Acetobacter Xylinum & the Development of an Alternative Biodegradable Textile

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The purpose of this experiment was to derive a textile out of a symbiotic culture of bacteria (acetobacter xylinum) and yeast (SCOBY), and chlorella algae. Engineering goals for this textile included the following: for it to decompose faster than traditional textiles, specifically polyurethane leather, to be folded and hand-sewn with 0.15 mm thread, and to have a carbon-sequestering period of 48 hours. The fabric was generated by brewing kombucha tea and integrating algae to allow fermentation and a biofilm to develop. Biodegradability rates were tested and compared using mass loss percentages. The kombucha textile along with cotton, polyester, and synthetic leather textiles was cut into circles (2-in diameters), weighed (in grams), and individually placed into compositing aquariums. After 15 days, the results yielded mass losses of 16.7% of kombucha SCOBY textiles, 8.73% of cotton textiles, 0.73% of polyester textiles, and 0.03% of polyurethane synthetic leather textiles. From these results, it can be concluded that the textile derived from kombucha decomposed at a faster rate than traditional textiles. Carbon absorption rates of kombucha textiles with varying algae concentrations (10mL, 25mL, 50mL) were tested by measuring pH levels using a hydrocarbon indicator solution. The starting pH of the solution was 8.4, which is representative of a standard 0.04% carbon dioxide level in the atmosphere. When CO2 is absorbed, atmospheric pH decreases. The results of the pH tests were too inconsistent to draw a conclusion. The increases in pH were not significant enough to conclude that photosynthetic activity was occurring. More research is being conducted to successfully achieve a prototype that can photosynthesize and sequester carbon dioxide.

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