collection will require more sweeping infrastructural changes.
- production methods need to be scalable if the material is to be commercially viable. scalable methods may include hot pressing large quantities of bags into sheets that are then lapped together using a rolling lamination system.
- large-scale integration is dependent upon streamlined collection, sorting, and production. efficiency must be maximized in all steps of the repurposing process to keep consistent with the environmentally conscious mindset.
- further empirical assessment using ASTM-recommended techniques is needed. tests prescribed by the ASTM assess puncturability, 24-hour vapor impermeability, and tensile strength.
- the production of the material is limited by the availability of the bags; therefore, recycling habits must be improved, especially specific to the recovery of HDPE bags.

[rethinking] waste

