



## Efficacy of cellulase enzyme produced by some fungal isolates in the cellulose degradation of some organic materials

Mabrouka I. Abuzeid<sup>1</sup>, Khadeja A. Abuonezza<sup>1</sup>, Nazar N. Babiker<sup>2,3</sup>, Magdollen S. Ibrahim<sup>1</sup> and Mona A. Mohamed<sup>1</sup>

- 1- Faculty of Sciences, Microbiology department, Sebha University, Libya.
- 2- Faculty of Agricultural Sciences, University of Gezira, Wad medani, Sudan.
- 3- Faculty of Agriculture, Soil and Water department, Sebha University, Libya.

---

### Abstract

Cellulases are enzymes which act on plant cell wall, cellulolytic microorganisms produce the enzyme during their growth on cellulosic material. The cellulases enzyme have attracted considerable attention in recent years due to their great biotechnological and industrial applications. In this study. Fungi were isolated from Soil, tree leaves and sawdust of tree branches and screened for degradation of cellulose of some organic materials .The results showed that 36 fungi isolates were obtained included: *Aspergillus niger*, *Aspergillus awamori*, *Aspergillus sp.* *Fusarium solani* and *Curvularia coimbatorensis*. *Aspergillus niger* was one of the most frequent isolates with rates of 57%,70% and 70 in soil, twigs and leaves, respectively, followed by *Aspergillus awamori* with a frequency rates of 19%, 20% and 12% in soil samples, twigs and leaves, respectively, whereas *Fusarium solani* was one of the most frequent fungi 30% in sawdust samples. To detect the cellulolytic ability of fungal isolates, they were cultured on the Cellulose Basal medium, Congo red stain method was used to screen the cellulolytic ability of fungal isolates at different temperatures and pH, Based on the hydrolytic zones formation and cellulase enzyme production. The results showed that the pH and temperature both had a significant effect on the activity of the isolates for enzyme production, *Fusarium solani* isolates showed high and good activity for enzyme production at pH5 and pH7 under all tested temperatures.

Keywords: cellulose, cellulase enzyme, degradation of cellulose, fungal isolates, organic materials.

---

### Introduction

Cellulose is one of the most important organic compounds available in nature, where it is about (15 - 60%) of the plant cell wall components, gaining them the shape and hardness (Mahmood *et al.*, 2006). This polysaccharide is abundantly available in

materials, such as agro-wastes, municipal wastes, and forest residues. Therefore, the wastes generated from forests, agricultural fields and agro industries contain a large amount of unutilized or underutilized cellulose. (Milala *et al.*, 2005.) These wastes generally accumulate in

Corresponding Author: Nazar N. Babiker -Faculty of Agricultural Sciences, University of Gezira, Wad medani, Sudan.

Phone:

Email: [nazarbabiker@hotmail.com](mailto:nazarbabiker@hotmail.com)

Received: 15/5/2025

Accepted: 15 /12/ 2025

the environment causing pollution (Abu *et al.*, 2000). Acids can breakdown the long chains in cellulose to release the sugars through hydrolysis reaction, but because of their high specificity, cellulase can achieve higher yield of glucose from cellulose (Wyman, 2004). The hydrolysis of cellulosic biomass through enzymatic reaction is a preferred method over chemical reaction (Zhang, *et al.*, 2006). Cellulose, the substrate of cellulase, is the most abundant polysaccharide present on earth. It is the main substance in plant materials. Cellulase catalyzes the decomposition of cellulose polysaccharide by simply breaking down  $\beta$ -1, 4-glycosidic bonds. Three major types of enzymes are generally involved in hydrolyzing cellulose micro fibrils in the plant cell wall: endoglucanase, exoglucanase, and  $\beta$ -glucosidase. Complete cellulose hydrolysis is mediated by the combination of these three main types of enzymes. A portion of pretreated biomass can be used by fungi or other organisms that produce cellulase to release glucose (Wyman, 2008). Fungi, bacteria, and actinomycetes are recorded to be efficient cellulase enzyme producers in the natural environment. Filamentous fungi which use cellulose as carbon source possess the unique ability to degrade cellulose molecules in plant lignocellulose. Although, a large number of microorganisms are capable of degrading cellulose, a few of these organisms produce significant quantities of cell-free enzymes capable of completely hydrolyzing crystalline

cellulose in vitro (Immanuel *et al.*, 2006). Fungi are the main cellulase producing microorganisms. Fungal genera like *Trichoderma* and *Aspergillus* are known to be cellulase producers and crude enzymes produced by these microorganisms are commercially available for agricultural use (Wainwright, 1992). Their enzyme production efficiency and the enzyme complex composition are always diverse from each other. *Aspergillus* species attack cellulose producing significant amount of cell free cellulase capable of hydrolyzing cellulose into fermentable soluble sugars such as glucose; an important raw material in chemical industries (Wainwright, 1992). *Aspergillus* and *Trichoderma* sp are well known efficient producers of cellulases (Peij *et al.*, 1998). Several studies have been carried out to produce cellulolytic enzymes from biowaste degradation process by many microorganisms including fungi such as *Trichoderma*, *Fusarium solani*, *Penicillium* and *Aspergillus* species etc., (Kuhad, *et al.*, 2011).

The objectives of the current study were:

- 1- Isolation and identification of fungal species from (soil, tree leaves and sawdust of tree branches).
- 2- Detection of the ability of fungal isolates to produce cellulase enzyme.
- 3- Determination of the best range of temperatures and pH to stimulate fungal isolates to produce cellulase enzyme.

## Materials and Methods

### Collection of fungal isolates

Thirty samples of soil and plant parts (10 of soil, 10 of tree leaves and 10 of sawdust of tree branches) were collected from two different sites, 15 samples of which were collected from an orange farm in the South Sebha – Libya and the rest were collected from the garden and herbarium of the Faculty of Science at Sebha University. Soil samples were collected from depth (0–12 cm) from each site in sterile tubes using a sterile spoon while the leaves and sawdust were collected in sterile tubes using a scalpel and sterile forceps. The samples were transferred to the microbiology laboratory for the isolation and identification of the fungi (Sivaramanan, 2014).

### Isolation of fungi

The fungi were isolated from the specimens as described by (Sivaramanan, 2014), using the Sprinkled method of sawdust samples as well as leaves after cutting them into small pieces using sterile scissors. Then spray the samples spaced out on petri dishes containing the medium of Potato Dextrose Agar (PDA) which was prepared from the following ingredients (G\L): 20g agar, 20g Dextrose and 200 gm. Potato.

### Purification and identification of fungal isolates

The fungal isolates were purified identified using cultural and morphological features such as colony growth pattern, mycelium and conidial morphology under a microscope X40, the data were compared to the identification key

literature such as Fungi Morphologies of Cultured Fungi and Key to Species (Watanabe, 2010).

### Primary screening of cellulose-decomposed isolates

To examine the ability of fungus isolates to hydrolyze cellulose, Cellulose Basal medium (CBM) medium was used, which was prepared with the following components g/L:

NH<sub>4</sub>NO<sub>3</sub>(2g), KCL(0.5g), KHPO<sub>4</sub> ( 1g), MgSo<sub>4</sub> (0.5g), FeSO<sub>4</sub>.7H<sub>2</sub>O(0.01), Cellulose (15g), Agar (20g) and Peptone(0.2g). It was also prepared the control medium, which consisted of the same ingredients as mentioned above, with the replacement of 15g of cellulose with the same weight of sucrose sugar. The pH of both mediums was adjusted at pH7 and pH5 after sterilizing the media, to which the antibiotic Chloramphenicol was added at a concentration of 30 mg/L, After hardening the media in petri dishes and using a cork borer 5 mm and then transferring discs from the fungus colony (5 days old) to the center of petri dishes containing CBM medium (Triplicates) in addition to petri dishes containing control (Triplicates too) for each fungus. The dishes were incubated at different temperatures 18 °C, 25 °C and 30 °C for 5 days so as to examine the ability of fungal isolates to produce the enzyme Cellulase at different temperatures(Bekele, *et al.*2015).

### Examining the dishes and subculture cellulose-degrading fungi

The fungal colonies were examined and immersed in a solution of Congo red dye solution of 0.1%, as the Congo red dye has the

ability to bind to cellulose and produce a bright red color if the enzyme is effective for cellulose analysis where a transparent area (hydrolysis zone) appears around the fungus growth zone as evidence of the fungus ability to break down cellulose and produce the enzyme (Bekele, *et al.*, 2015; Sivaramanan, 2014). The dishes were immersed in the Congo red dye for 15 min. Then the diameter of the hydrolysis zone around the colonies was measured. The colonies that were incubated at a temperature of 30 ° C and had the largest and most effective hydrolysis zones for enzyme productions were inoculated and subculture on the CBM medium. Then after 5 days of incubation at a temperature of 30°C the colonies were immersed again in the Congo red dye 0.1% and then the hydrolysis zones were measured. The most efficient fungal isolates were selected to produce the cellulase enzyme based on the diameter of the hydrolysis zone formed around the fungus colony ( Bekele, *et al.*, 2015).

#### Measuring the Effectiveness and Activity of Cellulase Enzyme Using Well Diffusion Method

First, suspensions of the most efficient fungal isolates were prepared to produce the Cellulase enzyme at a concentration of  $10^{-5}$  CFU/ml by using a Spectrophotometer at wavelength 530nm . The CBM medium was used to measure the effectiveness of the enzyme by making wells diameter of 5 mm using a cork borer in the center of the medium and then 60  $\mu$ L of fungal suspensions were added to the wells with three

replicates for each suspension, and then the dishes were incubated at a temperature of 30°C for 6 days. After the incubation The dishes were immersed in Congo red dye 0.1% After 15 minutes the dye was discarded and then the dishes were washed with sodium chloride solution ( 1 mol), Finally, the mean diameters of the hydrolysis zones around the wells was measured in millimeters (Bekele, *et al.*, 2015).

#### Statistical analysis

To measure the efficiency of fungal isolates for cellulase production, statistical analysis was performed using one-way analysis of variance (ANOVA) to study the differences between more than two groups by SPSS Version (23) at a probability value of 0.05.

### Results and discussion

#### Isolation and identification of fungal isolate

Based on the macroscopic and microscopic characteristics of the different isolate, these isolates were classified into 5 fungal genera including three genera of *Aspergillus*: *Aspergillus niger*, *Aspergillus awamori*, *Aspergillus sp.*, *Curvularia combatorensis* and *Fusarium solani* ( Table 1).

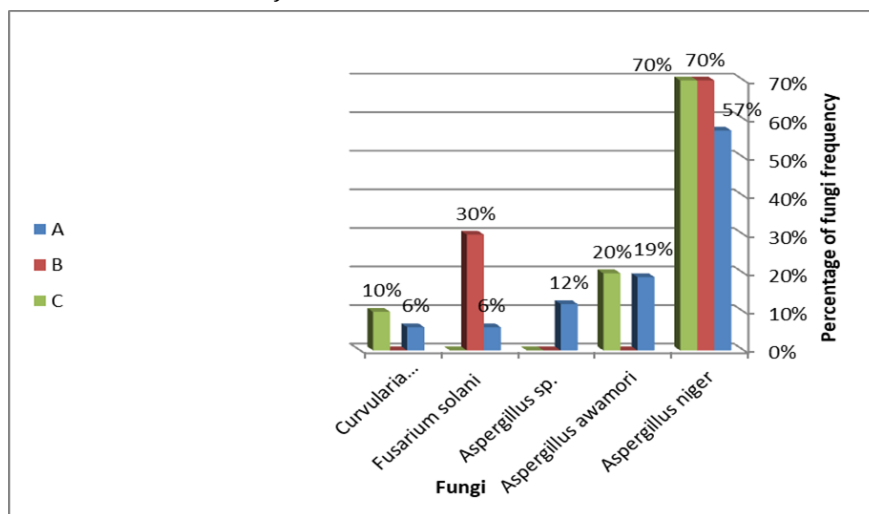
Table 1. macroscopic and microscopic characteristics of fungi isolates on PDA medium:

Fungi isolates	Collection site	macroscopic characteristics on the PDA medium	microscopic characteristics
<i>Aspergillus niger</i>	Orange farm And herbarium	Fast-growing with transparent white fluff interspersed with black spots and the back of a plate appears yellow	The conidiophore has thick walls and is yellow in color. The Conidia are Spherical in shape, with black in colour, separate, simple, or branched, and binary
<i>Aspergillus awamori</i>	Orange farm And herbarium	Colonies of greenish-gray color, the fungal mycelium is dense and highly branched	It has colorless vertical sporophores and spores arise at its apex with a basal succession and the spores are spherical to elliptical in shape
<i>Aspergillus sp.</i>	Orange farm	Small colonies are white, but in the next two days the culture became black.	mycelium are divided into cells from which conidiophores branch out and end with heads with tails that carry conidia externally
<i>Fusarium solani</i>	Orange farm and herbarium	Fungal mycelium white to creamy color on the PDA medium, the colony texture is cotton and its edges are regular	macro conidia spores are relatively wide, while small conidian spores are oval or renal in shape and may be undivided or divided by one or two barriers.
<i>Curvularia c</i>	Orange farm	Wool-like colonies, fast-growing, the color of the colony is at the beginning white to gray and then the mycelium turns to black gray with a look similar to coarse hair with a brown background to black	mycelium is divided by septa, ending with pear-shaped conidian spores curved or elliptical, and divided by transverse septa.

The frequency and percentage of fungal species in the samples.

The results of fungal species frequency showed that the fungal isolates differed according to the percentage of their appearance in the three sources (soil, tree leaves and sawdust of tree branches), (Fig1), where *Aspergillus niger* appeared at a rate of from 57% to % 70 in all samples, followed by *Fusarium solani* with an appearance rate of 6-30%, while the appearance rate of *Aspergillus awamori* was 19-20%, and *Aspergillus sp.* 12%, the lowest genus was *Curvularia combatorensis*, with percentage of 6 to 10%, This result is similar to those conducted for the production of cellulase enzyme from

some local fungal isolates by (Abdul-Hadi, 2011). The study demonstrated the effect of some cultural conditions, as it showed *Aspergillus niger* is the fungi with the highest percentage Compared to fungi of other genera, the reason for the predominance of this fungus is due to its wide spread in the environment, which comes from its ability to form many asexual reproductive units resistant during the inappropriate environmental conditions. The species of the genus *Aspergillus niger* are characterized by growing in a range of temperatures between (5-45) °C (Silva *et al.*, 2015).



A= soil samples, B= sawdust samples, C= leaf samples.

Figure 1. Percentage of fungi frequency.

Effect of temperature on the activity of isolates to produce cellulase enzyme at pH7

In this study, the Congo red staining method was used to examine the ability of fungal species isolated from soil, plant leaves and sawdust to

produce cellulase enzyme( Sazci *et al.*,1986).The effect of the pH of the medium and temperature on the ability of fungal isolates to produce the cellulase enzyme and their impact on the efficiency of this enzyme was tested. The results showed that the temperatures at pH7 had a significant and varying impact on the ability of

fungus species to produce Cellulase enzyme. At a temperature of 30°C most fungal species did not have the ability to produce the enzyme except for the genus *F. solani*. where some of its isolates had the ability to produce The cellulase enzyme at 30°C as the average diameters of the hydrolysis zone were 40 mm and 36.6 mm around the growth discs of *F.solani1* and *F.solani2* respectively (Fig 2,3). These results are somewhat harmonized with those of a study (Abdulhadi, 2011) which showed that the enzymatic activity of the *F.solani* was 52.71 mm at PH6 and a temperature of 28±1. The temperature of 25°C had a different effect and variation from the temperature of 30°C on all fungi, where some fungi had an average ability to produce cellulase enzyme with average diameters of the decomposition (35, 31.6, 33.3, 35mm) of fungi genera *A.awamori1*, *A.awamori2*, *Aspergillus sp.1*, *F.solani3* respectively ( Fig 2,3). This corresponds to a study (Naher et al., 2021) where *A.awamori* fungi isolates isolated from herbal leaves were effective for producing cellulase enzyme at a temperature of 27°C. While fungi *F.solani1* and *F.solani2* had a weak ability to produce cellulase enzyme, with average diameters of the hydrolysis zone (8.33 and 10 mm) respectively. The rest of the isolates did not have the ability to produce the enzyme at pH7 and 25°C. The enzymatic activity of fungi at a temperature of 18°C and pH 7 was between medium to weak as well, and some isolates did not have the ability to produce the enzyme while others showed medium activity represented by the fungi of

*A.awamori1* and *A.awamori2* with mean diameters of the decomposition zone (26.67 and 25 mm) respectively, on the other hand the fungal isolates *A.awamori3*, *Aspergillus.sp.1* and *F.solani2* exhibited a weak enzymatic activity, which is consistent with the study of (Reanprayoon and Pathomsiriwong, 2012), which shows in his study of the efficiency of some tropical soil fungi that *Aspergillus sp.* isolates were more efficient for cellulose production than the fungi *Curvularia lunata* and *Fusarium sp*, which showed lower efficiency in producing the enzyme at 25°C.As for *A.niger* fungi isolates (9 isolates from soil, 7 from sawdust and 7 from leaf plants) they had no ability to produce cellulase enzyme at pH7 at temperatures (30 – 25 and 18 °C). The inability of some isolates such as *Aspergillus sp.2* and *C.combatorensis*, or the weakness of most of them to produce cellulase enzyme could be attributed to the age of colony or PH level or the incubation period may be insufficient to stimulate the isolates to form cellulose, as well as the difference in the ability of the isolates to exploit the culture medium (Abdulhadi,2011).

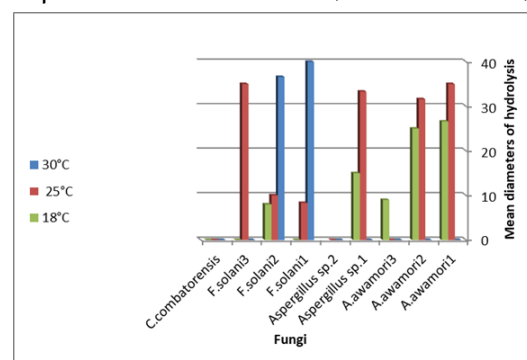


Figure 2. Average diameters of cellulose hydrolysis zones of fungal isolates at pH7.

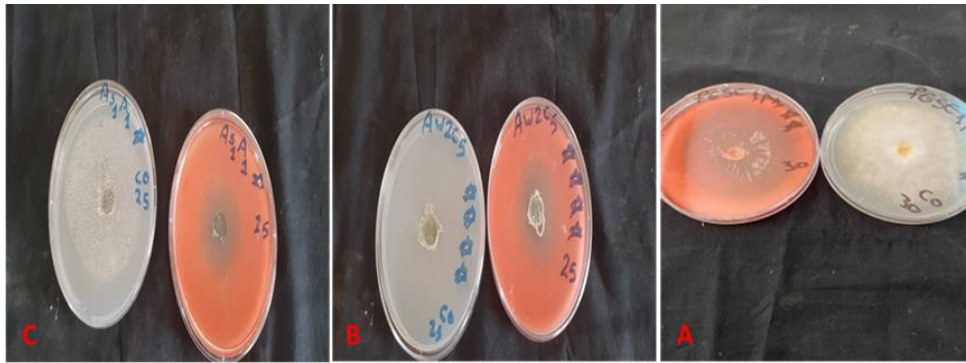


Figure 3. The ability of the isolates to produce the enzyme at pH7 through the appearance of the hydrolysis zone around the fungi disc(A) *Fusarium solani*1 (B) *Aspergillus awamori*1 (C). *Aspergillus* sp.1

### Effect of temperature on the effectiveness of isolates to produce cellulase enzyme at pH5

The pH has a significant impact on the growth of microorganisms as well as on the production and activity of enzymes. This was clearly demonstrated in the results of the effect of different temperatures on the ability of fungi to produce cellulase enzyme at pH5, Whereas, with the exception of the *A.awamori*1 isolate, which showed a high ability to produce the enzyme at a temperature of 30°C with an average diameter of 84 mm, and for all *F.solani* isolates, all other isolates tested were unable to produce the enzyme at pH5 and under the influence of different temperatures (Fig. 4) which can be explained by the inability of these isolates to exploit the culture medium and the breakdown of cellulose substance present in the nutrient medium. The appropriateness of the pH of media affects their efficiency on the production of the enzyme, and this was confirmed by the study of (Mangnt and Mandahr, 1998), and the effectiveness of cellulase enzyme production

varies according to different strains (Naher *et al.*, 2008).

Some previous studies showed that several types of genus *Aspergillus* sp such as *A.famigatus*, *A.terreus* and *A.flavus* had the highest ability to produce cellulase enzyme at pH5.8 and temperatures ranging from 40-50°C (Barapatre *et al.*, 2020). The fungus *A.niger* was effective in producing cellulase enzyme at pH5-6 and pH4 at temperatures ranging from 35°C-50°C (Gautam *et al.*, 2011; Sohail *et al.*, 2009). *F.solani* isolates gave efficiency ranging from high to medium in the breaking down of cellulose (Fig 4,5), the diameter of the hydrolysis zone of the isolate *F.solani*1 at temperatures (30, 25 and 18 °C) reached (56, 42, and 58.6 mm), respectively, while the diameter of the hydrolysis zone of isolate *F.solani*2 ranged between (47.3, 51.6, 17.6 mm) at temperatures (30, 25, 18°C) respectively. The *F.solani*3 isolate showed efficiency between medium to high to the production of cellulase enzyme with an average diameter of the hydrolysis zone (28.3, 60.6, 58.3 mm) at temperatures (30, 25, 18 °C) respectively, and this corresponds to a study

(Abdulhadi, 2011). Where the isolation of *F.solani* gave an enzymatic activity of 52.77mm, where this value represents a high efficiency in the production of the enzyme compared to the ability of the isolates to produce the enzyme at pH7 and pH5, It was observed that the isolates *A.awamori1*, *A.awamori2*, *A.awamori3*, *Aspergillus.sp.1* were effective in producing the enzyme at pH7, while the isolates of *F.solani* increased their ability to produce the enzyme at PH5 compared to their activity at pH7, and this can be explained by the fact that the neutral pH may cause a change in the triple and secondary structure of the cellulase enzyme and disruption of the site and the active part in it, which affects

its ability to break down the cellulose in the medium (Sulyman *et al.*, 2020).

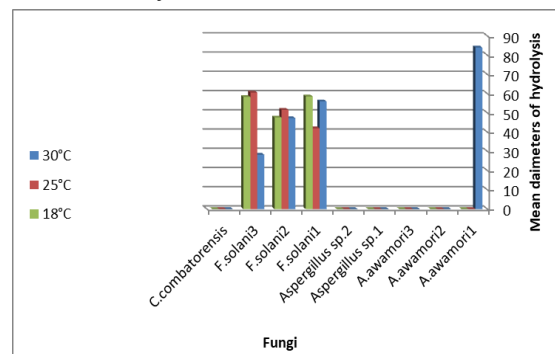


Figure 4. Average diameters of cellulose hydrolysis zones of fungal isolates at pH 5.

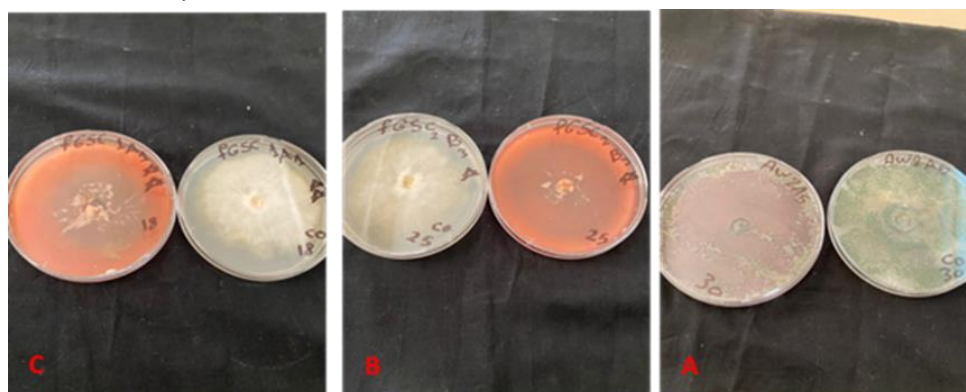


Figure 5. The ability of the isolates to produce the enzyme at PH5 through the appearance of the hydrolysis zone around the fungi disc (A) *Aspergillus awamori1* (B) *Fusarium solani3*(C). *Fusarium solani1*.

The most effective fungal isolates for cellulase enzyme production

Among the 9 isolates of fungi isolated from different sources, 7 of them showed medium, good and high efficiencies for the production of cellulase enzyme at different temperatures and pH. Therefore, confirmatory tests were carried out according to the method (Bekele, 2015) under a temperature of 30°C and pH7 and the average diameter of the hydrolysis zone were

compared. Through the test, it was found that the *F.solani* fungi isolates were one of the most effective isolates for the production of cellulase enzyme, where the isolates of this fungus were able to grow and produce the enzyme with an efficiency ranging between medium, good and high under all temperatures and the degree of hydrogen on concentration tested, Figure (6), as it was found by comparing the average diameters of the hydrolysis zone that the

F.solani1 fungi isolates, F.solani2, F.solani3 were remarkably effective for enzyme production at a probability value of 0.05 which is consistent with the findings of Gunathilake *et al.*, (2013), which indicates that soil and tree branches are a good source of cellulose-degrading fungi that can be used in various industrial applications.

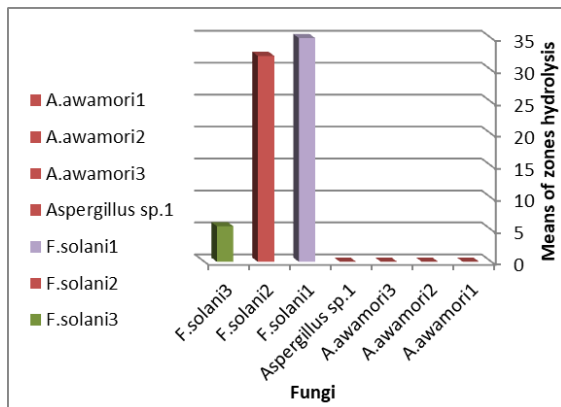


Figure 6. Average diameters of cellulose hydrolysis zone of the most effective isolates for the production of the Cellulase enzyme.

### Conclusion

Through this study, which was conducted to isolate fungi from the different sources included (soil, tree branches and decomposing plant leaves), the result showed the isolates of fungus *Aspergillus niger* were the most frequent in testing samples, followed by *Aspergillus awamori* and *Fusarium solani*. During testing the effect of different temperatures and pH degree on the variation in the ability of isolates to produce cellulase enzyme at pH7 and (pH5) it was found that *Fusarium solani* fungus is highly efficient and good for the production of Enzyme at pH5 and pH7 at different temperatures.

### References

- Abdlhadi, S.Y. 2011. Determining the efficiency of some local fungal isolates in cellulase enzyme production. *Tikrit Journal of Pure Sciences*, 16, (2), 168-174.
- Abu, E. A.; P. C. Onyenekwe, D. A. Ameh, A. S. Agbaji and S. A. Ado, 2000. Cellulase (E.C.3.21.3) production from sorghum bran by *Aspergillus niger* SL 1: An assessment of pretreatment methods. *Proceedings of the International Conference on Biotechnology: Commercialization and Food Security*, (ICBCFS'00), Abuja, Nigeria, pp: 153-1594
- Barapatre, S.; Savita, M. R. and Nandal. M. 2020. Isolation of fungi and optimization of PH and temperature for cellulase production. *Nature Environment and pollution Technology*, 19(4), 1729-1735.
- Bekele, A.; Abena,T.; Habteyohannes, A.; Nugissie, A.; Getie, T.; Kelel, M. and Berhanu, A. 2015. Isolation and characterization of efficient cellulolytic fungi from degraded wood and industrial samples. *African Journal of Biotechnology*, 14 (48), 3228-3234.
- Gautam, S. P.; Bundela, P. S.; Pandey, A. k.; Khan, J.; Awasthi, M. K. and Sarsaiya, S. 2011. Optimization for the production of cellulase enzyme from municipal. Solid waste residue by two novel cellulolytic fungi. *Biotechnology Research International*, 2011, 1-8.
- Gunathilake, K.M., Ratnayake, R. R.; Kulasooriya, S. A. and Karunaratne, D. N. 2013. Evaluation of cellulose degrading efficiency of some fungi and bacteria and their biofilms. *J. Natl. Sci. Foundation. Sri Lanka*, 41(2): 155-163

- Immanuel, G.; R. Dhanusha, P. Prema and A. Palavesam, 2006. Effect of different growth parameters on endoglucanase enzyme activity by bacteria isolated from coir retting effluents of estuarine environment. *Int. J. Environ. Sci. Technol.*, 3: 25-34.
- Kuhad, R. C.; Gupta, R.; Singh, A. Microbial cellulases and their industrial applications. *Enzyme Res.* 2011, 2011, 280696.
- Mahmood, k.; Wei-jun, Y.; Nazir, K.; Iqbal, R. Z. and Arijio, A. G. 2006. Study of cellulolytic soil fungi and two nova species and new medium. *J. Zhejiang Univ Science B*, 7 (6): 459-466.
- Mangat, M. K. and Mandahr, C. L. 1998. Effect of cultural conditions on the production of cellulases by *Helminthosporium teres*. *Res. Bull. Punjab university Sci.* 46 (1-4), 139-145.
- Milala, M. A.; A. Shugaba, A.; Gidado, A. C.; Ene and J. A. Wafar, 2005. Studies on the use of agricultural wastes for cellulase enzyme production by *Aspergillus niger*. *Res. J. Agric. Biol. Sci.*, 1: 325-328.
- Naher, L.; Fatin, S. N.; Sheikh, M. A. H.; Azeez, L. A.; Siddiquee, S.; Mdzain, N.; Omojasola, P. F.; Jilani, O. P. and Ibiyemi, S. A. 2008. Cellulose production by some Fungi cultured on pineapple wastes. *Nature and science.* 6(2). 64-78.
- Peij, N.; M. M. C.; Gielkens, R. P.; Verles, K.; Visser and L. H. Graff, 1998. The transcriptional activator XlnR regulates both xylanolytic and endoglucanase gene expression in *Aspergillus niger*. *Applied Environ. Microbiol.*, 64: 3615-3617.
- Reanprayoon, P. and Pathomsiriworg, W. 2012. Tropical soil Fungi producing cellulase and Related Enzymes in Biodegradation. *Journal of Applied Sciences*, 12(8), 1909-1916.
- Sazci, A.; Radford, A. and Ereter, K. 1986. Detection of cellulolytic fungi by using congo red as an indicator: a comparative study with the dinitrosalicylic acid reagent method. *Journal of Applied Bacteriology.* 61, 559-562
- Silva, F. C.; Chalfoun, S. M.; Batista, L. R.; Santos, C. and Lima, N. 2015. Use of polyphasic approach including MALDI-TOF MS for identification of *Aspergillus* section *Flavi* strains isolated from food commodities in Brazil. *Ann Microbiol.* 65, 2119–2129.
- Sivaramanan, S. 2014. Extraction of cellulolytic Fungal enzymes from isolated fungi and evaluate their use in bio pulping bio bleaching and degradation of paper wastes *JAIR*, 2, 8-17.
- Sohail, M.; Siddiqi, R.; Ahmed, A. and Rhan, S. A. 2009. Cellulase production from *Aspergillus niger* MS82: effect of temperature and PH. *New Biotechnology*, 25(6), 437-441.
- Sulyman, A. O.; Iguhnu, A. and Malomo, S. O. 2020. Isolation, purification and characterization of cellulase produced by *Aspergillus niger* Cultured on *Arachis hypogaea* shells. *Heliyon*, 6 (2020), 1-1.
- Wainwright, M., 1992. An introduction to fungal Biotechnology, Wiley Biotechnology Series. John Wiley and Sons, Toronto, NY., pp: 280-284.
- Watanabe, T. 2010. Pictorial Atlas of Soil and Seed Fungi. 3rd Ed. Taylor and Francis Group LLC.

Wyman, C. E. 2004. Ethanol Fuel. In:  
Encyclopedia of Energy, C. Cleveland, (Ed.).  
Elsevier, St. Louis MO., pp: 541

Wyman, C. E. 2008. Cellulosic ethanol: A unique  
sustainable liquid transportation fuel. MRS  
Bull., 33: 381-382. [Direct Link](#) |

Zhang Y. H. P.; Himmel M. E.; Mielenz J. R. 2006.  
Outlook for cellulase improvement: screening  
and selection strategies. Biotechnology  
Advances. 24(5):452–481.  
doi: 10.1016/j.biotechadv.2006.03.003



## فاعلية إنزيم السليوليز المنتج بواسطة بعض العزلات الفطرية في تحلل سليولوز بعض المواد العضوية

مبروكة حسين ابوزيد<sup>1</sup>، خديجة عبدالله ابوعنيزة<sup>1</sup>، نزار نصر الدين بابكر<sup>2,3</sup>، مجدولين سعد  
ابراهيم<sup>1</sup>، منى علي محمد<sup>1</sup>

1 - قسم الأحياء الدقيقة ، كلية العلوم ، جامعة سبها ، ليبيا

2 - قسم علوم التربة والمياه ، كلية العلوم الزراعية ، جامعة الجزيرة ، السودان

3 - قسم علوم التربة والمياه ، كلية الزراعة ، جامعة سبها ، ليبيا

### المستخلص

إنزيمات السليوليز تؤثر على الكائنات الحية الدقيقة في جدار الخلية النباتية أثناء نموها على المواد السليولوزية. ولقد حظي إنزيم السليولوز باهتمام كبير في السنوات الأخيرة نظرًا لتطبيقاته التكنولوجية الحيوية والصناعية الواسعة. في هذه الدراسة، عُزلت بعض فطريات من التربة وأوراق الأشجار ونشارة الخشب لأغصان الأشجار، وفُحصت مقدراتها لتحليل السليولوز في بعض المواد العضوية. حيث أظهرت النتائج الحصول على 36 عزلة من الفطريات شملت : *Aspergillus niger*, *Aspergillus awamori*, *Aspergillus sp.*, *Fusarium solani* and *Curvularia coimbatorensis* من أكثر العزلات انتشارًا حيث بلغت نسبتها 57% ، 70% و 70% في عينات التربة، اغصان الأشجار و أوراق النبات المتحللة على التوالي ، يلها الفطر *Aspergillus awamori* بمعدل تكرار 19% ، 20% و 12% في عينات التربة، اغصان الأشجار و أوراق النبات المتحللة، بينما كان فطر *Fusarium solani* من أكثر الفطريات انتشارًا في عينات نشارة اغصان الأشجار بنسبة 30%. ولدراسة تأثير بعض الظروف الزراعية على العزلات الفطرية ، تم تربيتها على وسط السليولوز القاعدي ، واستخدمت طريقة صبغة الكونغو الحمراء لفحص العزلات الفطرية عند درجات حرارة و حموضة مختلفة ، بناءً على تكوين مناطق التحلل المائي وإنتاج إنزيم السليوليز. حيث أظهرت النتائج أن كلا من الأس الهيدروجيني ودرجة الحرارة لهما تأثير معنوي على نشاط العزلات لإنتاج الإنزيم ، كما أظهرت عزلات *Fusarium* نشاطاً عالياً وجيداً لإنتاج الإنزيم عند pH5 و pH7 تحت جميع درجات الحرارة المختبرة في هذه الدراسة.

الكلمات المفتاحية: السليولوز ، إنزيم السليوليز ، تحلل السليولوز ، العزلات الفطرية ، المواد العضوية.