Optimization of Cellulase Production by A Newly Isolated Bacterial Strain Using Physical and Chemical Parameters

Madiha Sattar[1]*, Naseem Begum[2], Irfa Shireen[2]
[1]Department of Biochemistry, University of Karachi, Karachi-75270, Pakistan.
[2]Department of Biochemistry, Jinnah University for Women, Karachi, Pakistan.
*E-mail: madiha_sattar77@hotmail.com

ABSTRACT

Introduction: Cellulose, the most abundant natural polymer on Earth, is a complex carbohydrate integral to plant cell walls (Juturu and Wu 2021). The hydrolysis of cellulose into fermentable sugars and other intermediates for higher value products is an essential step of many biotechnological processes (Kumar *et al*. 2020). The hydrolysis of cellulose into glucose is facilitated by specific enzymes called cellulases (Singh *et al*. 2019). Cellulases have an important role in the breakdown of cellulose (Chen *et al*. 2022). They are extensively utilized in industries including food processing, textiles, and detergents (Rathoure *et al*. 2020). Despite this, cellulase production cost is still an industrial problem. Identifying fast-growing and economically-environmentally friendly cellulase producers is a good approach to minimize the cost of enzyme production and improve the yield of enzymes (Kuhad *et al*. 2019) . In this study, we isolated a bacterial strain capable of producing cellulase from garden soil (Juturu and Wu 2021). The research emphasized optimizing chemical and physical conditions to maximize enzyme output.

Aims and Objective:

- To identify and isolate a potential cellulase-producing microorganism from garden soil.
- To explore eco-friendly and cost-effective methods for cellulase production using fast-growing microorganisms.
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Materials and Methods: Soil samples from a garden were used to isolate cellulase-producing microorganisms through serial dilution and plating techniques. Cellulase production was screened using agar media with cellulose as the sole carbon source, and zones of hydrolysis were measured to identify producers.Optimization of production parameters involved varying physical (pH, temperature, incubation time) and chemical (substrate concentration, carbon sources, nitrogen sources, salt concentration) conditions to determine their impact on enzyme yield. Carboxy methyl cellulose (CMC) was used as substrate, and enzymatic degradation was evaluated by measuring reducing sugar release using the DNS method. Statistical analysis was performed to determine the significance of the optimization process.

Result: The optimum temperature for the incubation was 40 °C and the ideal cellulase activity was recorded at pH 7. Enzyme production was optimum at 72 hours of incubation period.Higher cellulase activity was observed when bagasse (2%), CMC (1.5%), wheat bran (4%), and sawdust (4%) were utilized as carbon sources. Among nitrogen sources, ammonium sulfate (4%), yeast extract (4%), urea (3%), and peptone (1%) demonstrated optimal yields for cellulase production.Cellulase production increased dramatically when produced under these optimized conditions.

Conclusion: The aim of the present work was to isolate and identify a high cellulase producing bacteria from soil. This information of optimization regarding physical and chemical parameters has enabled the ideal formulation of media composition for maximum cellulase production. Molecular identification of

newly isolated bacterial strain, characterization purification and immobilization of cellulase will also be done in further for betterment of enzyme.

Keywords: CMC, Cellulase Production, DNS Method, Optimization.

REFRENCES

1. Chen, Hongli, *et al*. "A Novel Cellulase from Bacillus subtilis: Cloning, Expression, and Characterization." International Journal of Biological Macromolecules, vol. 193, 2022, pp. 1358-1366.
2. Juturu, Vinod, and Jianping Wu. "Microbial Cellulases: Advances and Applications." Journal of Applied Microbiology, vol. 131, no. 2, 2021, pp. 532-543.
3. Kuhad, Ramesh Chander, *et al*. "Bioconversion of Lignocellulosic Biomass into Bioethanol Using a Novel Cellulase from Penicillium janthinellum." Bioresource Technology, vol. 297, 2019, pp. 122311.
4. Kumar, Vinod, *et al*. "Cloning, Expression, and Characterization of a Novel Cellulase from Aspergillus terreus." Journal of Molecular Catalysis B: Enzymatic, vol. 127, 2020, pp. 109-116.
5. Rathoure, Ashok Kumar, *et al*. "Production, Purification, and Characterization of a Novel Cellulase from Bacillus amyloliquefaciens." Journal of Environmental Biology, vol. 41, no. 2, 2020, pp. 249-256.
6. Singh, Anoop, *et al*. "A Novel Cellulase from Trichoderma harzianum: Cloning, Expression, and Characterization." International Journal of Biological Macromolecules, vol. 137, 2019, pp. 110-118.