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Lesson 3: Mycelium as a composite material

Objectives:

1. Understand how mycelium creations are composite materials.
2. Identify examples of chemical resins in today's industries.
3. Apply mycelium composite materials to the marketplace.

Warm Up
Make observations on your finished mycelium product. Its mass, texture, strength.

Mycelium as a composite material
You may have noticed that the substrate in your mycelium creation is hemp. Since fungi are natural decomposers in the ecosystem, mycelium easily feeds off of the hemp fibers for nutrients, just as fungi may grow on a rotting log in the forest. They can also feed off of byproducts from agriculture, like the husks and stalks left over from crops. As the mycelium continue to spread their hyphae strands through the substrate to feed, a composite material is formed. The mycelium acts as a binding agent, solidifying the hemp into a particular mold or shape. Then this mold or shape can be suited to a specific purpose.

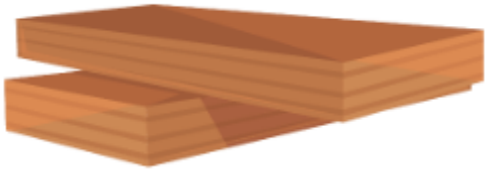
Why hemp?
While mycelium will happily feed off of byproducts from forestry, like wood chips, hemp hurd can offer another sustainable solution for a composite. Hemp yields more biomass than wood, and up to two times more usable fibers than wood per acre. Hemp can produce three times more cellulose than the same trees, which is a multi-use fiber that can become many products. It's quick growing and resilient in dry environments. Because hemp is 100% plant material, it is biodegradable and leaves no chemical traces into the environment.

Hemp or *Cannabis sativa*, is able to produce tetrahydrocannabinol, or THC (a chemical compound responsible for the plant's psychoactive effects in marijuana). However it is commercially grown at extremely low THC levels, negating its use as a psychoactive drug. Alongside bamboo, hemp is one of the fastest growing plants in the world. It has been used for thousands of years by human civilizations, and has a role in many markets today, including textiles, animal feed, biofuel and natural remedies.

Figure B; hemp grown by farmer Kelsie Schiechl of Heartland Farms LLC, Colorado

What is resin?

Mycelium acts as a binding agent to bind together the hemp hurd into a particular mold. A material scientist would refer to mycelium as acting as a 'resin'. In production, resins are sticky substances that can bind together composites, or be used as a varnish or coating. They can be made from plants or synthetic materials. They have a complex chemical structure containing many carbon atoms. In the production of furniture, a synthetic resin glues together several pieces of wood material to make particle board or plywood. Toys, medical equipment and household products often contain plastic, petroleum based resins.



Take a look around your classroom now. If you're wearing sneakers, they are probably binded together with a polyurethane adhesive. The covers and pages of textbooks are held together by polyvinyl acetate. Scotch tape and self-sealing envelopes use natural rubber. Plywood or particle boards, perhaps in the desks, use amino resins.

Activity: Vocabulary Check

Take a picture (or draw a sketch) of your own mycelium creation and label it correctly using the following terms:

- Hemp hurd
- Mycelium
- Substrate
- Composite
- Resin

- Growth form

Reflect

1. Is the substrate for mycelium material coming from a sustainable source?
2. In what way does mycelium act as a natural glue, or resin?
3. Given what you know now about the composite nature of mycelium, what types of products are possible to make out of this? Brainstorm a list.
4. Of the list that you brainstormed, which products do you think would be most successful among consumers? Why?