Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 2, Number 9; April-June, 2015 pp. 776-777

http://www.krishisanskriti.org/jbaer.html

Fungi Foams

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Abstract—*Styrofoam, the soft and white-colored foam, is one of the most rampantly used material for the protective packaging of stuff like televisions, refrigerators etc. but it has a lot of disadvantages, non-biodegradability being the most cardinal and grave one. So, in order to promote sustainability, a revolutionary material in the field of packaging and insulation is developed recently called Fungi Foams. Since they are made up of agricultural byproducts and natural mushrooms i.e. a type of fungus, they are absolutely bio-degradable unlike the Styrofoam, which is used profusely in the present world but are just lightweight as their artificial competitor. Fungi Foams, as people generally call them, are formed by allowing strands of the fungi, which act like a binder to glue everything together, to cultivate around organic matter for nearly 5 days. Then, it is heat dried in order to kill the live fungi so that it might not sprout or pop out ever. Apart from being easily biodegradable, Fungi Foam is technically edible, although it is not recommended to gulp it on a general purpose.*

Its uses hold infinite possibilities. It can serve as a really great alternative to the universally accepted and used foams made up of Expanded Polystyrene (EPS), Expanded Polypropylene (EPP) and Expanded Polyethylene (EPE) as it provides the same usual benefits like its artificial counterparts but also generates infinitesimal Volatile Organic Compounds (VOCs) which are deleterious to humans as they have respiratory, allergic and immunity relatedeffects on us. Besides, it may also be used in the insulation of buildings as it has Class A fire rating

So, basically, this is a plastic which is GROWN not chemically SYNTHESIZED.

1. POLYSTYRENE FOAMS

1.1 Introduction

What we generally know as Styrofoam or Thermocol, are just market names for foams made up of Polystyrene, which is a synthetic polymer made up of Benzene (the reason behind calling it as an Aromatic Polymer). As the name suggests, it is a multiple chain of the monomer Styrene. It is rampantly used in the present world due to its light weight and easy manufacturing. It has numerous uses in the daily life running the gamut from protective packaging to heat insulation. According to a report, due to the extensive use of them, their market value is predicted to rise as much as US$15 billion until the year 2020.Polystyrene Foams are produced by expanding the Polystyrene polymer using some sort of expanding or blowing agents to expand them. The bubble type formations generally seen in the “Thermocol” or “Styrofoam” are the result of these expanding agents only.It takes one and a half liters of petrol to manufacture a Styrofoam strip which is 33 cm long.

1.2 Detrimental effects of Polystyrene Foams on the environment

Beginning with their production, the Polystyrene Foams, like the Extruded Polystyrene Foams, are made up of Hydrofluorocarbons which are very well known for their vital role in the global warming and hence the depletion of the Ozone layer in the Stratosphere as much as the whopping 1000-1300 times the potential of Carbon dioxide.

As far as the tenure of their serving is concerned, they are packed in the cartons of the electronic appliances for the time they are being transported to their respective destinations and as soon as the boxes are unpacked they are thrown away and nobody gives a thought what happens to the white colored fluffy materials that just saved their televisions or refrigerators from the hefty bumps and jerks on their way from the manufacturer. So, technically, they aren’t used for more than a week or so. After getting thrown away by the consumer, they are either thrown in a landfill, where they lie for thousands of years and further poison the soil or are just thrown away in the seas and the oceans where they disturb the marine life as various organisms swallow them and die. They are completely NON-BIODEGRADABLE, which means that they can’t be destroyed by the environment on its own. They are incinerated as well, where they are burnt at very high temperatures ranging from 800-1000 degree Celsius. Doing so leads to generation of Carbon dioxide which is also a very harmful element for the environment.

In a nutshell, the artificially synthesized Polystyrene Foams pose a very big threat to the planet and its organisms and due to their rapid usage, they must not be used and some better alternative in context of biodegradability should be searched for.

2. FUNGI FOAM–THE BIODEGRADABLE ALTERNATIVE

2.1 Introduction

Taking into consideration the need for finding the alternative to the generic Styrofoam, two classmates from Rensselaer Polytechnic Institute and the co-founders of the company

Ecovative Design, Eben Bayer and Gavin McIntyre developed a revolutionary material, which they call it MycoBond or generally called as Fungi Foams which aremade up of mushrooms by using the strands of the roots called Mycelium as the microbinding material for gluing the agricultural biproducts together. Just like Polystyrene is a synthetic polymer, according to Eben Bayer, Mycelia is a natural polymer and we should always go for the natural alternatives in order to pass on a better planet for our coming generations to live on.

2.2 Manufacturing

Unlike Styrofoam, it requires just some commonplace materials to manufacture the MycoBond which include water, feedstock material like rice, wheat, corn, hazelnut, cotton husk etc, molds according to the shape required,oven and of course, the fungi i.e. Mushrooms. The basic theory behind this tremendous technique is that fungus needs energy to grow and this energy is provided to it by the feedstock which have Cellulose in them. The fungus keeps growing and consuming the feedstock material in order to make a strong polymer matrix.

Initially, the feedstock material is washed nicely and dried. Then, it is placed in the desired shaped molds with water and Mycelium and allowed to incubate for about 5 days in a dark place and it is, later, heated at high temperatures in order to kill the fungus so that the mushroom doesn't sprout or pop out of the foam. In the end what we get is an incompressible light weight foam which is similar to Styrofoam in physical properties.

2.3 Uses

Styrofoam and the similar products are used in almost every commonplace items like cars, electronic and electrical appliances, buildings, naming a few. Fungi Foam is the all encompass alternative to the basic Styrofoam, therefore, it can be used in each and every field where Styrofoam can be used. The uses include **protective packaging** purposes for providing safety to various fragile and brittle stuff and appliances like televisions, air conditioners, refrigerators etc., in **marine uses** like in surfboards, fins, handplanes etc., in **automobiles** for various insulation and absorption coatings and packaging, in **buildings** for heat, fire, sound, moisture and gas insulation, just to name a few. Fungi Foam has practically countless applications.

3. WHY IS MYCOBOND THE BETTER PLASTIC?

Being equally light in weight, MycoBond has practically humungous number of benefits over the conventional synthetic foams. The most cardinal and basic benefit is that it is BIO-DEGRADABLE since it is made just of the naturally occurring materials like fungus, feedstock material, water etc. Unlike the Styrofoam, it won't be there for a thousands and thousands of years buried in the pits or floating around the water bodies. It will get absorbed in the soil and will even further enrich the soil acting as a manure which is the reason that people won't be needing to throw the "protecting material" of their stuff into the garbage, rather, they can simply throw it in their gardens or backyards which would be beneficial for everybody including the microorganisms in the soil. Besides, these are very cheap and easy to grow as they require just the basic materials of common life and that too the agricultural waste and byproducts like various types of husk due to which the wastage will be maximum utilized and lest amount of manufactured goods will be required for its production. Being the icing on the cake, it can be grown in different countries using their respective materials. For example, India has an abundance of wheat and rice crops, so, the husk from these crops can be used to grow the MycoBond and similarly for different areas because the fungus requires the husks to form micro bonds and to have Cellulose from it. Although this is not recommended, but these Fungi Foam are edible too, which means they won't harm the organisms who swallow it mistakenly unlike the Styrofoam which may lead to the death of the organism. Since they are grown in dark rooms, they require comparatively low amount of energy for their growth. They have better energy dissipation and sound absorption than the general artificial foams. Volatile Organic Compounds (VOCs) are chemicals that have high vapor pressure at room temperature. They possess a great threat for the humans' health as they have respiratory, allergic and immunity related effects on us. Fungi Foams generate a very low amount of VOCs as compared to Styrofoam.

4. CONCLUSION - MY OPINION

According to me, MycoBond or Fungi Foam, as people know it, is the icebreaker in the field of Civil and Environmental Engineering and not to mention the field of humanity where we will be passing on a healthier planet to the generations of the future and leaving a great impression of responsibility over to their shoulders. I think it will serve its purpose to the fullest of serving the nature and to replace the conventional Styrofoam. Using the Fungi Foam, the planet will be saved and the lots and lots of non-biodegradable waste won't be teeming the Earth.

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