Mini Review
Volume 12:11, 2022

Journal of Bioprocessing & Biotechniques

ISSN: 2155-9821 Open Access

Industrial and Agricultural Wastewater Bioprocessing

Shijie Liu*

Department of Bioengineering, Worcester Polytechnic Institute, Massachusetts, USA

Abstract

Enzymes are chemicals that hasten chemical processes without altering themselves in the process. The employment of enzymes in the pharmaceutical, chemical and food sectors is encouraged by their many benefits over chemical catalysts, including tunable activity, high specificity, and high catalytic efficiency. Due to their numerous uses, industrial enzymes are in higher demand, which has prompted on-going research and development aimed at improving enzyme production and lowering manufacturing costs. Due to their numerous uses in diverse industries, pectinases have become one of the most important industrially important enzymes. The group of enzymes known as pectinases is responsible for hydrolysing pectin-containing compounds. Depending on the method of action, pectinases are divided into polygalacturonase, pectate lyase, pectin esterase, and pectin lyase.

Keywords: Pharmaceutical • Enzymes • Hydrolysing • Pectin

Introduction

Pectinase is made from a variety of sources, including bacteria, plants, insects, and nematodes. Because of its quick growth, vast distribution, short fermentation times, and simple genetic alterations, the microbial source is crucial. In plant pathology, symbiosis, and the breakdown of plant deposits, microbial pectinases are crucial. Fungi, bacteria, and yeasts are used as microbial sources to make pectinase through submerged fermentation (MSFs) and solid-state fermentation (SSF). Acidic pectinases are frequently produced by fungi, with Aspergillus sp. being a key fungus strain for pectinase synthesis and a generally recognised as safe (GRAS) microorganism. Different fungal species, including *Aspergillus fumigatus*, *Aspergillus oryzin*, *Aspergillus nicer*, *Aspergillus Tubingen* is, and Penicillium, have been used by my researchers to produce pectinase [1].

To determine how the starting pH affected the activity of pectinase, solid-state fermentation was carried out. Orange peel was used as a substrate for the fermentation synthesis of pectinase enzymes at various starting pH levels (3 to 10). By preserving cell membrane permeability, nutrient solubility, and the ionisation of amino acids and proteins, a medium pH level influences enzyme function. Therefore, a medium pH level controls the growth of the culture and has an impact on the activity of the enzymes. No appreciable changes in the media's pH were noticed during SSF. As demonstrated in, the peak pectinase activity was found at a starting pH of 4. Pectinase activity reduced as pH rose from 4 to 8 [2].

SSF was used to investigate how incubation temperature affected pectinase activity. For the investigation, an incubation temperature range of 25°C and 60°C was taken into consideration. The pectinase activity increased as the incubation temperature rose from 25 to 37 degrees Celsius. Furthermore, as seen in, the enzyme activity dropped as the incubation temperature rose from 37 to 60 degrees Celsius. Various scholars looked into how incubation time affected pectinase activity [3].

***Address for Correspondence:** Shijie Liu, Department of Bioengineering, Worcester Polytechnic Institute, Massachusetts, USA, E-mail: shijieliu907@gmail.com*

Received: 02 November, 2022, Manuscript No: jbpbt-23-86129; **Editor Assigned:** 04 November, 2022, PreQC No: P-86129; **Reviewed:** 16 November, 2022, QC No: Q-86129; **Revised:** 21 November, 2022, Manuscript No: R-86129; **Published:** 28 November, 2022, DOI: 10.37421/2155-9821.2022.12.548

Literature Review

Using *Aspergillus Niger* ABT-5, Abdullah et al. discovered that the maximal pectinase activity was 8 IU/mL on the third day. The greatest pectinase activity was seen on the fifth day when *Aspergillus fumigates* were grown on banana peels, according to Zehra et al. In agreement with our findings, MS found that *Aspergillus Niger* HFD5A-1 had a maximal pectinase activity of 1.27 IU/mL on the sixth day of incubation. On the fourth day of incubation, Sethi et al. discovered the maximum pectinase activity utilising *Aspergillus terreus* NCFT 4269.10. Using *Aspergillus fumigates* R6, Wong et al. discovered that an incubation period of 4 days was ideal for achieving the highest pectinase activity. \Alternately, it's possible that when the temperature rises, the enzyme molecule absorbs more energy, which allows it to overcome the weak forces of the globular protein structure and become inactive [4].

The coefficient of determination confirmed the model's suitability (R2). The model's precision is indicated by an R2 score that is closer to 1. The amount of variability in the observed response values is shown by the regression coefficient's (R2) value. Experimental variables and their interactions account for the variation. The remaining 14.53% of the overall variation, or an R2 value of 85.47%, cannot be explained by the model. This variation in enzyme activity is attributed to the independent parameters. The correlation between experimental and anticipated values is stronger and the model's prediction of the response is also better the closer the R2 value is to 1. An improved correlation between the predicted and experimental data was demonstrated by the projected R2 value of 0.7826.

Discussion

According to Demir and Tari's observations using *Aspergillus sojae*, pectinase activity peaked around 37°C, which is consistent with the findings of the current investigation. Using *Aspergillus niger* ABT-5, they discovered that 30°C was the best temperature for maximising pectinase activity. Using *Aspergillus fumigates* MS16 under SSF, Zehra et al. discovered that 25°C was the ideal incubation temperature for maximising pectinase activity. When *Aspergillus niger* HFD5A-1 was used, Darah et al. discovered a maximal pectinase activity of 1.40 IU/mL at a temperature of 30°C. Using *Aspergillus terreus* NCFT 4692, Sethi et al. discovered that the ideal temperature for optimum enzyme activity is 30°C [5].

Response surface curves are used to identify the factors with the highest optimal values for enzyme activity as well as to understand how the variables interact. Pareto charts, 3D surface plots, and 2D contour plots, in that order, show the impact of two parameters on the activity of the enzyme. To investigate the relative effects of process factors on pectinase activity, several 3D surface

plots were created. The vertical axis of the 3D surface plots indicates the response (enzyme activity), and the two horizontal axes, which retain other variables at their control levels, represent the coded levels of two separate process variables. Illustrates the pareto chart's interpretation of the relationship between substrate particle size, starting pH, and moisture content [6].

Enzyme activity increased as pH and moisture content increased, reaching a peak at midpoints for both parameters before declining at high points for both parameters. The relative effects of pH and incubation temperature are indicative of a similar impact on pectinase activity. The enzyme activity rises with rising temperature and moisture content, peaking at midpoints for both parameters. The ideal pectinase activity for substrate particle size of 2 mm, beginning pH of 4.9, moisture content of 107%, and incubation temperature of 31.5°C was determined by Minitab optimizer as 107.14 0.71 IU/mL. After statistical optimization, A. cervinus ARS2's pectinase activity in the current study rose by almost 2.38-fold [7].

Conclusion

For improved pectinase production, numerous researches has been done on various process variables, including moisture content, starting pH, incubation temperature, inoculum size, substrate particle size, incubation time, and agitation. For the manufacture of pectinase, the incubation period, a crucial process variable, changed according to the kind of microbe and substrate employed. The maximum pectinase activity was discovered by Wong et al. during the 129-hour incubation period. On the fourth day of incubation, *Aspergillus Sojae* showed the most polygalacturonates activity, according to Demir and Tari. Production of pectinase is significantly influenced by incubation temperature.discovered that Aspergillus strains had the maximum activity of polygalacturonates.

Acknowledgement

None.

Conflict of Interest

There is no conflict of interest by author.

References

1. Angenent, Largus T., Khursheed Karim, Muthanna H. Al-Dahhan and Brian A. Wrenn, et al. "Production of bioenergy and biochemicals from industrial and agricultural wastewater." Trends Biotechnol 22 (2004): 477-485.
2. Lin, Shin-Ping, Darin Khumsupan, Yu-Jou Chou and Kuan-Chen Hsieh, et al. "Applications of atmospheric cold plasma in agricultural, medical, and bioprocessing industries." *Appl Microbiol Biotechnol* (2022): 1-14.
3. Zeng, Xianhai, Xiaoyi Guo, Gaomin Su and Michael K. Danquah, et al. "Bioprocess considerations for microalgal-based wastewater treatment and biomass production." *Renewable Sustainable Energy Rev* 42 (2015): 1385-1392.
4. de la Noüe, Joël, Gilles Laliberté and Daniel Proulx. "Algae and waste water." *J Appl Phycol* 4 (1992): 247-254.
5. Jiménez-Tototzintle, M., I. Oller, A. Hernández-Ramírez and S. Malato, et al. "Remediation of agro-food industry effluents by biotreatment combined with supported TiO2/H2O2 solar photocatalysis." *J Chem Eng* 273 (2015): 205-213.
6. Kanimozhi, J., V. Sivasubramanian, Anant Achary and M. Vasanthi, et al. "Bioprocessing of agrofood industrial wastes for the production of bacterial exopolysaccharide." Bioprocess engineering for a green environment, 1st edn. CRC Press, Boca Raton (2018): 67-98.
7. Bhumibhamon, Orapin, Achara Koprasertsak and Suptawee Funthong. "Biotreatment of high fat and oil wastewater by lipase producing microorganisms." *Agric Nat Resour* 36 (2002): 261-267.

How to cite this article: Liu, Shijie. "Industrial and Agricultural Wastewater Bioprocessing." J Bioprocess Biotech 12 (2022): 548.