





Comparison of natural insulation materials


Insulation type	Cellulose
 	<p>Material is made from finely shredded recycled newspaper, for roofs it can simply be laid by hand or dry-injected/blown between and above the rafters. For wall cavities it can be dry injected with an air hose, or damp-sprayed between wall studs before the wall is closed. Provides a continuous layer with no air-gaps, which reduces thermal bridging. Can also be made into board form with the addition of recycled jute sacking.</p> <p>Cellulose Board is made from recycled paper and recycled jute sacking. Boards are supplied in various thicknesses with tongue and groove edges. There are boards for different applications such as:</p> <p>External wall application; to be used with appropriate renders, on timber or steel framed walls and masonry walls. For window and door openings, reveal boards are available.</p> <p>If installed in the roof it will absorb heat from the sun during the day and then release it later when the temperature has fallen. Water-resistant fibreboard for application over rafter insulations as protection of the insulation material or in inter rafter constructions directly on the beams instead of underlays.</p> <p>Internal non water resistant insulating fibreboard for use in floor, roof and wall constructions.</p> <p>Wood shavings have been used for loft insulation in the USA since the 50s. Sawdust can be blown into wall cavities (Finland). It is important to keep heat generating wiring away from chippings due to the fire risk, mixing it with limestone will keep vermin away.</p>
Pros	Con
<p>Made from post-consumer recycled newspaper and cardboard, and recyclable after use. Low embodied energy Reclaimable/recyclable/bio-degradable Non-toxic, non-volatile additives for pest, fungal and combustion control; pose none of the considerable health concerns associated with synthetic pesticides. Well suited to a breathable construction. Good sound insulation. Stable durable and rot-proof. No protective equipment required to install, board is easy to cut with a sharp knife.</p> <p>Blown fibres K value: 0.036 W/mk Cost: £4 per m²</p> <p>Cellulose board K value: 0.038 W/mk Cost: £2 per m²</p>	<p>Possible small amount of odour and formaldehyde off gassing from printing inks and additives (vapour barriers between the insulation and the living space will prevent this). Becoming damp will add to chance of odour release as well as negate fire retardant qualities. It is treated for resistance to fire and rot; Borax is recommended over aluminium sulphates</p>

Insulation type	Coconut Fibre Board	
	Made from the outer husk of coconuts with minimal processing and no other additives. The highly elastic fibres are tubular and are able to store up to 65% air. Coconut fibres have a good insulation value and can be made into batt form, or for use in screed or timber floor and ceiling constructions.	
Pros	Cons	
<p>Sustainable/ renewable Low embodied energy Reclaimable/recyclable/bio-degradable Non-toxic and naturally resistant to rot, bacteria and mildew Well suited to a breathable construction. Good sound insulation. Stable and durable. No protective equipment required to install.</p> <p>K value: 0.045 W/mK Cost: £9 per m2</p>	<p>Coconut-fibres are flammable, so the material must be treated with a fire retardant such as borax.</p>	


Insulation type	Cotton recycled	
	Cotton mill scraps or recycled cotton is mixed with a bulking fibre such as hemp and a thermoplastic binder like polyester. It comes in the form of slabs or rolls.	
Pros	Cons	
<p>Made from a mixture of 'waste' materials that would have gone to landfill and plant material. Low Embodied energy in the production process. Reclaimable/recyclable/biodegradable Low toxicity non-volatile additives for pest, fungal and combustion control; pose none of the considerable health concerns associated with synthetic pesticides. Well suited to a breathable construction. Good sound insulation. Stable durable and rot-proof. No protective equipment required to install.</p> <p>K value: 0.038 W/mk Cost: Between £8 per m2</p>	<p>Pest and combustion control is provided by borates; low-toxicity minerals with insecticidal, fungicidal, and herbicidal properties.</p> <p>Low-melt polyester added for structural integrity to be self-supporting in stud wall applications</p>	


Insulation type	Cork	
	<p>Cork is one of the oldest, most sustainable and effective sound and thermal insulations. It comes from harvesting the outer bark of the cork oak trees found around the Mediterranean, India and California. Production is sustainable when properly managed: The tree is first harvested when it is between 20 and 30 years old, thereafter the outer bark can be stripped every 8 -14 years as it grows back, older trees produce the best cork.</p> <p>The cork tree is unique in that the outer layer can be stripped off several times in a 200-year lifespan with no harm to the tree, thus providing a steady and renewable source of raw material. As this industry relies on healthy growing trees it also functions as a carbon sink, capturing and storing CO₂.</p> <p>Commonly used as underlay under hardwood and ceramic floors for its. The cork is reduced to granules that are expanded and then clustered together under high pressures and temperatures. No binders need to be added as the natural resins exuded during manufacturing fuse the granules together. The honeycomb structure of cork provides tiny cell-like compartments, which seal bubbles of air; providing a layer of insulation that means low conductivity for heat, sound and vibration.</p>	
Pros	Cons	
<p>Sustainable/ renewable production if trees are managed correctly.</p> <p>Low embodied energy</p> <p>Reclaimable/recyclable/bio-degradable</p> <p>Non-toxic and naturally anti-microbial, cork contains suberin, a natural wax which makes it impermeable to gasses, liquid and naturally resistant to rot, fire and termites; it does not absorb dust and is anti-static.</p> <p>Well suited to a breathable construction.</p> <p>Good resilience and good thermal and acoustic insulation performance</p> <p>Good sound insulation.</p> <p>Stable durable and rot-proof.</p> <p>No protective equipment required to install.</p> <p>Comfortable and attractive, can be used as flooring or wall covering.</p> <p>K value: 0.041 W/mk</p> <p>Cost: £2.50 per m² (8mm thick)</p>	<p>Some energy required to process.</p> <p>Some manufacturers may use chemical binders.</p> <p>Natural cork is hygroscopic and breathable however, cork that is altered chemically can lose its natural benefits.</p>	

Insulation type	Flax Slabs	
	<p>The fibres of the flax plant's stem are bound together with potato starch and treated with borax to make them fire and insect resistant. Standard thicknesses are 50, 75, 100, 125, 150 mm Available in batt or roll form. Roll form reduces the amount of seams (points of heat loss).</p>	
Pros	Cons	
<p>Sustainable/ renewable, providing carbon sink as plant grows. If grown organically they can add to bio-diversity, providing food and shelter for birds, small mammals and some wild flowers.</p> <p>Low embodied energy</p> <p>Reclaimable/ recyclable/ bio-degradable</p> <p>Non-toxic and natural</p> <p>Well suited to a breathable construction.</p> <p>Good sound insulation.</p> <p>Stable durable and rot-proof.</p> <p>No protective equipment required to install.</p> <p>Breathable due to its hollow-fibre composition benefiting the building and its occupants</p> <p>Flax fibre is very strong, and hollow enabling it to absorb up to 12% of its own weight in water, and its strength increases by 20% when wet. It also dries quickly, and is anti-static.</p> <p>K value: 0.038 W/mK</p> <p>Cost: £9 per m²</p>	<p>It is made in Germany; Finland & France and must be transported to the UK, adding to its embodied energy.</p> <p>Some products may use plastic binding agents</p>	

Insulation type	Hemp	
	<p>Hemp insulation is a natural fibre insulation material made from hemp fibres. It is thermally efficient having a thermal resistance of 0.040Wm/K. Sold in batts, the cubic metre rate equates to approximately £85. Cost per m2 at 100mm is about £8.43 plus carriage. Like wool insulation batts it does contain 15% polyester fibre to retain lift and stability and also has non-reacting salt additives to provide fire resistance.</p>	
Pros		Cons
<p>Very similar product to flax (see above) Sustainable/ renewable Low embodied energy Reclaimable/ recyclable/ bio-degradable It can be grown without pesticides and is naturally resistant to bugs and mould. Non-toxic and natural, sodium bicarbonate is added to act as a fire retardant. Well suited to a breathable construction. Good sound insulation. Stable durable and rot-proof. No protective equipment required to install. Made from a member of the Cannabis family that contains low THC, which is the psychoactive ingredient of Cannabis.</p> <p>K value: 0.038 W/mk Cost: £7-£8 per m2</p>		<p>Prolonged exposure to water will cause decay.</p> <p>Can be more expensive than conventional insulation materials.</p>

Insulation type	Perlite beads	
	<p>Perlite is a volcanic glass, which expands to 7-16 times its original size when heated to 900C, it is used as lightweight hollow beads suitable for use in wall cavities. It can be poured into wall cavities from above during house construction and has the advantage of easily finding its way into nooks and crannies, providing excellent cover throughout the wall.</p>	
Pros		Cons
<p>Naturally occurring mineral, disposable as is non-toxic. Reclaimable. Can be recycled at source. Stable durable and rot-proof. No protective equipment required to install.</p> <p>K value: 0.05 W/mk Cost: £2.50 - £3 per m2</p>		<p>Non-renewable resource. High embodied energy. Non-biodegradable. When installing perlite, be aware that poured beads are extremely lightweight and take a static electric charge very easily, and so are difficult to control. Any holes in the wall structure will leak beads.</p>

Insulation type	Straw	
	<p>Straw is inexpensive. Bales, panels or slabs can be used as partitions or linings for external wall and roof insulation. As a construction material straw reduces the need for timber and other more costly materials e.g. Thatched roof or straw bale construction. Precautions to prevent insect and moisture intrusion need to be taken. Straw produces its own resin, which binds it together under compression. It can be compressed into large panels. It is 100% natural but will be susceptible to decay if untreated.</p>	
Pros		Cons
<p>Natural/ sustainable/ renewable, providing carbon sink as plant grows. If grown organically it can add to bio-diversity, providing food and shelter for birds, small mammals and some wild flowers.</p> <p>Reclaimable/recyclable/bio-degradable</p> <p>Well suited to a breathable construction.</p> <p>Low embodied energy</p> <p>Non-toxic</p> <p>Well suited to a breathable construction.</p> <p>Good sound insulation.</p> <p>Stable durable and rot-proof if treated.</p> <p>No protective equipment required to install</p> <p>K value: 0.05 W/mk</p> <p>Cost: less than £1 a bale</p>		<p>Susceptible to decay if untreated.</p>

Insulation type	Wool Insulation and Felt	
	<p>'An effective insulation - as used by sheep all over the world!' Sheep's wool comes in slabs made of fleece off cuts, the wool is treated with borax to make it fire and insect resistant and then carded (combed) to produce a fine insulation mat.</p>	
Pros		Cons
<p>Sustainable/ renewable while sheep are bred for meat.</p> <p>Low embodied energy</p> <p>Reclaimable/recyclable/bio-degradable</p> <p>Non-toxic and natural</p> <p>Well suited to a breathable construction.</p> <p>Good sound insulation.</p> <p>Stable durable and rot-proof.</p> <p>No protective equipment required to install.</p> <p>Locally produced, ideal for Welsh housing!</p> <p>Copes well with moisture due to natural microbial action and can absorb 40% of its dry weight in moisture without effecting its insulating value, thus offering exceptional insulation and condensation control.</p> <p>It is good for summer coolness too as it reduces peak temperatures.</p>		<p>Can be expensive compared to other alternative insulation types.</p> <p>Sheep produce methane, which contributes to climate change.</p> <p>Some fleeces are imported from overseas, adding to embodied energy.</p>

Un-scoured fleece can be used to line walls
Does not sag or drop between joists.

K value: 0.037 W/mk
Cost: £9.50 per m²