The plastic
of the future

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Introduction

With this article we wish to introduce a new material and give a complete picture of the products of Ecovative. We want to explain to the readers the benefits of fungi and why fungi will help our world and future. Thanks to meticulous experiments and research, this material is becoming more improved. It is thus a very versatile material, environmentally friendly, low cost and no waste. Will fungi be the new alternative material of the future?

Ecovative is a company that is using fungi to make packages. The main goal of Ecovative is to replace polystyrene with fungi. One of the great things about this packages is that when you're done using it, it will decompose in the right environment. Meaning that there will be less waste or no waste at all. Companies like Dell and Steelcase are already using this packages for their products for years. And also IKEA will soon be joining them.

Ecovative (ecology and innovative) is cradle to cradle certified and has up till now two products which are Mycofoam and MycoBoard. Ecovative also gives the opportunity and option to grow it all by yourself, and this program is called MycoMake.

The **Mycofoam** is the environmental-friendly mushroom packages. It's an alternative and replacement for Styrofoam and other packaging materials.
MycoBoard is an alternative for plywood and is also made with the natural glue called mycelium.
MycoMake is a grow it yourself program that gives you the chance to make your own projects and products using the materials that Ecovative use. To do this you can buy the tools and materials on the website of Ecovative, under the section GIY. People and artists has been working with this product, and for example Danielle Trofe made some lamps, and Erin Smith a wedding dress. MycoMake gives people the opportunity to get creative and to let their imagination run wild. It encourage open innovation and people to take initiatives for creating new products. It also stimulates people to share their work and their knowledge (GIY community), which results in new ideas.

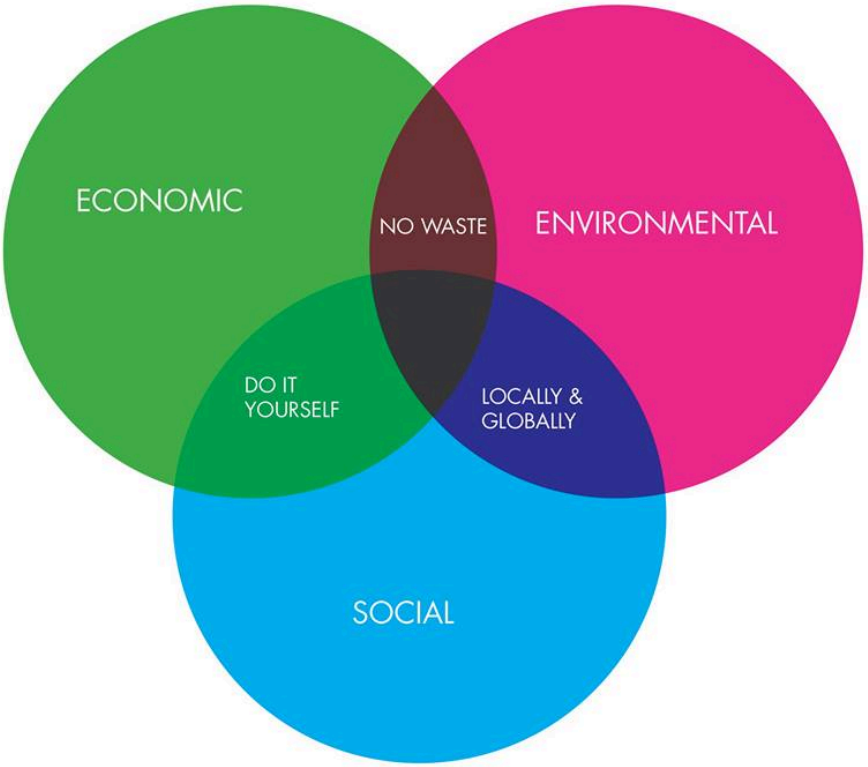
Ecovative buys agriculture waste (cotton burrs, rice hulls and buckwheat hulls) from regional farmers and cleans them by letting it go through a steam cleaner to eliminate mold, bacteria and insects. Putting mycelium in it and let it grow for a few days. Then it’s broken in particles again and put in a tool for a few days, where the mycelium will grow around the particles. This is where the mycelium starts to work. It excretes compounds into the agricultural waste, that's how it breaks down cellulose. It pulls in the cellulose, digests it and turns it into a polymer. So basically the organism is used as glue; a living glue that grows into every nook and cranny. After its solid, the material will be dried off to stop growing and to prevent mushroom growing or spores.
To keep other spores off of the material, Ecovative uses a steam heat process, but with the help from the National Science Foundation (NSF), it's working on a sterilization treatment made with natural oils that uses significantly less energy. Ecovative's technology already consumes one-tenth the energy used to manufacture foam packaging. The new treatment, made with a mix of cinnamon bark oil, thyme oil, oregano oil and lemongrass oil, lowers its energy needs down to one-fortieth, or about 2.5 percent, of that of foam.

The strength and flexibility of the foam can be adjusted in the mixture. More cotton burrs increase the thermal dynamic, more rice hulls makes it more fire-retardant.

The ecovative product will only degrade with the exposure of living organisms that is found in soil biota, and moisture. In other words they make a product out of agriculture waste that will eventually decompose and leave no waste. And this product is an alternative for polystyrene, which is one of our biggest waste problem. Polystyrene can take up to 500 or even 1000 years in landfills. Light breaks plastic down so it photodegrades rather than biodegrades. Unfortunately, we don't really know, as plastic is a relatively new invention. As for the ecovative products, within weeks it will start to decompose and completely biodegrade.

The three dimensions:

ENVIRONMENT: naturally decomposition, home compostable and sustainable (mycelium + agricultural waste=mushroom material), not derived from petroleum or food, alternative to plastic.
SOCIAL: "Grow it yourself mushroom material!" is a project to encourage open innovation. The company has also launched a series of initiatives to encourage products and has created a competition on the company to reward the best ideas.
ECONOMIC: cost competitive, receive agricultural waste purchased from regional farmers.



Fungal Futures
Ecovative is not the only one that is working with fungi, because here in the Netherlands different people are collaborating and researching about fungi. There was an exhibition, Fungal Futures, at Enschede about the fungi material. The exhibition showed different artist and people that are currently working with fungi such as Aniela Hoitink, Maurizio Montalti, Gianluca Tabellini, Jonas Edvart, Eric Klarenbeek etc. There was different products that were made such as a dress, a chair, shoes etc.

Fungal Futures shows the future of fungi and the possibility with it and also explains what it is. Fungi often consist of growing threads and the network of all threads of a growing fungus is called mycelium.
Fungi are nature cleaners, they live by consuming the remains of plants and woods. Depends on the fungus is the mycelium more or less elastic, brittle or heat proof.
Therefore fungi are easy to modify , which makes it possible to get the right characteristic by making the right combinations and applications. This creates fungi as material for furniture, but also fungi that looks like rubber, textile and leather. So you see that the possibility with fungi are large.

Many designers have turned the mycelium for use as fiber. These material offer attractive alternatives to traditional synthetics as it is 100% natural, fully compostable, with excellent insulating properties and can be produced from organic waste streams.

Benefits	
Polystyrene	**Fungi/Ecovative product**
can be recycled or reused	does not require fossil fuels to manufacture
is extraordinarily light and can support many times its own weight in water.	it's fully compostable (no-waste)
it is a great insulator.	Takes 5 to 7 days to make
Moisture resistant	Uses 98% Less Energy than Styrofoam
Resist bacterial growth	No chemicals
	low-cost
	Does not affect people's health
	Heat-proof (to a certain point)

Disadvantages	
Polystyrene	**Fungi/Ecovative product**
every 0.02 cubic metres of polystyrene requires a litre and a half of petroleum to manufacture.	Cannot be an alternative yet for all sort of packages.
It takes at least 500 years to decompose.	Is not certified for direct food contact at this time
Polystyrene contains the toxic substances Styrene and Benzene, suspected carcinogens and neurotoxins that are hazardous to humans.	No numbers, not much transparency about the costs, because it’s a new product.
Hot foods and liquids actually start a partial breakdown of the Styrofoam, causing some toxins to be absorbed into our bloodstream and tissue	
Danger to wildlife	

Conclusion

So as you can see fungi are being use for different products and in different ways, such as for making textiles, clothing, furniture, packaging, plywood etc. We believe that for now it's more suitable and more useful for using fungi for packages, because people have their particular taste and some would chose for the traditional textiles and clothing, while with packages people don't really care if it does it's job. It is also clearly better than the toxic polystyrene and this way we can reduce the plastic waste and harmful packages.
It will take years before we can replace most plastic with the fungi material, but this is already a great step for a better future. The mushroom packages are already on the market and people/companies are recognizing the value and benefits of this product.

On the other hand fungi textile and furniture's are still in the process and in research. Although it shows promising results, it cannot be put yet on the market because it is still in the beginning steps.
As for Ecovative's mushroom product, this is the beginning of so much more, since there is so many things that you can do with fungi and still a lot more to be discovered.

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