

- Adhesive:** able to stick to a surface or other substance
- Biodegradable:** capable of being broken down by decomposers back into inorganic particles.
- Chemical compound:** a substance containing atoms from two or more chemical elements.
- Composite:** made up of several distinct materials.
- Compostable:** capable of being broken down by decomposers into inorganic particles, that can all be reused by producers without pollutants.
- Covalent bond:** a bond existing between two atoms, where the electrons are shared.
- Growth form:** the mold used in order to shape the mycelium composite as the mycelium digests its substrate.
- Electronegativity:** the tendency of an atom that is covalently bonded to attract electrons closer to it.
- Flammability:** the ability to ignite or burn easily.
- Hemp hurd:** the woody, inner part of the stalk of a hemp plant.
- Heterogeneous:** a physical mixture of different substances.
- Hydrogen bond:** a weak bond between two molecules
- Hydrophilic:** a tendency to dissolve in water.
- Hydrophobic:** an inability to dissolve in water.
- Material science:** the study of the design and application of materials for use in various industries.
- Mycelium:** mainly composed of natural polymers, they are the vegetative part of a fungus organism.
- Partial charge:** an electric charge that is less the charge of an electron.
- Polarity:** the state of a molecule where there is a difference in electrical charge between atoms.
- Raw material:** materials that are harvested directly from nature.
- Resin:** a polymer used as an adhesive or glue.
- Solubility:** the ability to be dissolved, usually in water.
- Substrate:** the substance that is acted on in a chemical reaction.
- Sucrose:** a chemical compound, also known as 'table sugar'.
- Sustainable material:** the life cycle of a substance does not upset the balance of the ecosystem.
- Synthetic material:** artificially made

## Curricular Standards

The module is appropriate for the physical sciences, grades 7-12, and incorporates the following topics:

- Introduction to material science as a discipline
- Composite materials versus chemical compounds
- The role of electronegativity in adhesion of materials
- The role of polarity in solubility of materials
- Scientific method practice with flammability and hydrophobicity
- Introduction to biodegradable and compostable materials

NGSS & Common Core Standards	
Lesson 1: What do material scientists do?	Lesson 2: Composites versus chemical compounds
<p>NGSS.CCC.6 - The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.</p> <p>NGSS.CCC.CETAS - Science and engineering complement each other in the cycle known as research and development (R&amp;D).</p> <p>NGSS.CCC.CETAS - Modern civilization depends on major technological systems, such as agriculture, health, water, energy, transportation, manufacturing, construction and communications.</p>	<p>NGSS.CCC.6 - Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.</p> <p>MS-PS1-2 - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</p> <p>NGSS.SEP.8 - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.</p>
Lesson 3: Mycelium as a composite material	Lesson 4: Adhesion and electronegativity
<p>NGSS.CCC.6 - Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.</p> <p>NGSS-MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.</p> <p>NGSS-HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</p> <p>NGSS.CCC.CNS - Science and engineering are influenced by society and society is influenced by science and engineering.</p>	<p>NGSS.CCC.6 - The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.</p> <p>HS-PS2-6 - Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.</p> <p>NGSS.SEP.8 - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.</p>
Lesson 5: Is mycelium safe?	Lesson 6: Is mycelium water repellant?
<p>NGSS.CCC.1 - Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.</p>	<p>NGSS.CCC.1 - Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.</p>

<p>NGSS.SEP.3 - Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.</p> <p>NGSS.CCC.CETAS - New technologies can have deep impacts on society and the environment, including some that were not anticipated.</p>	<p>NGSS.SEP.3 - Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.</p> <p>HS-PS1-3 - Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.</p>
<p>Lesson 7: Biodegradable and compostable materials</p>	<p>Lesson 8: Advocate for mycelium</p>
<p>CCSS.RH.6-8.7. Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.</p> <p>NGSS.CCC.5 - Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.</p> <p>NGSS.SEP.8 - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.</p> <p>NGSS.SEP.3 - Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.</p> <p>NGSS.CCC.CETAS - New technologies can have deep impacts on society and the environment, including some that were not anticipated.</p>	<p>NGSS.SEP.7 - Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.</p> <p>NGSS.SEP.7 - Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.</p> <p>NGSS.SEP.6 - Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.</p> <p>NGSS.SEP.7 - Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.</p> <p>CCSS.WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection and research.</p> <p>CCSS.WHST.9-10.2d - Use precise language and domain specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.</p>