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Harnessing Fungal Lipase from Oil Contaminated Soil Fungi: A Strategy Towards Waste to Wealth Conversion

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ABSTRACT

Globally, there is an increasing demand towards more eco-friendly, sustainable, and economic measures to deal with the growing problems of environmental issues. The aim of the work lies in selecting new techniques involving greener and cleaner procedures to utilize so called waste for deriving valuable products. The soil present in the oil mill areas have huge population of various microbes', especially of fungal origin. These microbes being rich in lipase content due to their oil source origin, if cultured in laboratory and fermented and bio molecules extracted will give rise to production of lipase enzymes.Thus in this we isolated fungal colonies from this oil rich soil, cultured in laboratory, fermented them under various conditions to extract fungal enzyme i.e. lipase and then used it for further applications. Lipases are highly versatile and industrially important enzymes. Deriving the lipases from waste soil is the main attraction of this work and is a venture strategizing the "best from waste" approach.

1. Introduction

For the past few years, there is a universal drive to promote more selective and efficient green technology. Major advances and scientific breakthrough in enzyme directed biocatalytic transformation has become an important weapon to rationally design of sustainable environment-friendly, industrial process development (Moura et al., 2014) Devising enzyme properties such as stability, activity and substrate specificity customize the rate of biocatalytic process. The hydrolase enzymes (lipases) render an exceptional tool for biocatalysis. Lipases catalyze the hydrolysis of glycerides and other fatty acid esters to glycerol and fatty acid under aqueous condition.

Lipases of microbial origin, specially bacterial and fungal, have already established their potential regarding their use in various biotechnological applications (Kapoor et al., 2012. Fungal lipases are more preferable over bacterial lipases given to the condition of simpler extraction and purification processes. Lipase-producing fungi are omnipresent and can be found in various habitats such as industrial wastes, vegetable oil processing factories, dairies, soil contaminated with oil, oilseeds, and decaying food (Fernandez-Lafuente 2010), compost heaps, coal tips, and hot springs etc (Singh et al., 2012). Lipid-sources are essential for obtaining a high lipase producing fungi. Using agro and food industrial waste products such as soil near the oil processing industry might probably be a rich source for production of lipase with heavy industrial interests (Gog et al., 2012). The global market is presently demanding for scope of industrial lipases application.

1.1. Lipases in Leather Industry

Lipases have many applications and benefits in the pre tanning operations of leather processing. Lipases have the ability to bring about hydrolytic and synthetic reactions in both aqueous

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and non-aqueous media, hence in leather industries, lipases have many applications in pre tanning as well as post tanning operations. Be it liming, baiting, dehairing, or degreasing and fat liquoring operations. The enzymatic applications in these techniques and operations for leather processing might have a parallel lane for a better, economic and ecofriendly strategies in this field.

2. Objective

The following specific objectives have been formulated:

1. Isolation of fungal colonies from leather samples
2. Screening of extracellular lipase producing fungi using tributyrin contained agar plates.
3. Investigation of lipase production of selected strains under various culture conditions.
4. Analysis of hydrolytic reactions catalyzed by selected extracts.
5. Enzyme activity optimization

3. Materials and Methods

3.1. Media

PDA medium was used for storage of fungal cultures or fresh seeding for preparation of liquid cultures. The composition of potato dextrose agar (PDA) medium.

TBA medium was used for selective isolation of lipophilic fungi. Mustard oil was used in place of Tributyrin in general composition of TBA medium.

3.2. Other Chemicals

Lactophenol cotton blue was used for fungal staining. Tween 80, $CaCl_2$ KH_2PO_4, K_2HPO_4, HCl, NaOH, Ninhydrin, BSA were also required.

3.3. Collection of Soil Sample

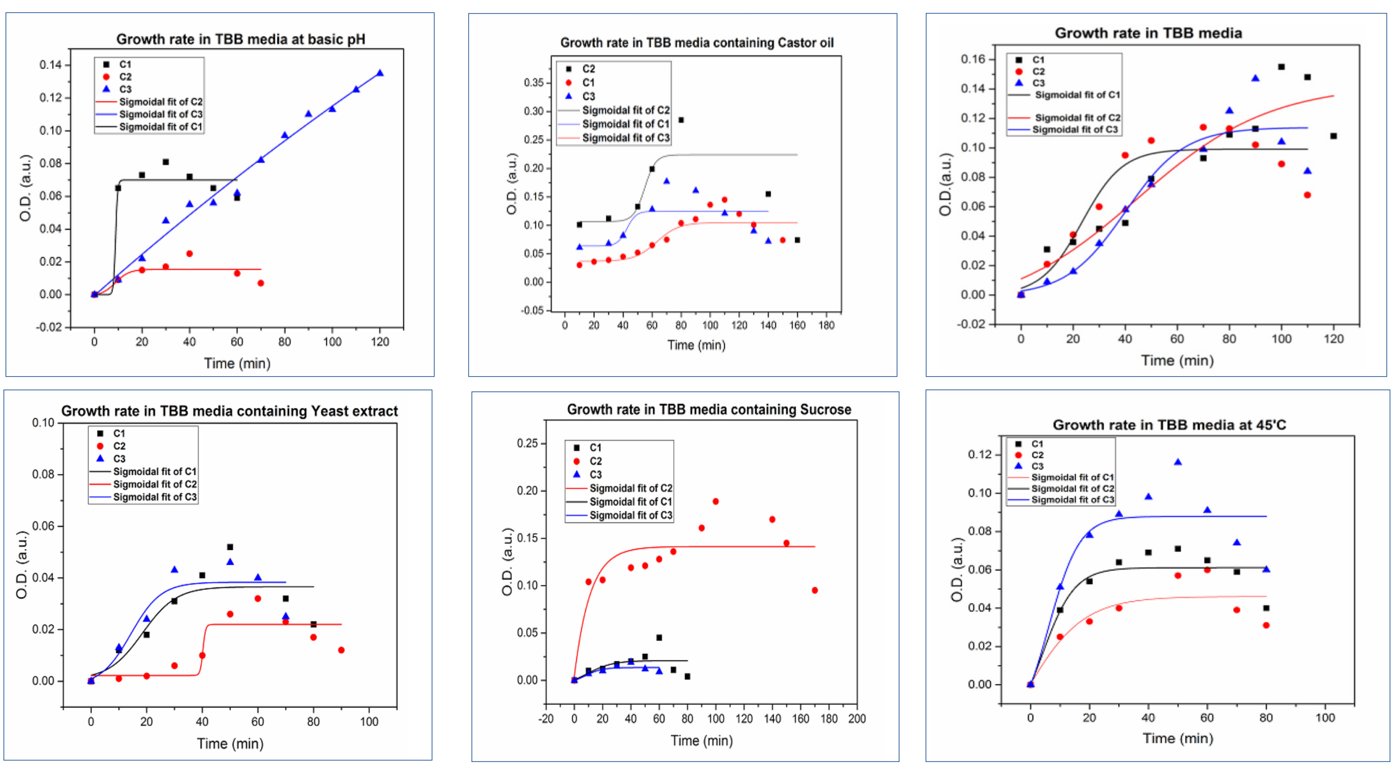
For the present study samples were collected from soil and oil contaminated soil from Diamond Harbor, District-South 24 PGS, West Bengal, India.

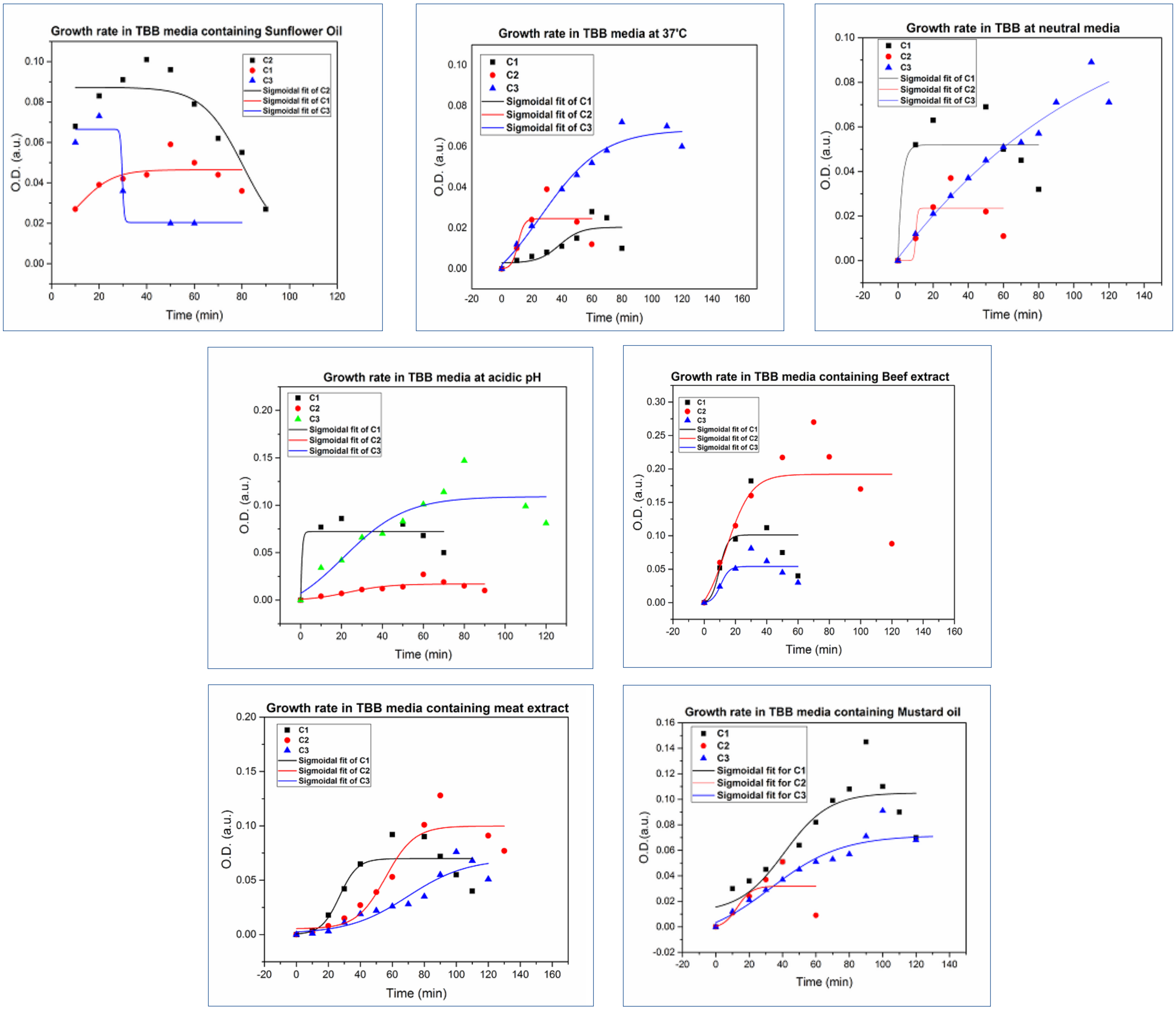
4. Result and Discussion

4.1. Measurement of Growth Curve

The recorded optical density with an interval of 10 min is representative of increased cell biomass with different time interval. Graphs were plotted with time versus optical density. Growth and multiplication of microorganisms on any substrates is often considered as the first step toward its bioconversion. Activity of lipase is directed by the biomass yield. The first phase was lag phase where no change in OD was observed. Rapid increase in OD indicates log phase. The next phase was the stationary phase, where there were no changes in OD. Last phase was death phase where negative slopes of the growth curve were observed. Optimizations were done based on varying temperature, carbon source, pH, inducer, surfactant, and nitrogen source.

5. Graphs





6. Conclusion

In this study, an endeavor has been made to study the lipase activity of three test fungal isolates for their application in fat liquoring during leather processing. Microbial lipases have become special industrially important due to their ability to remain active under extremes of temperature, pH and organic solvents, and chemo-, regio and enantioselectivity. Lipases might efficiently find applications in soaking, dehairing, bating, and degreasing operation for leather processing, bringing in an ecofreindly and economic aspects.

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