MUSHROOM HEALERS:
Evaluating the Characteristic of Agaricus Bisporus Infused Hydrogel Strips to Enhance First Degree Burn Healing

ABSTRACT

This study evolved from my initial study about the antimicrobial property of mushroom extracts that presented button mushrooms, Agaricus Bisporus, to be the most effective extract to prevent the growth of certain bacteria. Pursuing the antimicrobial effect of *A. bisporus* and its other possible inert characteristics, this second year study will show whether it could enhance the effects of a hydrogel strip to be used for first degree burn healing.

Burns, in general, require a moist environment and an appropriate pH level for effective healing. To meet these healing requirements, the hydrogel strips were infused with varying concentrations at 10 ml, 30 ml, 50 ml, and 70 ml of *A. bisporus* extract and evaluated for moisture retention capacity, absorbency and pH level.

Moisture retention was measured by its percentage mass loss over time. On the other hand, the absorbency, or swelling ratio, was measured by observing the weight of the strip after it took up some fluid. Moreover, the pH leachate was noted using pH strips.

Results showed that increasing extract concentration improved moisture retention and absorbency while maintaining most pH levels at 7. The 70 mL concentration demonstrated the highest moisture retention and absorbency with a mildly acidic pH of 6.

These findings suggest that *A. bisporus* infused hydrogel strips may be an effective alternative to promote healing in first-degree burns by maintaining moisture, absorbing exudate in case of misjudged cases, and supporting an optimal wound environment. Together with the antimicrobial property of the button mushrooms, the strips would give you a more efficient organic medium to take care of burn cases.

STATEMENT OF THE PROBLEM

This project focuses on creating and evaluating the characteristics of Agaricus Bisporus infused hydrogel strips to enhance first degree burn healing. To be specific, this project will answer the following questions:

1.Will the *A. bisporus* infused hydrogel strip have moisture retention capacity?

2.Can an *A. bisporus* infused hydrogel strip demonstrate absorbency?

3.Does the pH level of an *A. bisporus* infused hydrogel strip fall within the range necessary for a first-degree burn?

4.Will varying amounts of *A. bisporus* extract concentration on the hydrogel strip affect its pH, moisture retention capacity and absorbency?

BACKGROUND RESEARCH

The First-Degree Burn

Although a first-degree burn is not an open wound, the surface of the skin may become hydrated because of passive evaporation. This type of burn is usually superficial and can be seen and felt as red, painful and dry.

Clinically, first-degree burn has little to no exudate since the skin is intact but may, at times, be misclassified early. The burn area may sometimes show just initial signs of redness and pain but may later develop blisters which would indicate a second-degree burn.

First-degree burns are slightly acidic with pH ranging from 4-6 to support barrier function. It is essential to maintain the slightly acidic pH to promote healing. Making the burn area alkaline will enhance bacterial growth which will not help the healing process.

Burn Healing Requirements

Burns heal best in a moist environment and not wet. A wet area around the wound makes it macerate endangering tissues for more damage. A damp environment, however, promotes healing by maintaining enough moisture that is needed to keep the wound from being dry.

In case blisters start to appear, exudate would increase. This means that fluid would start to accumulate at the wound area making it wet. The extra fluids need to be reduced to keep the area simply moist and not wet.

pH levels that are skin compatible or mildly acidic are best suited for first degree burns. Extreme low or high pH levels will retard the healing process.

Hydrogels as Occlusive Dressing for Burns

Hydrogels can reduce pain due to their cooling effect. When the hydrogel is exposed to the heated surface of the burn area, the water within the hydrogel evaporates and contributes to the cooling effect. This effect, in turn, helps minimize the pain.

In addition, hydrogels can give protection to fragile healing tissue. The hydrogel can serve as a physical barrier when placed on the burn wound preventing bacteria and other substances from getting into the area.

Hydrogels also have low adherence that will be less traumatic during dressing change. This means that people using hydrogels for dressing will ease themselves of extra pain when the dressing is being pulled away from the wound which can, most of the time, add stress and anxiety to the patient.

The Power of Agaricus Bisporus

A. bisporus contains beta-glucans that have moisturizing and wound supporting effects. The beta-glucans carry with it antioxidants, anti-inflammatory and anti-bacterial properties that can enhance burn wound healing.

A. bisporus also has chitin which has good water retention property. This property will allow the maintenance and sustain a moist environment for the burn wound as it heals.

In case blisters and fluids begin to appear, indicating that the wound is a second-degree burn instead of a first-degree, the polysaccharides in *A. bisporus* can help prevent the wound area from getting too wet as polysaccharides are known to be good absorbers of exudate.

Furthermore, *A. bisporus* has good anti-microbial property which has been proven medicinally. Preventing the growth of bacteria in the wound will lessen the chances of infection.

HYPOTHESIS

The efficiency of *A. bisporus* hydrogel strips as a first-degree burn dressing, as demonstrated by moisture retention, absorbency and pH levels, will be enhanced as the extract concentration infusion increases.

VARIABLES

The **independent variable** in the experiment is varying concentrations of the *A. bisporus* extract infusion to hydrogel strips.

The **dependent variable**, on the other hand, accounts for the moisture retention capacity, absorbency and pH level.

Constant variables that come into play in the experiment would be the hydrogel formulation and the size of the strips tested.

METHODOLOGY

The project underwent several phases for its completion. Caution was taken at each step to make the results as reliable as possible.

PHASE 1

Phase 1 entails the preparation of the materials and obtaining the extract from *A. bisporus.* After purchasing the button mushrooms from the supermarket, they have been washed to lessen possible contaminants. The mushrooms were measured, *figure 1*, minced and were soaked in ethanol before grinding them as shown in *figure 2*. Moreover, the mixture was filtered to get the initial extract. The extract was then placed in glassware and subjected to a water bath to evaporate the ethanol and leave the final extract.

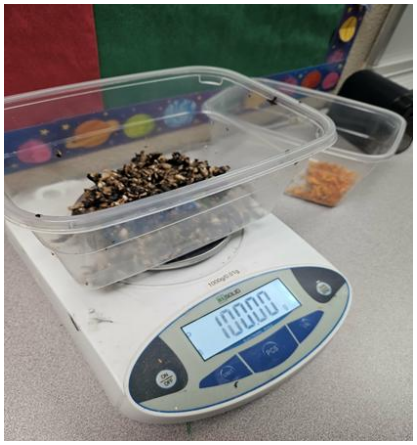


Figure 1

Figure 2

PHASE 2

Creation and molding the hydrogel strips with varying *A. bisporus* extract infusions of 10ml, 30ml, 50ml and 70ml were the focus of phase 2. A gelatin - glycerin hydrogel mixture was prepared in 4 batches to have the different amounts of infusions ready, *figure 3*. After blooming the gelatin, the preparations were placed in a gentle water bath as shown in *figure 4*. It was continuously stirred until the gelatin was dissolved. Extra caution was taken to make sure that the mixture does not reach boiling point.

Figure 3

Figure 4

Figure 5 shows the mixture of the infusions being poured in a mold to form the patch, which was later cut to form the desired strips, *figure 6*, after cooling down.

Figure 5

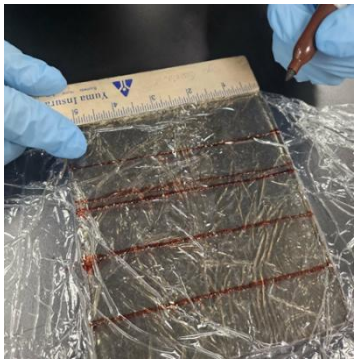


Figure 6

PHASE 3

Phase 3, 4 and 5 marks the procedures for the bench tests needed to simulate the needs of a first-degree burn. Each phase was tested with three trials to create more reliable data.

The moisture retention capacity of the *A. bisporus* infused hydrogel strips was done in phase 3 by measuring the percentage of mass loss. It started by weighing the dry strip followed by hydrating it in moist paper for 10 minutes, as shown in *figure 7*, then recording the hydrated weight of each strip. In addition, the hydrated strips were placed on a vented rack and were allowed to stand at room temperature for 30, 60 and 120 minutes, *figure 8*. *Figure 9* shows the strips being weighed again and recorded after each given time.

Figure 7

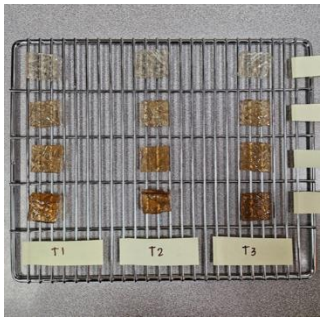


Figure 8

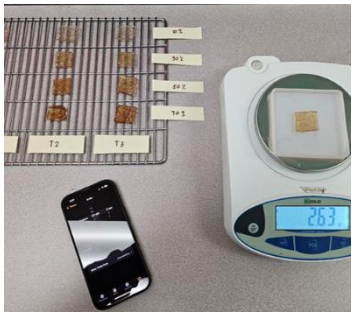


Figure 9

The percentage of mass loss was computed using the formula: % mass loss = 100 x (hydrated weight – timed weight) / hydrated weight. The average of each % mass loss for every infusion was then tabulated and graphed.

PHASE 4

The bench marking for the absorbency of the *A. bisporus* infused hydrogel strips were done in phase 4. In Figure 10, the patches were submerged in distilled water for 30 minutes after taking the dry weight. The strips were again weighed to note the amount of water absorbed after the allotted time. The swelling ratio for each strip and trial was recorded using the formula: swelling ratio = (swollen weight – dry weight) / dry weight.

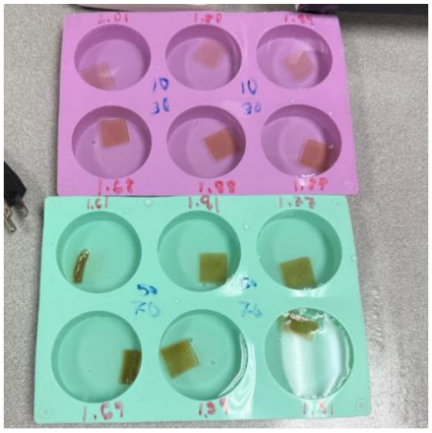


Figure 10

PHASE 5

The last phase was done to test the pH level of the *A. bisporus* infused hydrogel strips. Each strip was placed in distilled water for about 10 minutes. pH strips were then dipped in the water and checked for color changes as shown in *figure 11*.

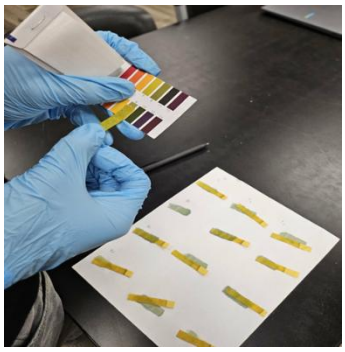
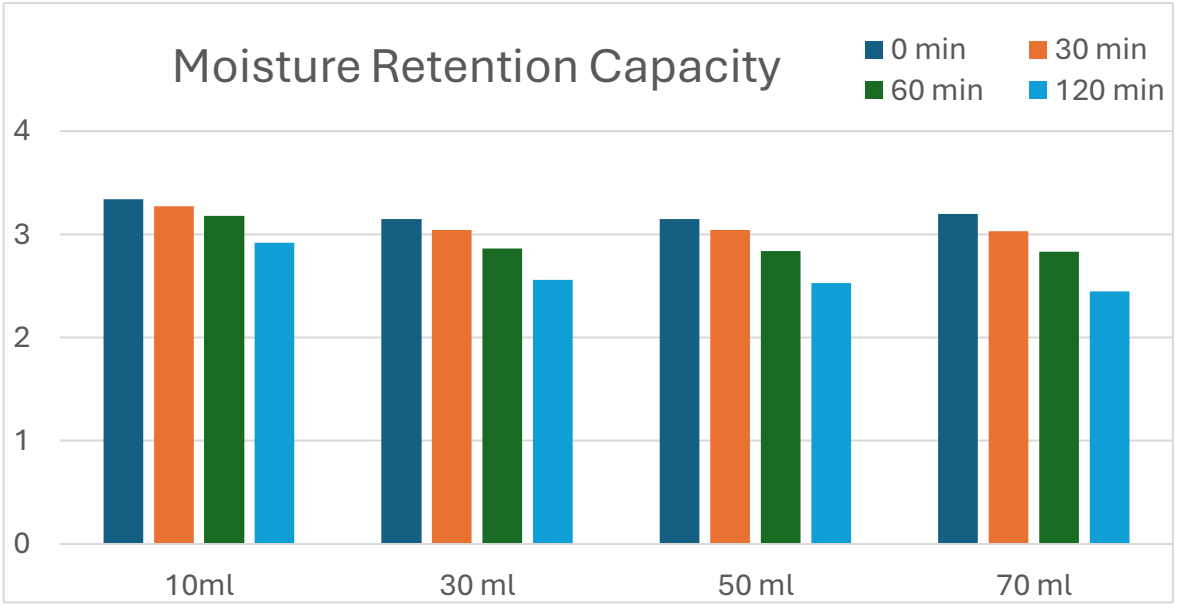


Figure 11

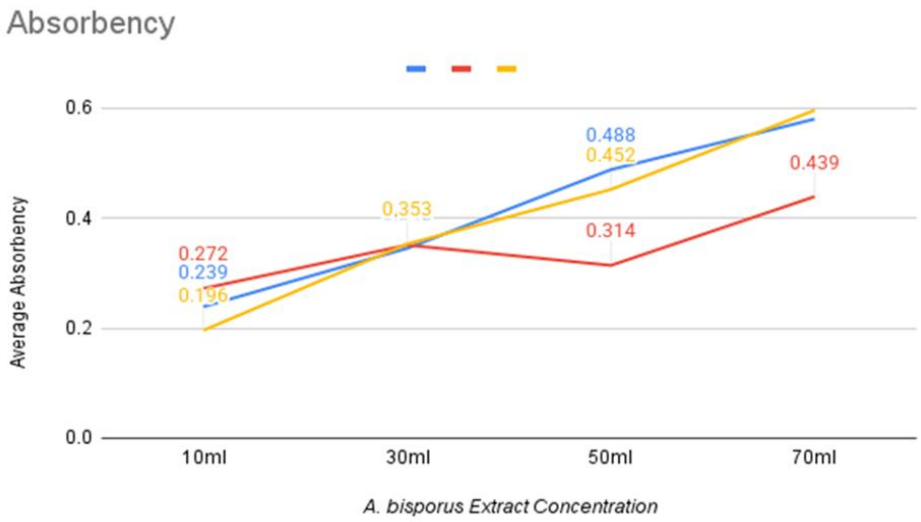
RESULTS AND DISCUSSIONS



Graph 1

In testing for moisture retention, absorbency and pH levels, 3 trials were set for 10ml, 30ml, 50ml and 70ml infusion concentrations of *A. bisporus* extract then averaged for the result.

Moisture retention data in *Graph 1* presents that mass loss measurements in all concentrations decreased overtime from 0 to 120 minutes which indicate good moisture retention. Linear to time, as the concentration of *A. bisporus* extract increased, measurement for mass loss also decreased showing good moisture retention capacity as 70ml extract concentration in the hydrogel strip was reached.



Graph 2

The absorbency data in *Graph 2* shows a concentration dependent trend making the 70ml formulation have the highest swelling ratio as compared to the other concentrations.

In testing for pH, almost all of the trials demonstrated a normal pH of 7 except for the 70ml concentration which registered 6 as shown in *Table 1*. The mildly acidic pH at 70ml concentration is acceptable for burn healing to help control microbial growth.

Concentration	pH Level	Concentration	pH Level
10ml	7	50ml	7
30ml	7	70ml	6

Table 1

CONCLUSION

At the end of the experiment, my hypothesis was accepted. Evidence cited were the following:

1. The hydrogel strip infused with *A. bisporus* extract has moisture retention capacity that increases with extract concentration.

2. Adding *A. bisporus* extract to hydrogel strips promote absorbency which can help absorb exudate in case blisters start to appear in burn areas.

3.The extract of *A. bisporus* help maintain pH levels within normal range in burns.

4.The higher the concentration of the infused *A. bisporus* extract, the more effective it becomes as an agent to heal burns.

5.The properties of *A. bisporus* extract can help enhance the efficiency of hydrogel strips to promote healing in first-degree burns.

MY FUTURE PLAN

- Test infused strips for additional needs of first degree burns such as water vapor transmission rate, cooling effect and strip tensile strength
- Test hydrogel strip on simulated burn

REFERENCE

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