

Original Research Article

# Use of *Pleurotus ostreatus* biomass and exudates, Johnson grass, Field bind weed and rice straw on some enzymes activity

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## Abstract

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The study was conducted in the laboratories of the Department of Plant Protection in the Faculty of Agriculture – University of Kufa to test the efficacy of enzymes (Exoglucanase, Laccase, CMCCase and Pectinase) in the crusts of rice straw, Johnson grass and Field bind weed alone which incubated with fungus *Pleurotus ostreatus* for two periods of 20 and 40 days at a temperature 25 °C. The results showed a significant improvement in the efficiency of all four enzymes when mixed with fungi compared to the plant residues alone, treatments were less effective for all incubation factors with *Pleurotus ostreatus* after 40 days compared to 20 days of incubation except for the lactase enzyme with the spandex plant.

**Keywords:** Exoglucanase, Laccase, CMCCase, Pectinase, *Pleurotus ostreatus*

## INTRODUCTION

*Pleurotus ostreatus* is the second most important food fungus after *Agaricus bisporus*, which grows wild in forests and pastures in the tropics and sub-tropics of the world (Shah *et al.*, 2004). In recent years, mushroom cultivation has increased worldwide. Flavor, taste, and high nutritional value for being rich in protein, vitamins and minerals (Dundar *et al.*, 2008; Dundar *et al.*, 2009). It also plays a role in the destruction of toxic substances in the medium where this fungus is grown by the enzymes produced by it (Lacina *et al.*, 2003 and Kermasha, 2012). The mushroom has a complex enzymatic system, which has a high potential for growth on many types of plant residues rich in calcite and cellulose such as wheat straw, rice production, maize and agricultural waste of date palm, as well as many different types of bushes (Hassan, 2011) (Kong, 2004).

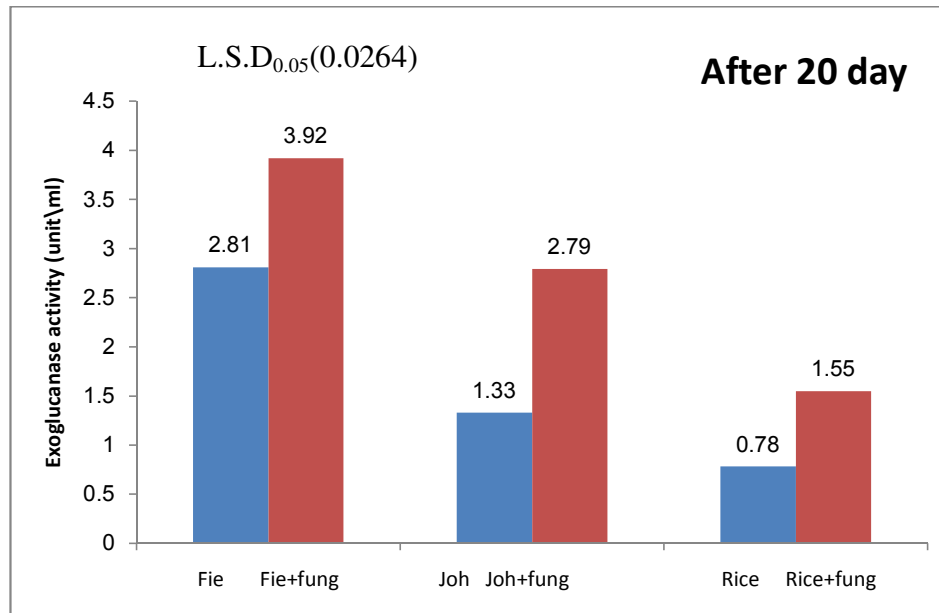
*Pleurotus ostreatus* grows on different agricultural and plant residues. The variation in the production of this fungus and its food components in different areas led to the search for other types of agricultural media, especially the weeds, which are available mostly for the benefit of mushroom production, The anthrax group of

this fungus, including the *Sorghum halepense* L., a long-lived weed belongs to the Poaceae family (Alhially, 2012) and *Convolvulus arvensis* which dates back to the Convolvulaceae family, causes major problems in crops: Wheat, cotton, sugar cane and potatoes (Menon and Asma, 2004), which is perennial weeds (Al-gburi, 2014). Rice husks are also introduced every year for hundreds of tons of waste, so it is necessary to use them for the same purpose as the growth of Johnson grass and the Field bind weed *Convolvulus arevensis* (Al-Hamdawi, 2012).

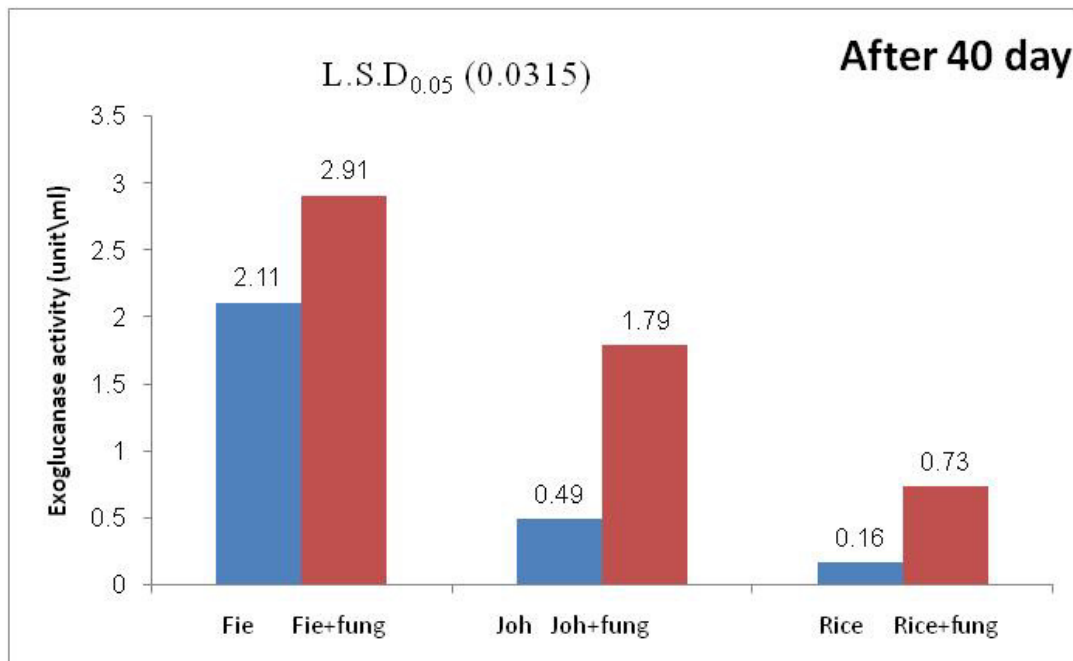
The aim of the research is to study the effectiveness of some enzymes produced by the fungus, to be used in the biological destruction of the growth of Johnson grass, aqueous and the rice straw for use in the growth and production of fungus and to convert those wastes into organic fertilizer.

## MATERIAL AND METHODS

The vegetative parts of Johnson grass and Field bind



**Figure 1a.** Effect of different culture media on Exoglucanase activity after 20 days



**Figure 1b.** Effect of different culture media on Exoglucanase activity after 40 days

weed were collected and extended from the fields of the Sherman area in Kufa city and the fields of the Faculty of Agriculture - University of Kufa, where the weeds were chosen because they are widely available and throughout the year, dried these vegetative parts in the oven and at a temperature of 65°C and crushed the samples after drying them Mediated by an electric mixer (Blender) for dry powder and then placed individually in paper bags at laboratory temperature.

Weight 10 g of dry growth of Johnson grass, Field bind weed and rice straw put in buffer acetate (50 ml) pH (5.5). Mix for 30 minutes by centrifuge at 5000 rpm for 10 minutes to separate the cells and solid parts. Use leachate as raw enzymatic solution to estimate the effectiveness of exogenous enzymes (Sherief *et al.*, 2010). The efficacy enzymes (lactase enzymes, Oxoglucanase, CMCCase, and Pectinase) were estimated for two periods after 20 and 40 days of incubation with

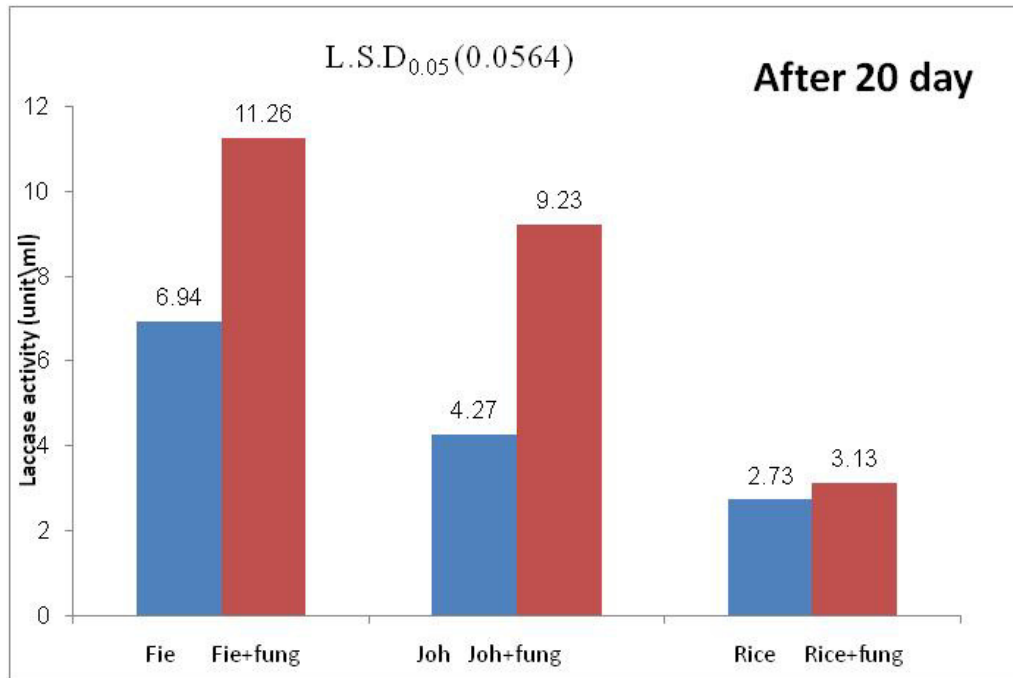


Figure 2a. Effect of different culture media on Laccase activity after 20 days

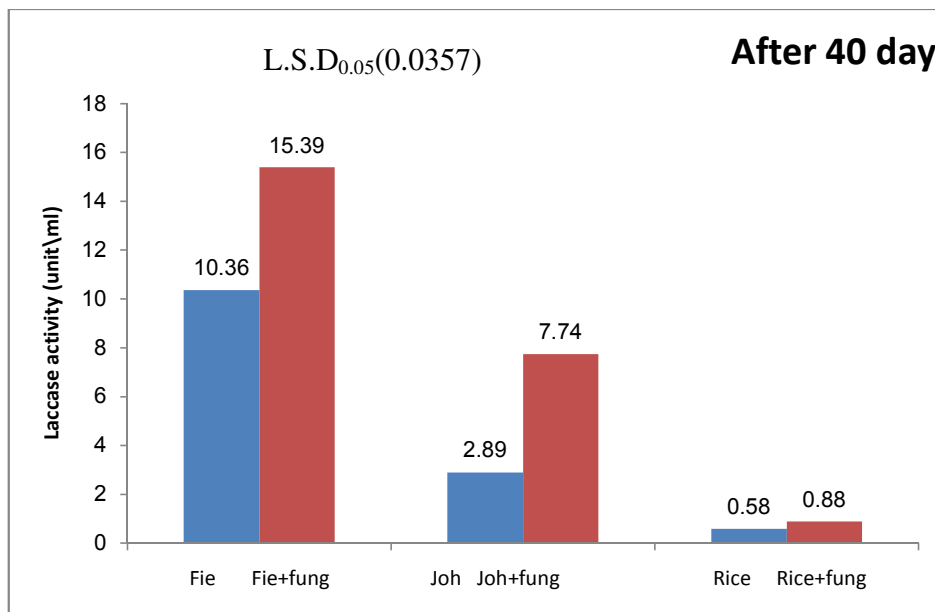


Figure 2b. Effect of different culture media on Laccase activity after 40 days

*Pleurotus ostreatus*. According to the method followed by (Khalil and Acharon, 2011 and Sherief *et al.*, 2010).

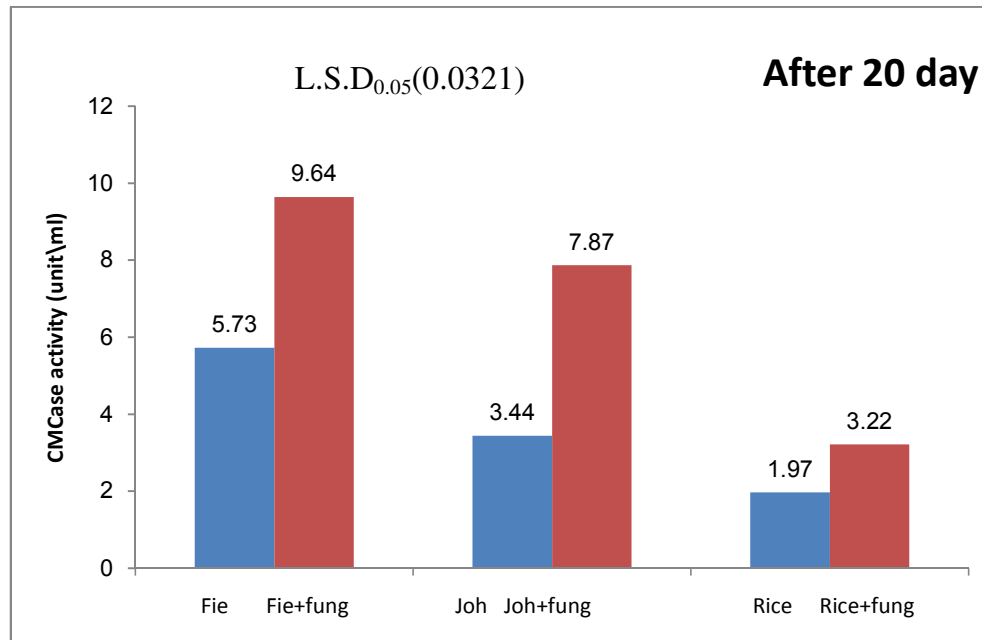
**DISCUSSION**

**Exoglucanase activity**

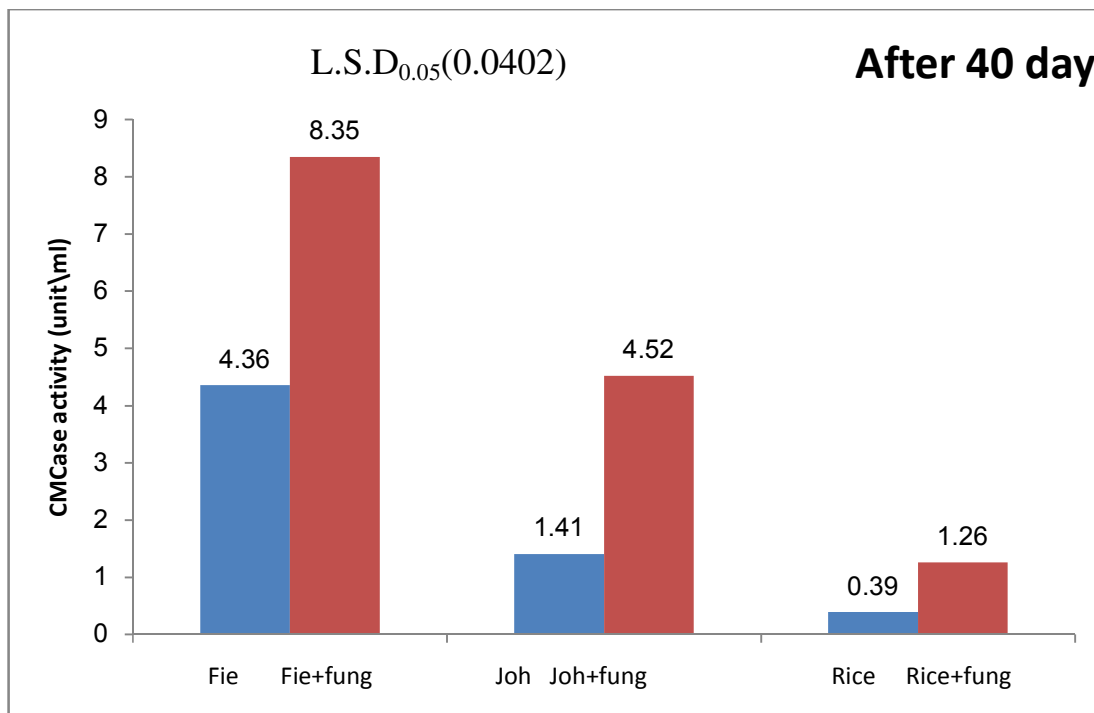
Exoglucanase is one of the three enzymes responsible

for cellulose decomposition, which works to break the peripheral bonds of the cellulose molecule randomly to release monoclinal sugars and thus generate new terminal endings.

Figure 1a shows that all confluence of *Pleurotus ostreatus* and plant residues has significantly increased the effectiveness of Exoglucanase compared to the plant residues alone, The highest was in the treatment of mixing mushrooms with each of the Field bind weed,



**Figure 3a.** Effect of different culture media on CMCase activity after 20 days



**Figure 3b.** Effect of different culture media on CMCase activity after 40 days

Johnson grass and rice straw where they reached 3.92, 2.79, 1.55 absorption units<sup>-1</sup> compared with control (Field bind weed, Johnson grass and rice straw alone) reached 1.81, 0.78 and 1.78 respectively. Moral superiority continued to increase the effectiveness of the above enzyme even after 40 days (1b) but less than 20

days of incubation with the fungus, The interaction between Field bind weed and mushroom was significantly higher than alone reached 2.91, 2.11 absorption units.ml<sup>-1</sup>, Johnson grass(1.79, 0.49 absorption units.ml<sup>-1</sup>) and the rice straw( 0.73, 0.16 absorption units.ml<sup>-1</sup>) respectively. This may be due to the fact that agricultural wastes are

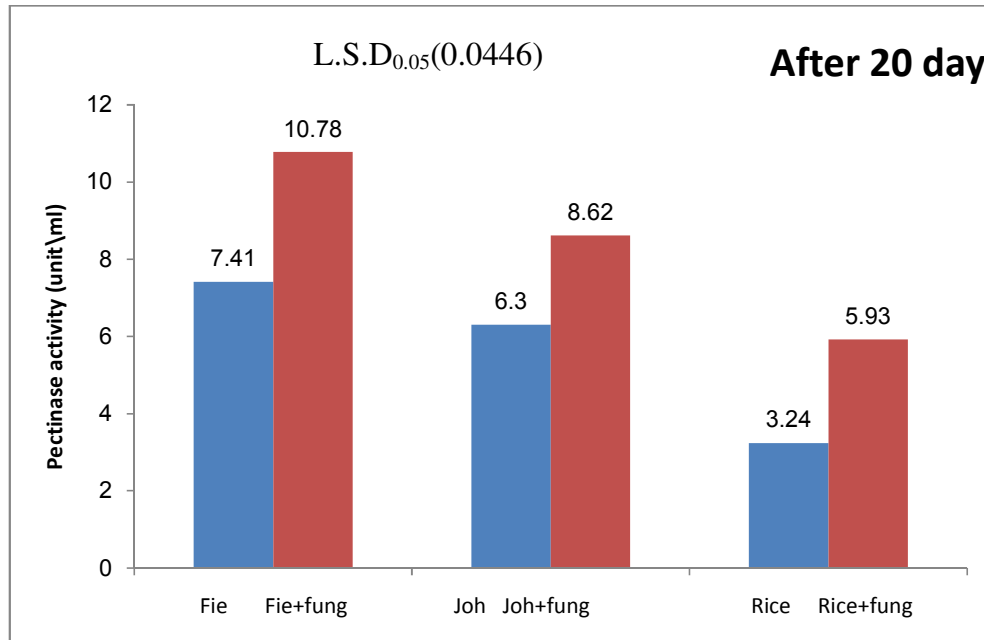


Figure 4a. Effect of different culture media on Pectinase activity after 20 days

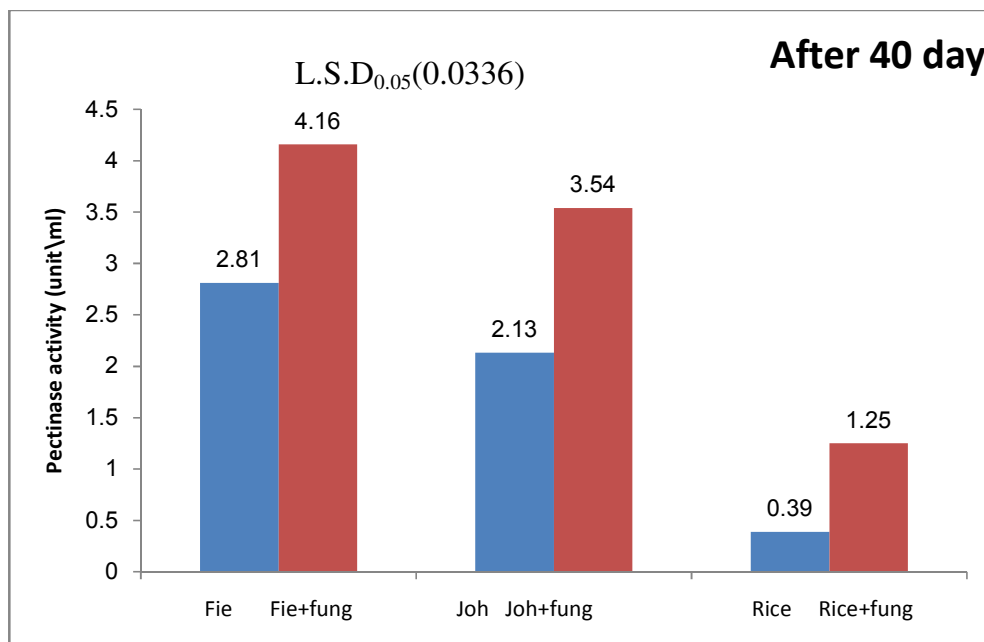


Figure 4b. Effect of different culture media on Pectinase activity after 40 days

sources and raw materials for fermentation processes to convert them into simple materials (Hamelinck *et al.*, 2005). These results are consistent with Daba *et al.*, (2011).

### Laccase activity

Laccase is an enzyme of oxidation produced by many

organisms. It requires oxygen to oxidize phenolic substances and similar substances by synthesis and has a role in destroying organic matter (Abd El Monssef *et al.*, 2015).

Figure (2a) Moral superiority shows all mixing coefficients between *Pleurotus ostreatus* and plant residues compared to plant residues alone. Field bind weed reached 11.26, 6.94 Unit.ml<sup>-1</sup>, Johnson grass (9.23, 4.27 Unit.ml<sup>-1</sup>) and rice straw (3.13, 2.73 Unit.ml<sup>-1</sup>)

respectively after 20 days, as well as After 40 days, the effectiveness decreased of the enzyme compared with 20 days in the spandex reached (7.74, 2.89 Unit.ml<sup>-1</sup>). The highest efficacy of the enzyme after 40 days in Field bind weed with and without fungus (15.39, 10.36 Unit.ml<sup>-1</sup>). These results are consistent with Rashad et al. (2009) in their study of processing rice straw residues using *Pleurotus ostreatus* NRRL-0366

### CMCase activity

CMCase is also called Endoglucanase enzyme, this enzyme attacks and breaks internal bonds in the cellulose molecule, often resulting in bipolar and triglyceride sugars. (Sherief *et al.*, 2010). Figure 3a shows the significant improvement in the efficacy of CMCase when *Pleurotus ostreatus* mixing with each of Johnson grass, Field bind weed and rice straw reached (9.84, 7.87, 3.22 Unit.ml<sup>-1</sup>) compared with their alone (5.73, 3.44, 1.97 Unit.ml<sup>-1</sup>) respectively, and less effectively after 40 days of incubation (Fig. 3b). In Field bind weed (8.35, 4.36 Unit.ml<sup>-1</sup>), Johnson grass (4.52, 1.41 Unit.ml<sup>-1</sup>) and rice straw (1.29, 0.39 Unit.ml<sup>-1</sup>) respectively. This may be due to the presence of the basis of fermentation of the enzyme which activates the enzyme at the peak of activity after 20 days and then gradually reduce these basic materials for fermentation of cellulose for consumption and become less after 40 days of incubation and this is consistent with (Sherief *et al.*, 2010).

### Pectinase activity

This enzyme has the ability to disassemble the pectin molecule and thus release the sugars. Fig. 4a and 4b showed the superiority of Pectinase enzyme when mixing the fungus with plant residues, whether after 20 or 40 days, In Field bind weed (10.78, 7.41, 4.16, 2.81 Unit.ml<sup>-1</sup>). In Johnson grass (8.62, 6.3, 3.54, and 2.13 Unit.ml<sup>-1</sup>) and rice straw (5.93, 3.24, 1.25, 0.39 Unit.ml<sup>-1</sup>) respectively. This may be due to the presence of the substance of the fermentation reactions, which is the pectin and is one of the main structural component of plants and can be found in the cellular walls in addition to cellulose, hemicellulose and lignin, in addition to acids, salts and minerals (Hamelinck *et al.*, 2005).

### CONCLUSION

The research indicates that the fungus *Pleurotus ostreatus* increases and accelerates the efficiency of

fermentation enzymes such as Exoglucanase, Laccase, CMCase and Pectinase for plant wastes, which decrease gradually due to the lack of concentration of the reaction substance over time.

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