Abstract

TESTING Alternative Insulating Materials

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For many years people have been stuffing materials in their walls to keep heat from escaping their homes. Modern insulation materials include vermiculite, cellulose, and fiberglass. This project seeks to find alternative recyclable materials that are similar or better in insulating value to save energy and make use of recyclable materials to replace typical materials. The recyclable materials that I tested were sawdust, fleece, and newspaper. It is hypothesized that the recyclable materials will keep the heat for a longer time than the regularly used insulation materials. The procedures for the experiment is to fill a tub with boiling water and have the tub inside a larger tub and in between the two tubs I would put the test insulation materials (which are the six that was listed above) and one the temperature reaches 200 degrees start a timer then every five minutes record the temperature till it reaches 2 hours and 20 minutes and do that for all six insulations. After I did the experiment it was shown that my hypothesis was proven incorrect. My results were that cellulose insulation was the best insulation material with the temperature at 192 degrees after 2 hours and 20 minutes and then the best recycleable material is newspaper with 190 degrees after 2 hours and 20 minutes. What I might do different next time would be to run the tests longer to see how much it would drop after 2 hours and 20 minutes.

Keep The Heat:
Testing Alternative Insulating Materials

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Introduction

For as long as most can remember people have been stuffing materials in their walls to prevent heat from escaping their homes.“In the old days, when we didn’t have good structural engineers, to be able to build a building you had to use a lot of material—and it had to be solid. You couldn’t put a lot of windows in there, and it needed to be pretty thick. So, you got decent R-value, just because…yeah, you used a lot.” (Yost,Lstiburek,Straube,Bailes, 2013) “R-Value is a measure of insulation’s ability to resist heat traveling through it. The higher the R-Value the better the thermal performance of the insulation.”(Recommended levels of insulation. 2013)

Building insulation is low-thermal-conductivity material used to reduce building heat loss & gain, and reduce noise transmission.("Cellulose insulation," 2014) The three types of conventional insulation materials used in this project are cellulose, fiberglass, and vermiculite.

Cellulose, when you first purchase it at the store, is packed together very tightly that when you install it you have to break it apart to be able to put it in, but when insulation installers put cellulose into a house they have a hopper which breaks it up for them and that is connected to a blower which blows the cellulose through the wall or into an attic. cellulose looks a lot like a gray fur ball or a dust ball it was pretty easy to work with in the experiment, but i am sure it would take more than one day to fill an entire house. it can be frustrating to work with sometimes because you have to wear gloves and a mask so that you don’t breath in the dust that it lets out when you are breaking it up. the dust can damage your lungs.” The word cellulose comes from the French word for a living cellule and glucose, which is sugar. Cellulose insulation is plant fiber used in wall and roof cavities to insulate, draught proof and reduce noise.” ("Cellulose insulation," 2014)

Vermiculite comes in large bags and when you pour it out it looks a lot like sand. Which is a coincidence because like sand “vermiculite is made out of minerals. Its name is from Latin vermiculare, to breed worms.” ("Vermiculite," 2014). When insulation installers install vermiculite they usually pour it into cracks in the walls or in the attic. Which is good for old homes that were built without insulation. Vermiculite is a naturally occuring mineral that looks like shiny mica flakes. When heated to a high temperature it expands into a fire resistant insulating material. ("Protect your family," 2013)

Fiberglass insulation, known as glass wool in the UK, is made of glass fibers arranged in a texture much like wool. Fiberglass insulation is designed in batts or rolls so it can fit in the wall cavities. The interweaving of the fiberglass traps the air in the glasses of fiber that is why if you compress fiberglass or make it tighter it lowers in R-value because if you compress it, it won't trap the air as well. (“Glass wool,”2014)

The three recycleable insulating materials that I chose were newspaper, fleece, and sawdust. The reason I chose newspaper is because it is a way of recycling newspaper. The reason I chose fleece is because it is made of recycled soda bottles. The reason I chose sawdust is because there are lots of woodworkers in the world that make sawdust and just throw it away and if there is a way to reuse it then we should reuse it.

In this project I will test three very good insulation materials with high R-values against some regularly used household materials to see if household materials works better than insulation materials. The problem that I want to solve is that without people knowing which insulation is the best we as a community we could waste a lot of energy. If energy is wasted then we won’t have much energy left for the things that actually need energy like cars, airplanes, TVs, devices, etc. without energy for those things we might just not have them. (and we know how

much we like them) A way to save energy is to pick some green options like green insulations " the color of home insulation isn't just pink. It's also green -- as in eco-friendly."
("Top 5 green," 2013)

I am interested in this project because I care about heat loss and wasting energy (and I, like other people like to have my devices) If I figure out which insulation is the best then people who are buying insulation, making insulation, selling a house, selling insulation, building a house, and so on, will know and if everyone knows than we can live without wasting energy through our houses and can all have our devices yeah!

Hypothesis

Due to research I believe that I have figured out what causes insulation to insulate (keep the heat) and I already know which insulation material is the best because of R-values, so I don't need to figure that out, but what I want to do in this project is see if something that is commonly used but no one has ever thought of it as an insulating material can insulate better than a commonly used insulating material. It is hypothesized that I can find a new insulating material that insulates better than regularly used insulating materials.

Procedure

In order to compare the the insulating values of each different materials, I measured the temperature change due to heat loss from boiling water in 2 hours and 20 minutes. To do this I put a 16 QT container containing 1 an a half gallons of boiling water inside a much larger container with the space between the two containers filled with each different insulating material. I put a lid over the container with a hole for a thermometer. I started the timer once the temperature dropped to 200^{o} and every 5 minutes recorded the temperature for two hours and twenty minutes. I repeated these steps for each insulation material and with no insulation as a

control. When the time was up I measured the remaining water to determine how much water evaporated during the experiment.

I would use newspaper as a test insulation material, i would use saw dust also as a test insulation material, cellulose, fiberglass, vermiculite are already insulations, foam board to not let the heat escape out of the top and bottom, I would use fleece as a test insulation, water is what I am testing the insulations on, oven for heating water to see how long it takes to cool down.

Results

The rate of temperature change for each of the six materials and the control were calculated divided the temperature change by the time. See table one below. The best conventional material was cellulose which had the slowest rate of change. Newspaper was the best recyclable material, in fact newspaper lost heat slower than both vermiculite and fiberglass. This research showed that rolling up old newspaper and putting it in your walls would work as well as other typical insulation materials used in homes today.

Table 1:

material	end temperature	temperature change	rate of change
control	174 ^{o} F	26 ^{o} F	11.2 ^{o} F/hour
sawdust	176 ^{o} F	24 ^{o} F	10.3 ^{o} F/hour
newspaper	190 ^{o} F	10 ^{o} F	4.3 ^{o} F/hour
fleece	183 ^{o} F	17 ^{o} F	7.3 ^{o} F/hour
fiberglass	189 ^{o} F	11 ^{o} F	4.7 ^{o} F/hour
cellulose	192 ^{o} F	8 ^{o} F	3.4 ^{o} F/hour
vermiculite	183 ^{o} F	17 ^{o} F	7.3 ^{o} F/hour

Conclusion

If I had the chance to redo this experiment I would put less water in the 16oz tub because it took so long to decrease in temperature. I was going to keep on going with the experiment until the temperature got to 100^{o}F but, it took so long to decrease in temperature that would just take too long. I would also change checking the temperature every 5 minutes to checking it every 10 minutes because every 5 minutes was just to constant and most of the time the temperature did not change that much over 5 minutes. I would also go longer that 2 hours and 20 minutes to see how the temperature changed after that because maybe the temperature would have a sudden drop in temperature or maybe even stay the same temperature for another hour.

Biography

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appendix 1

time	control (none)	news paper	fleece	sawdust	cellulose	fiberglass	vermiculite
o minutes	200	200	200	200	200	200	200
5 minutes	198	199	199	198	201	199	194
10 minutes	196	198	199	198	201	199	194
15 minutes	194	198	198	194	201	199	192
20 minutes	192	198	198	194	201	198	192
25 minutes	190	196	196	192	201	198	192
30 minutes	189	196	196	190	201	198	192
35 minutes	187	196	194	190	201	196	192
40 minutes	185	196	194	190	199	196	192
45 minutes	185	196	194	189	199	196	192
50 minutes	187	196	192	189	199	196	192
55 minutes	187	196	192	187	199	194	192
1 hour	185	196	192	187	198	194	190
1 hour and 5 min.	185	196	190	185	198	194	190
1 hour and 10 min.	183	194	190	185	198	194	190
1 hour and 15 min.	183	194	190	183	198	194	189
1 hour and 20 min.	181	194	189	183	198	192	189
1 hour and 25 min.	181	194	189	183	196	192	189
1 hour and 30 min.	180	194	189	181	196	192	189
1 hour and 35 min.	180	194	187	181	196	192	187
1 hour and 40 min.	178	192	187	181	196	190	187
1 hour and 45 min.	176	192	187	180	194	190	187
1 hour and 50 min.	176	192	185	180	194	190	187

1 hour and 55 min.	174	192	185	180	194	190	185
2 hours	174	192	185	178	194	190	185
2 hours and 5 min.		190	185	178	194	189	185
2 hours and 10 min.		190	183	176	192	189	183
2 hours and 15 min.		190	183	176	192	189	183
2 hours and 20 min.		190	183	176	192	189	183

acknowledgements

I would like to thank my dad for helping me with getting my materials and helping with doing my experiment. I would also like to thank Menards for donating the cellulose and vermiculite, and Kendall Lumber for donating the sawdust.