Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Invention)
(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: JABC058

Project Title: Aerial root bandage

Project Type: Invention

***To our best knowledge, there <u>are no</u> similar works in the market*; (if there are,) related product links are as below:**

I. Background

- In traditional Chinese medicine, aerial roots are used for rheumatic disease, epistaxis, injuries from falls over a long time. In our school, there are lots of big banyan trees (Ficus macrocarpa) around the campus. Sometimes their aerial roots would grow so long such that they needed to be cut off. In view of this situation and the above discovery, we want to investigate whether we can make use of this wasted aerial roots from banyan trees and transform it into aerial root's bandage

- We found that aerial roots coming from banyan trees are mainly made of triterpenoids (2) which have natural effects that can help wounded people to recover their wounds. Recent studies identified a variety of additional biological activities including antioxidant, antimicrobial, antiviral and antiallergic of triterpenoids.

- Compared with the normal bandage in many conventional shops and markets, our aerial root's bandage has a more efficient effect on recovering the wounds of wounded people. While normal bandage is used for covering the wounds to prevent bacterial infections, ours did not just contain this effect but also provide a better treatment on wounds such as providing a more breathable and hypoallergenic material. We also found that some bandages in conventional shops are made mainly from materials that are non-biodegradable. On the other hand, our product of aerial root's bandage is made up of 100% natural material, which mean they are totally biodegradable and environmentally friendly.

II. Objectives

- Nowadays, healthcare facilities around the world generate large amounts of uninfected waste. Used waste is either buried in landfills or disposed of through inadequate incineration. However, each of these practices can significantly negatively affect our environment. With aerial roots' easy decomposition and regenerative properties, we can strike a balance between health care and environmental protection to achieve waste utilization and reduce waste.

- The skin is the largest tissue structure of the human body and the first line of defense against external pathogens. When the skin is injured extensively, it may cause an imbalance in body functions, serious organ disorders, and even death. After the skin wound is treated with medicine, it will still be in contact with clothing or the outside world, which may cause the wound to deteriorate due to collision or contamination with dust or bacteria in the air. Therefore, we can use our invented bandage to avoid wound exposure to the air and promote wound healing. Many conventional bandages use adhesives to help them stick to human skin and cover wounds. But it's possible to be allergic to the materials in these adhesives. It's also possible to be allergic to the latex or rubber accelerators in the bandage itself. On the contrary, our invented bandage is breathable and non-

allergic to human skin since we use 100% natural ingredients to make the product.

III. Methodology

- First, we need to prepare our raw ingredient of our bandage, which is aerial root. We collected 190g of aerial roots with good-quality from the banyan trees in our school campus. Then we cut the aerial roots into pieces of about 1 to 2 cm using scissor. Next, we use the blender to further cut off the aerial roots into smaller pieces. Then, we soak the aerial root pieces into 5%(w/v) sodium hydroxide and put it into the water bath at 70 degrees Celsius for about one hour.

- Then we soak the aerial roots pieces into hydrogen peroxide solution with 5% (w/v) sodium hydroxide solution for about 2 hours for bleaching. The aerial roots residue is then separated from the mixture by filtration. The pretreated cellulose is washed with distilled water to reach neutral pH value. The washed cellulose is then spread into a plastic wrapping paper and we use a hammer to flatten out the cellulose so that it become a sheet with very little thickness just like a bandage. The flattened cellulose bandage is then left at room temperature to dry for 2 to 3 days.

- In order to test the quality and the effectiveness of our aerial root's bandage, we decide to carry out the following experiments to test several aspects of our aerial root's bandage such as the breathability, antibacterial ability, biodegradability, and absorbency of blood. The details of the experiments are as follow.

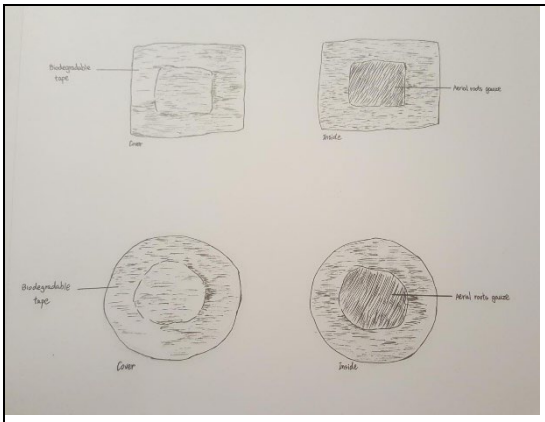
- Breathability Test: First, we put 15g of the water inside a beaker with the help of dropper and use our aerial root's film to cover the opening of it. Then, we put one the beaker inside an analytical balance to measure the change in mass of the setup due to the evaporation of water. We also set up a table lamp to provide heat energy to increase the rate of evaporation so that the experimental results are more obvious. We record the loss in mass of water on every 10 minutes interval for over an hour. We then use those data to plot a graph on weight loss versus time.

- Biodegradable Test: We measure the initial mass of the three bandages and bury them under the soil. Then we place them in the same environment in order to keep the same temperature and humidity. After 10 days, we take out the bandages and measured their new mass.

- Anti-Bacterial Test: First, we put the bandages inside the petri dish. Then we use a dropper to add a drop of water sample from toilet on the bandages. Finally, we pour the agar solution into the petri dish and we put them inside the incubator for a week.

- Absorbency testing: We test the unconstrained free absorbency ability of our aerial root bandage. Frist, we pour 10 ml of artificial blood inside a Petri dish. Then we measure the mass of the artificial blood with the help of an electronic balance. We prepared an aerial root bandage in the shape of square like those traditional bandages and measured its mass. Subsequently, we use a forceps to put the aerial root bandage into the Petri dish for artificial blood absorption for 10 seconds. After pulling it out we measured the Petri dish again to see how much test fluid has been absorbed.

IV. Design of Invention



In the design of our product, we used the aerial root bandage for wound dressing together with a biodegradable tape like bamboo tape to stick the bandage on our skin.

V. Application / Market Need

- In the biodegradability test, after we have taken the samples out of the soil, we measured the mass of them and compare it with the original mass. The mass of the aerial root bandage decreased by around 7% of its initial mass. For the Absorbent Gauze Swab and "Cancare" Adhesive Wound Dressing which we brought from the market, there are no change in their mass after 10 days in soil. Hence, we can conclude our aerial root bandage has a greater biodegradability than others.

- In the breathability test, after we have measured the mass of water loss for each 10 minutes interval for over one hour. The beaker that was covered by aerial root bandage have lost about 0.08 g of water due to evaporation, which is about 0.209 % of its initial mass. On the other side, the mass of water in the beaker that was covered by "Cancare" Adhesive Wound Dressing have lost about 0.022 g of water due to evaporation, which is about 0.058% of its initial mass. Therefore, we can conclude the breathability of aerial root bandage is about 4 times higher than that that of "Cancare" Adhesive Wound Dressing.

- The unconstrained free absorbency of the aerial root bandage was about 4.24(g/g), which mean 4.24 gram of artificial blood can be absorbed freely per unit gram of aerial root bandage. The unconstrained free absorbency of the Absorbent Gauze Swab and "Cancare" Adhesive Wound Dressing were 7.85 and 0.29 respectively. We can conclude the blood absorption ability of the aerial root bandage lie in the middle. Blood absorption is a very important element in wound healing material. With high or low blood absorption capacity, such as gauze, it may cause extra blood loss to the wound. Therefore, our product is targeted for wound dressing when blood absorption ability should not be too high or low.

- In the anti-bacteria test, we found that there are one bacterial colony formed in the sample using "Cancare" Adhesive Wound Dressing. There are no bacterial colony formed in the sample using aerial root bandage. This shows the aerial root bandage had a higher antibacterial ability than the commercial one.

VI. Conclusion

- To conclude, the aerial root bandage has good breathability and antibacterial ability. It is biodegradable and made up of 100% natural material. The blood and water absorption ability are good as well. We are confident that the use of aerial root as a material for wound dressing would be a feasible alternative for the market.