NEW METHOD FOR MYCELIUM GROWTH DEACTIVATION

MNEXT MATERIALS & ENERGY TRANSITION

Can an electrical treatment deactivate mycelium growth?

Guedes Batista, V., van Gameren S., Roccio R., Rovers I.
Project/Research Group: FungiZap – Smart Energy / BioBased Building
Contact information: v.guedesbatista@student.avans.nl
Date: June 2024

Introduction

Mycelium, the underground network of fungi, consists of hyphae filaments that absorb nutrients. When grown densely with a substrate, it can be shaped into bio-based materials (Fig. 1) suitable for construction, packaging, textiles, and more. Traditional drying methods to deactivate mycelium take 24 hours and consume significant energy.
The objective is to optimise mycelium deactivation by using electrical treatment, aiming for a more cost-effective solution.

Figure 1: Mycelium bio composite inside treatment chamber

Background:

- **PEF(Pulsed Electric Field):** Commonly used in the food industry for sterilisation [1,2,3], but high-voltage equipment required more time to acquire than available for this research.
- **Experiment Approach:** Conducted with lower voltage ranges to explore feasibility.

Methods

It was monitored voltage, current, and electric field to assess treatment viability. The parameters for low voltage were set at 50 V (2.1 A) and 25 V (1 A).

- **Substrate**: Rapeseed straw
- **Strains**: *Ganoderma resinaceum* and *Pleurotus ostreatus*
- **Sample Height**: 2-5 mm, corresponding to an electric field of 125-250 V/cm
- **Protective parts**: plastic
- **Copper plates**: 5 mm larger than the petri dish lid

The samples were grown on petri dish lids, zapped, and then reinoculated in agar. Growth was evaluated over a 7-day period. The setup can be seen in Fig. 2.

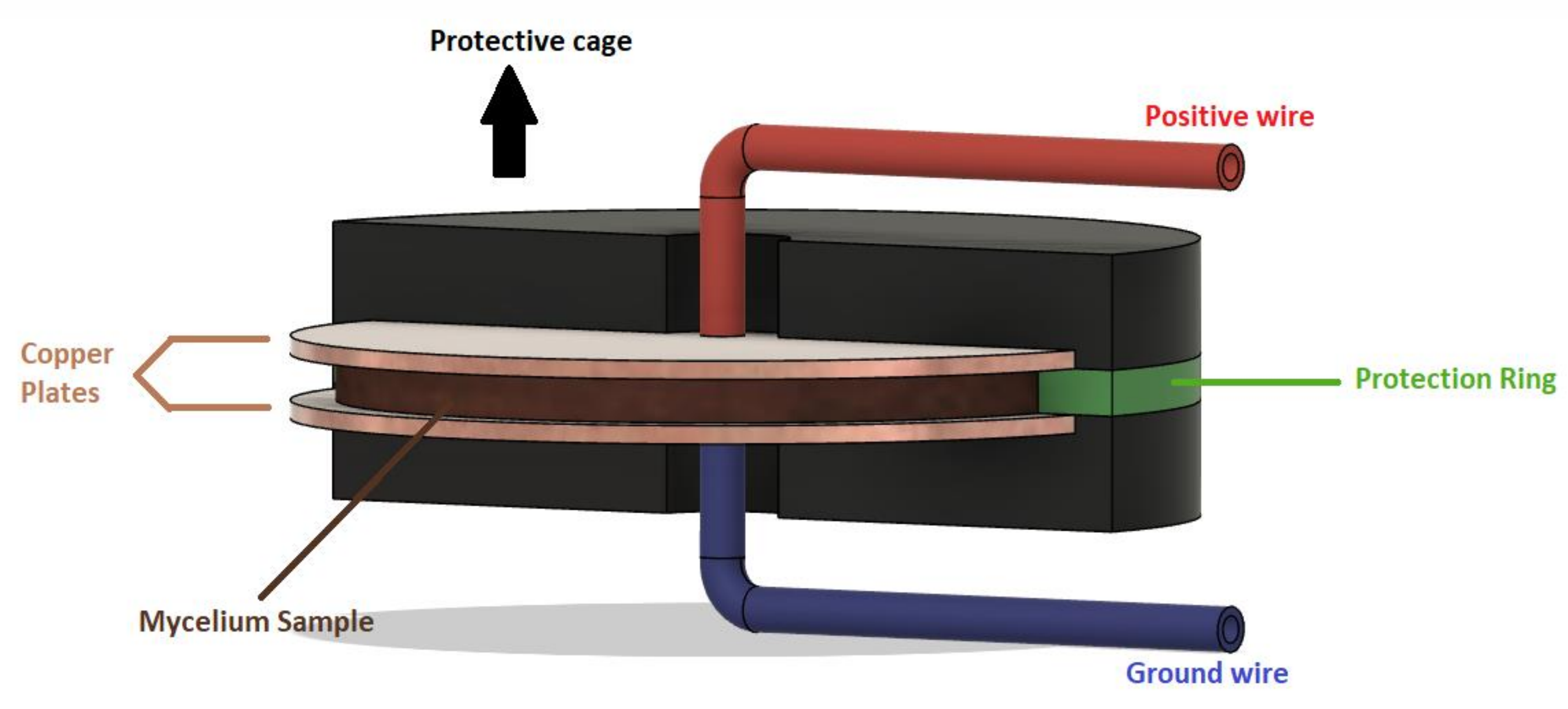

Figure 2: Setup for experiment

Results and discussion

The low voltage testing results are summarised in Table 1. Although none of the samples had their growth stopped, the data provides valuable regarding the electrical properties of the bio-composite.

Strain	Time (min)	Voltage (V)	Average Energy Input (kJ/kg)	Deactivated
GR	1	25	71.6	No
GR	1	50	264.1	No
GR - Petri	1	25	0	No
GR - Petri	1	50	0	No
PO	1	25	63.3	No
PO	1	50	182.0	No
PO - Petri	1	50	0	No

Table 1: Summary of results

The specific energy input data suggests that energy alone is not a decisive factor in mycelium cell death. This leads to a discussion on the deactivation mechanism, indicating that other factors may play a more significant role in the process.

Conclusions and next steps

Low Voltage Findings: Voltages of 25-50V for up to 1 minute cannot deactivate mycelium growth. Instead, they may enhance growth, suggesting a need for further research.
Future Work: High voltage treatments are planned to explore their efficacy.
Additional Research Directions: Strong evidence indicates that vibrations [4], sound waves [5], and magnetic fields [6] can improve mycelium growth, opening new research avenues.

References

1. Hülsheger, H., J. Potel, and E -G. Niemann. "Killing of bacteria with electric pulses of high field strength." Radiation and environmental biophysics 20 (1981): 53-65.
2.Alvarez, I., et al. "Comparing predicting models for the Escherichia coli inactivation by pulsed electric fields." Innovative Food Science & Emerging Technologies 4.2 (2003): 195-202.
3.Zhang, Cheng, et al. "Pulsed electric field as a promising technology for solid foods processing: A review." Food Chemistry 403 (2023): 134367.
4.C. Kobayashi, H. Mukai, and T. Takanashi, "Vibrations and mushrooms: Do environmental vibrations promote fungal growth and fruit body formation?", Ecology, vol. 104, no. 6, e4048, 2023
5.M. N. I. B. H. Mazidi, R. Ibrahim, and T. S. Teck, "Comparison of ultrasonic and acoustic sound treatments on grey oyster mushroom (pleurotus sajor-caju) cultivated on sawdust and kenaf waste", in IOP Conference Series: Materials Science and Engineering, IOP Publishing, vol. 932, 2020, p. 012 005.
6.R. Radhakrishnan, "Magnetic field regulates plant functions, growth and enhances tolerance against environmental stresses", Physiology and Molecular Biology of Plants, vol. 25, no. 5, pp. 1107–1119, 2019.