Evaluación de los efectos de la fermentación de estado sólido del hongo Basidiomiceto *Pleurotus* spp. y crecimiento en sustrato de semillas de leguminosa: *Leucaena leucocephala*

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Resumen

Las leguminosas son importantes por su contenido nutricional, pero los factores antinutricionales limitan su uso. La fermentación en estado sólido con Pleurotus spp. mejora su calidad. Este estudio evaluó el impacto de la fermentación con Pleurotus ostreatus en semillas de Leucaena leucocephala, con el fin de mejorar su valor nutricional. Se usaron semillas de Leucaena recolectadas en Barranquilla y una cepa comercial de Pleurotus. Los sustratos fuero preparados a base de semillas trituradas. Los sustratos fueron inoculados con micelio y fermentados por 20 días. Se observó una falta de crecimiento del hongo en el sustrato hasta su posterior muerte, Por lo que se puede deducir que el principal factor posiblemente fue la temperatura o composición del sustrato los que inhibieron su colonización.

Palabras claves
leguminosas,pleurotus ostreatus, mimosina, proteína, cambio climático

Abstract

Legumes are important for their nutritional content, but anti-nutritional factors limit their use. Solid state fermentation with Pleurotus spp. improves its quality. This study evaluated the impact of fermentation with Pleurotus ostreatus on Leucaena leucocephala seeds, in order to improve their nutritional value. Leucaena seeds collected in Barranquilla and a commercial strain of Pleurotus were used. The substrates were prepared from crushed seeds. The substrates were inoculated with mycelium and fermented for 20 days. A lack of growth of the fungus in the substrate was observed until its subsequent death. Therefore, it can be deduced that the main factor was

possibly the temperature or composition of the substrate that inhibited its colonization.

keywords
legumes, pleurotus ostreatus, mimosine, protein, climate change

REFERENCIAS

- Ilham, Z., Hamidon, H., Rosji, N. A., Ramli, N., & Osman, N. (2015). Extraction and Quantification of Toxic Compound Mimosine from Leucaena Leucocephala Leaves. *Procedia Chemistry*, *16*. https://doi.org/10.1016/j.proche.2015.12.029
- Fodor, N., Challinor, A., Droutsas, I., Ramirez-Villegas, J., Zabel, F., Koehler, A. K., & Foyer, C. H. (2017). Integrating Plant Science and Crop Modeling: Assessment of the Impact of Climate Change on Soybean and Maize Production. In *Plant and Cell Physiology* (Vol. 58, Issue 11). https://doi.org/10.1093/pcp/pcx141
- Sharma, A., Sharma, A., & Tripathi, A. (2021). Biological activities of Pleurotus spp. polysaccharides: A review. In *Journal of Food Biochemistry* (Vol. 45, Issue 6). https://doi.org/10.1111/jfbc.13748
- He, L., Jin, N., & Yu, Q. (2020). Impacts of climate change and crop management practices on soybean phenology changes in China. *Science of the Total Environment*, *707*. https://doi.org/10.1016/j.scitotenv.2019.135638
- Mohan, V. R., Tresina, P. S., & Daffodil, E. D. (2015). Antinutritional Factors in Legume Seeds: Characteristics

and Determination. In Encyclopedia of Food and Health. https://doi.org/10.1016/B978-0-12-384947-2.00036-2

- Marcos-Méndez, D. A., Canseco-Nava, H., Oliart-Ros, R. M., & Ramírez-Higuera, A. (2021). Presence of antinutritional factors in legumes. Revista de Ingenieria Innovativa. https://doi.org/10.35429/joie.2021.17.5.6.13
- Toshiro Arai (2014). The development of animal nutrition and metabolism and the challenges of our time. https://www.frontiersin.org/articles/10.3389/fvets.2014.00023/full#:~:text=Nutrition%20is%20defined%20as%20the,and%20metabolism%20in%20the%20cells
- Naciones Unidas (2017). World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100. https://www.un.org/en/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100
- Carlos Gomes (2021). Incremento importante en precio de Maíz y Soya afectara a la actividad pecuaria en los siguientes meses. https://agraria.pe/columna/incremento-importante-en-precio-de-maiz-y-soya-afectara-a-la-23546
- Miller preciado (2023). El cambio climático y su impacto en la agricultura: un desafío urgente. https://mascolombia.com/el-cambio-climatico-y-su-impacto-en-la-agricultura-un-desafio-urgente/
- Ministerio de ambiente y desarrollo sostenible (2023). ¿Cómo afectaría el cambio climático a Colombia en los próximos años? https://www.minambiente.gov.co/como-afectaria-el-cambio-climatico-a-colombia-en-los-proximos-anos/
- Jegadeesh Raman, Kab-Yeul Jang, Youn-Lee Oh, Minji Oh, Ji-Hoom Im, Hariprasath Lakshmanan, Vikineswary Sabaratnam (2020). Cultivation and Nutritional Value of Prominent *Pleurotus* spp.: An Overview

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7832515/#:~:text=Pleurotus%20mushrooms%20are%20rich%20in,-soluble%20vitamins%2C%20and%20minerals

- Food and Agriculture Organization of the United Nations (2016). Climate is changing. Food and agriculture must too. https://www.fao.org/3/I5758E/I5758E.pdf
- Rani Polak, Edward M. Phillips, Amy Campbell (2015). Legumes: Health Benefits and Culinary Approaches to Increase Intake. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4608274/#:~:text=They%20provide%20fiber%2C%20protein%2C%20carbohydrate,are%20cholesterol%20free%20as%20well.
- Mayo clinic (2023). DASH diet: Healthy eating to lower your blood pressure. https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/dash-diet/art-20048456#:~:text=The%20DASH%20diet%20focuses%20on,in%20salt%2C%20also%20called%20sodium.
- Fabio Stagnari, Albino Maggio. Angelica Galieni, Michele Pisante (2017). Multiple benefits of legumes for agriculture sustainability: an overview. https://chembioagro.springeropen.com/articles/10.1186/s40538-016-0085-1#:~:text=Legumes%20fix%20the%20atmospheric%20nitrogen,crop%20or%20as%20crop%20residue.
- Mrinal Samtiya, Rotimi E, Aluko, Tejpal Dhewa (2020). Plant food anti-nutritional factors and their reduction strategies: an overview https://fppn.biomedcentral.com/articles/10.1186/s43014-020-0020-5
- Edith Espinosa-Páez, Ma. Guadalupe Alanis-Guzman, Carlos E. Hernandez-Luna, *et al.* (2017) Increasing

Antioxidant Activity and Protein Digestibility in *Phaseolus vulgaris* and *Avena sativa* by Fermentation with the *Pleurotus ostreatus* Fungus https://www.mdpi.com/1420-3049/22/12/2275

- Pereira, P. M., & Vicente, A. F. (2013). Meat nutritional composition and nutritive role in the human diet. Meat science, 93(3), 586–592. https://doi.org/10.1016/j.meatsci.2012.09.018
- Kenneth J. Jenkins, A. S. Atwal (1994). Effects of dietary saponins on fecal bile acids and neutral sterols, and availability of vitamins A and E in the chick. https://www.sciencedirect.com/science/article/abs/pii/0955286394900841?via%3Dihub
- Nevin Şanlier, Büşra Başar Gökcen, Aybüke Ceyhun Sezgin (2017) Health benefits of fermented foods https://www.tandfonline.com/doi/abs/10.1080/10408398.2017.1383355
- Sulagna Gupta, Jaslyn J. L. Lee, Wei Ning Chen (2018). Analysis of Improved Nutritional Composition of Potential Functional Food (Okara) after Probiotic Solid-State Fermentation https://pubs.acs.org/doi/10.1021/acs.jafc.8b00971
- Raghavarao, K. S. M. S., Ranganathan, T. V., & Karanth, N. G. (2003). Some engineering aspects of solid-state fermentation. Biochemical Engineering Journal, 13(2-3), 127-135. https://doi.org/10.1016/s1369-703x(02)00125-0Xiao Y, Xing G, Rui X et al (2014) Enhancement of the antioxidant capacity of chickpeas by solid state fermentation with *Cordyceps militaris* https://www.sciencedirect.com/science/article/abs/pii/S1756464614001996?via%3Dihub
- Vikki Thompson, Dann Mitchell, Gabriele C. Hegerl, Matthew Colins, Nicholas J. Leach, Julia M. Slingo

(2023) The most at-risk regions in the world for high-impact heatwaves. https://www.nature.com/articles/s41467-023-37554-1

- Ashok Pandey (2003) Solid-state fermentation. https://www.sciencedirect.com/science/article/abs/pii/S1369703X02001213?via%3Dihub
- Anna de Angelis, Laura Gasco, Giuliana Parisi, Pier Paolo Danieli (2021) A Multipurpose Leguminous Plant for the Mediterranean Countries: *Leucaena leucocephala* as an Alternative Protein Source: A Review https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8388360/
- Organización de las Naciones Unidas para la Alimentación y la Agricultura (2022). Marco estratégico de la FAO para 2022-2031. https://www.fao.org/strategic-framework/es#:~:text=El%20Marco%20estratégico%20de%20la%20FAO%20para%202022-2031%20busca,sin%20dejar%20a%20nadie%20atrás.
- Naciones Unidas (2023). ¿Qué es el cambio climático? https://www.un.org/en/climatechange/what-is-climate-change
- Word Weather Attribution (2023). Extreme April heat in Spain, Portugal, Morocco & Algeria almost impossible without climate change. https://www.worldweatherattribution.org/extreme-april-heat-in-spain-portugal-morocco-algeria-almost-impossible-without-climate-change/
- Ian Sue Wing, Enrica De Cian, Malcolm N. Mistry (2021) Global vulnerability of crop yields to climate change. https://www.sciencedirect.com/science/article/pii/S0095069621000450#:~:text=In%20the%20absence%20of%20additional,under%20a%20vigorous%20warming%20scenario.

- Ching-Hui Chang, Hsing-Yu Lin, Chi-Yue Chang, Yung-Chuan Liu. (2006) Comparisons on the antioxidant properties of fresh, freeze-dried and hot-air-dried tomatoes https://www.sciencedirect.com/science/article/abs/pii/S0260877405004917?via%3Dihub
- Sánchez-García, J., Asensio-Grau, A., García-Hernández, J. et al. Nutritional and antioxidant changes in lentils and quinoa through fungal solid-state fermentation with Pleurotus ostreatus. Bioresour. Bioprocess. 9, 51 (2022). https://doi.org/10.1186/s40643-022-00542-2
- Food science (2006) Crude Fat Determination - Soxhlet Method. https://meatupdate.csiro.au/infosheets/Crude%20Fat%20Determination%20-%20Soxhlet%20Method%20-%201998.pdf
- UMass Amherst (2003) Analysis of food products. Food science 581. https://people.umass.edu/~mcclemen/581Toppage.html
- Hui-Ling Liao, Chih-Ming Hsu, Khalid Hameed, and Van T. Cotter (2022) Isolation of mother cultures and preparations of spawn for oyster mushroom cultivation. https://edis.ifas.ufl.edu/publication/SS663
- R K. Patterson (1973). Automated Pregl-Dumas technique for determining total carbon, hydrogen, and nitrogen in atmospheric aerosols. https://pubs.acs.org/doi/pdf/10.1021/ac60325a050
- Heuzé V., Tran G (2015) Leucaena *(Leucaena leucocephala).* Feedipedia. https://www.feedipedia.org/node/282
- Yang, X., Liu, E., Zhu, X., Wang, H., Liu, H., Liu, X., & Dong, W. (2019). Impact of Composting Methods on

Nitrogen Retention and Losses during Dairy Manure Composting. International journal of environmental research and public health, 16(18), 3324. https://doi.org/10.3390/ijerph16183324

- María del Pilar Rios, Jose Luis Hoyos, Silvio Andrés Mosquera (2010) Evaluación de los parámetros productivos de la semilla *Pleurotus ostreatus*-propagada en diferentes medios de cultivo. http://www.scielo.org.co/scielo.php?pid=S1692-35612010000200012&script=sci_arttext

WFO (2024): Leucaena leucocephala (Lam.) de Wit. Published on the Internet; http://www.worldfloraonline.org/taxon/wfo-0000164084