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Foam Types Used in Cushioning

Prepared by the Standards Committee of the Sustainable Furnishings Council, October 2009.

The purpose of this green paper is to assist consumers, buyers and furniture manufacturers in making decisions about the purchase of foam for cushioning, according to their values.

SFC considers Life Cycle Assessments (LCA) to be a key tool in evaluating the environmental impacts of products. LCAs, are readily available for manufacturers to conduct at a reasonable expense and they should be encouraged to do so as specified for credit in the SFC Standard.

This paper deals with foam used for cushioning in upholstered furniture. The same foam is used in mattresses, but they are subject to different regulations and are not covered in this paper. We have compiled a summary in the first section of what is currently known about these various product types. The second section deals with the future and offers parameters for where the industry might ultimately go on its path toward a viable industry that can be sustained over time.

Petroleum Based Foam

By far the most commonly used material for cushioning, petroleum based foam has two main components: petroleum derived polyols and toluene diisocyanate (TDI).[1] The industry has made a major effort to reduce the use of toxic chemicals, not only to meet or exceed government standards, but to reduce the overall impact of the manufacturing process in general.

The industry responded to consumer complaints of adverse health effects experienced after sleeping on petroleum based foam mattresses, by commissioning a test in 1995 to determine the levels of outgassing and dermal exposure of 34 chemicals. The results indicated very minimal levels of chemical exposure.[2] Yet today, an internet visit to product sites with customer comments yields numerous complaints of the same nature to various products made of petroleum based foam. It would appear that some individuals experience adverse effects from some formulations of this foam, but that the exact causes have not been determined. New certifications from BIFMA (Business and Industrial Furniture Manufacturers Association) and CertiPure may help consumers assess a product's toxicity.

Post industrial foam scraps are virtually all recycled into other products, leaving no waste scraps to go to a landfill. However, the product is difficult to recycle post-consumer, and frequently ends up in a landfill where it may not decompose for an extended period of time.

Petroleum based foam is highly flammable and needs fire retardant chemicals to pass the Cal 117 test. This is a laboratory test in which a flame is applied to foam for 12 seconds. While required only for foams sold in California, most cushioning will carry a white "Passes Cal 117" tag, because it's easier for manufacturers to produce to one standard.

The main advantage of petroleum based foam is its low cost. The main disadvantage is that it is made from a non-renewable source, petroleum, which will only become more expensive and scarce with time, eliminating the benefit of low cost. Thus, alternatives for cushioning are needed.

Natural Latex

Once widely used for cushioning, the use of natural latex declined rapidly after the advent of the cheaper, lighter, and easier to manufacture petroleum based foams. Made from the sap of the Hevea Brasiliensis (rubber) tree, the raw material for latex comes from a renewable resource. It is both recyclable and biodegradable, and has little or no off-gassing associated with it. As the sap of the tree is harvested primarily in third world countries, there are concerns with the labor and working condition problems generally associated with these areas, as well as deforestation. Third party certification would help to address these issues, and is just getting started. To date, the Forest Stewardship Council (FSC) has certified six latex plantations.

The energy it takes to produce latex foam is higher than that for petroleum based, due to heating, cooling and baking. But since it takes virtually no energy to tap a rubber tree, as opposed to the extraction of oil, the overall environmental footprint of natural latex is much smaller.[3] The more energy intensive production costs, as well as the limited supply of raw materials, make latex more expensive than petroleum based foam.

Natural latex is not highly flammable and does not require fire retardant chemicals to pass the Cal.117 test.

Habitat conducive to growing rubber trees is found in equatorial areas, mostly in Asia. There was far more acreage planted with rubber trees before petroleum based foam was invented than there is today, so there is enough suitable land to increase the supply of latex somewhat. Of course, other crops now grow where rubber plantations once grew, and it is not known if converting back to growing rubber trees would be economically and environmentally preferable. Because of the demand for natural latex, however, there is some risk today of indigenous forests being cleared to grow rubber trees. However, even if all of the conducive habitat was put into rubber production, there would still not be enough to replace all the petroleum based foam we use today, let alone what increasing populations will require. Indeed, there is no other material on Earth that is as plentiful as the oil we have extracted from the ground. No one alternative will replace it so we should be prepared to find multiple alternatives.

Polyurethane Foam Containing Bio-based Polyols

Replacing oil based polyols with bio-based polyols is a logical step toward viable alternatives to petroleum based foam. Currently, soy oil is the primary ingredient used by the industry to produce these alternative polyols, and the percentage of the soy polyol used to produce the foam is currently limited, by problems with a “burnt popcorn” smell associated with higher levels of soy-polyol content, to around 20%. This is not usually mentioned in advertising by companies utilizing this hybrid product, leaving the consumer with the impression that it is a “bio-based” or soy product, when it is essentially a petroleum based product with some soy content.

Over time, concerns have arisen with the production of conventional soy (as opposed to certified organic soy) which merit a close look.

The cultivation of conventional soy requires high inputs of nitrogen, which result in dead zones in the bodies of water that the fields drain into.

Since 80% of the world's soy is now genetically modified, and because there are no claims made that the soy used for foam production is certified organic, it must be assumed that the soy is grown from genetically modified seeds. They are genetically engineered to be resistant to the wide spectrum herbicide glyphosate, which means that an entire field can be sprayed with the herbicide, rather than selective spraying of weeds only. Widespread experience with soy and most other glyphosate resistant crops shows that eventually the organisms intended to be killed mutate to become immune to the glyphosate, necessitating the use of more and different herbicides in order to kill them. This increases the herbicide usage, and the cost, considerably. Yield eventually decreases, negating the original advantage of the genetic modification.

Additionally, genetically modified seeds can be carried by the wind into neighboring fields or any fields in the transportation path, which can contaminate organically grown crops.

The use of food grade soy for industrial applications puts tremendous pressure on Amazon rain forests, which are being cut down at an alarming rate in order to grow soy.[4] This demand may also result in higher food prices, or shortages, of a major global food source.

The combination of high chemical inputs and deforestation has a significant impact on global warming. Amazon deforestation is responsible for 20% of the world's carbon emissions, and 70% of Brazil's. Carbon is released by machinery and burning used in clearing. Halting new deforestation could be as powerful a way to combat warming as closing the world's coal plants.[4] Chemically intensive farming destroys the natural biological life of the soil, reducing its ability to store carbon. Research by the Rodale Institute indicated that biologically rich soil could absorb carbon through micorrizhal fungi which attach themselves to the roots of plants and pull carbon dioxide out of the air and through the plants to build carbon shells around themselves for protection. The Rodale report estimated that if all the tillable acreage in the world was converted to organic practices, we could sequester 40 percent of all of the world's emissions.[5]

Biobased products made from organically cultivated crops, over the course of their life cycles, substantially outperform petroleum based products in terms of pollution reduction including climate change mitigation.[6] We encourage the conversion of soy production to organic methods, which would:

- Eliminate about 30 listed hazardous wastes from pesticide manufacturing
- Eliminate substantial habitat destruction and water pollution from fertilizer extraction including phosphates
- Eliminate adverse health and ecological effects from pesticide application
- Eliminate substantial climate pollution from the extraction, manufacturing, distribution, and application stages of pesticides and fertilizers
- Eliminate endocrine disruptors
- Eliminate GMOs
- Sequester significant amounts of carbon

Although soy initially appears to hold great promise as an alternative polyol to oil, upon consideration of the environmental damage that conventional soy production causes, that assumption must be questioned.

Synthetic Latex

This is generally about 70% polyurethane and 30% natural latex. The terminology here is very confusing, as synthetic latex is often referred to as simply "latex." So is 100% natural latex. The Specialty Sleep Products Association is attempting to develop industry-wide standards for terminology, to eliminate confusion among consumers.

Recycled Foam

Polyurethane foam can be easily cut up and rebonded to form new, but firmer, foam, which is mainly used for carpet underlayment. This is now a well developed cycle, with recycled foam accounting for around 80% of all carpet underlayment, most of it coming from post-industrial scraps. By no means is all post-consumer foam recycled, however, and if it were, new uses would need to be found for it, because the supply would far outstrip the need for carpet underlayment.

One problem with recycling is that California forbids the recycling of foam containing PBDEs (polybrominated diphenyl ethers), which were used in many petroleum based foams as fire retardants between 1984 and 2004. PBDEs are endocrine disrupters that have been linked to memory impairment, delayed sexual development and disturbed thyroid hormone levels.[7] They are persistent and bioaccumulative, and present a significant challenge to the industry as they are hazardous to handle and hazardous to landfill.

Natural latex can be shredded and recycled into stuffing for pillow and plush toys, but again, very little post-consumer latex foam is actually recycled. A reclamation system for disassembling and recycling the component parts of furniture is sorely needed.

It should be noted that recycling of foam is really downcycling, meaning it is made into a product of lesser value than the original. This is not a true closed loop, which will be discussed in the next section.

Where Do We Ultimately Need To Go?

What would truly sustainable cushioning look like? That is, production that could be sustained indefinitely without damage to the natural systems which support life? To answer that question, we'll need to look to nature for operating principles.

Nature operates in a closed loop. Waste from one species becomes food for another. There is no waste in nature, no "away" to throw things. A product that is made from natural materials comes from the earth and should be returned to the earth at the end of its life cycle. An example of that is natural latex foam, which comes from rubber trees, and can be composted at the end of its useful life, back into feedstock for other species. Petroleum based foam, and anything mixed in with it, even biological materials such as natural latex or soy, can't.

Additionally, there is the concept of a closed loop industrial cycle. This is a cycle in which man made products can be continually recycled back into the same product, or another product at the same level of value. An example of this is nylon 6,6, which can be recycled from carpeting back into nylon 6,6 and used again for carpeting.[8] In order to be a closed loop, this kind of a process must not use, or create, any toxic materials, or it will degrade the natural systems that we all depend upon for life. While the original feedstock for these products may not be renewable (in the case of nylon 6,6, it is petroleum), it is a good way to make use of abundant materials that have already been created, which would otherwise end up in a landfill.

To get to what sustainable cushioning would look like, we would want to assess any candidate technologies against our goal of production that can be sustained indefinitely without damage to the natural systems that support life. To do that, we could ask these questions:

1. Is this product idea going to lead us toward our goal, or does it lead us away from it?

2. When considering multiple options, which choice gives us the greatest flexibility? Since we don't know what will happen in the future, it's important that we not get all of our investments tied up in something that we can't get out of, if that technology proves to be a dead end.

3. Can we develop this new product in an economically viable manner? This includes not just the short term costs, but the long term value.

As mentioned before, there is no one substance on earth that will replace oil for all the services we ask of it. In planning for new products, we need to ask "what is the service we are trying to offer?" In the case of cushioning, it would be comfortable, supportive seating. Then we need to open ourselves to new ways to provide that service. Some creative options currently on the market are office chairs made out of bungee cord, and the Aeron chair by Herman Miller, which is made of mostly recycled and recyclable materials. Petroleum based foam is so widely used for cushioning because it is cheap. That has created a class of disposable furniture items that litter our landscapes and fill our garbage dumps. The future of cushioning, and furniture in general, will need to be one that is designed entirely differently than our current reality. Creating that future is the challenge facing the industry today.

1.Robert J. Luedeka, in testimony to US House Committee on Foreign Affairs, July 17, 2008.

2.Assessment of Potential Health Risks Resulting from Chemical Emissions from New Bedding Sets. Available from the Polyurethane Foam Association www.pfa.org.

3.Life Cycle Analysis done for Teknion, Inc.
http://en.wikiversity.org/wiki/DFE2008_Office_Chair_Foam#Basics

4. http://www.nytimes.com/2009/08/22/science/earth/22degrees.html

5. "Regenerative Organic Farming, a Solution to Global Warming" by the Rodale Institute:
http://www.rodaleinstitute.org/files/Rodale_Research_Paper-07_30_08.pdf

6. SMaRT Sustainable Product Standard & Background Documents 2009: Sustainable Products Training Manual

7. Flame Retardants in the Bodies of Pacific Northwest Residents, A study on Toxic Body Burdens; Northwest environment Watch, September 29, 2004. www.northwestwatch.org

8. Ecotextile News issue No. 26, p.9, July 2009