Original Research Article

EFFECT OF POTASSIUM METABISULPHITE AND MODIFIED ATMOSPHERE PACKAGING ON SHELF LIFE OF PINK OYSTER MUSHROOM (Pleurotus eous)

ABSTRACT

This research investigated the combined effect of potassium metabisulphite - KMS (0.2%), packaging film (high density polyethylene and low density polyethylene) and modified atmosphere packaging (MAP) on the shelf life of pink oyster mushroom (*Pleurotus eous*). High oxygen packaging (HOP), medium oxygen packaging (MOP) and low oxygen packaging (LOP) were the three different conditions of MAP were used. The mushroom packed in MOP with KMS (0.2%) had increased the shelf-life up to 16 days as compared to the control – atmospheric air (3 days). Mushroom preserved with KMS (0.2%) +HDPE+MAP presented better results in physical, biochemical and microbiological analysis as compared to KMS (0.2%) + LDPE+MAP. Pink oyster mushrooms packaged in HDPE+MOP showed the lowest physiological loss in weight (2.76%), decreasing trend in weight was recorded throughout the storage time. Despite the lowest ($p < 0.05$) bacterial count for sample in HDPE+LOP, mushroom packaged in LDPE+MOP scored the highest for the overall acceptability of the packaged mushrooms. This study has significant effect of combining KMS (0.2%) +HDPE+MOP to increase the shelf life of pink oyster mushroom for 16 days.

Keywords: Oyster mushroom, potassium metabisulphite, Modified atmosphere packaging, Shelf life,

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INTRODUCTION

Mushroom growing is now a commercial endeavour focused on export. Canada, US, Europe, Mexico and Israel are the top foreign markets for Indian mushrooms, fresh and preserved/processed forms of mushrooms are exported. The nutritional, antioxidant, antitumor and antimicrobial properties of mushroom enable it to be used as a functional food and as a source for the

development of drugs and nutraceuticals (Khatun *et al*., 2015), this made the mushroom to be more demand in market. There are many edible mushrooms commercially available, the third most commercially produced mushroom is oyster (Ventura-Aguilar *et al*., 2017), it has 26 different species (Raman *et al*., 2021). Though it possesses excellent qualities, it can last for 1-3 days at ambient temperature (Olivera *et al*., 2012). Their thin epidermal structure, high moisture content and high respiration rate are the major factors that contribute to short shelf life of mushroom (Wei *et al*., 2017). Many research have been conducted to prolong the shelf life of different oyster species. But there is a scarce of information related to pink oyster mushroom (*Pleurotus eous*). *P. eous*has attractive colour, aroma, texture (Madhusudhanan *et al*., 2013), it contains high protein, fiber, ash, fat and carbohydrate (Telang *et al*., 2010). It has Ca, Fe, K, Mg, Na and P in variable amounts, along with Cu, Zn, Pb and Mn, depending on the substrate formulation (Wiafe-Kwagyan, 2014 and Wiafe-Kwagyan *et al*., 2016).

Therefore, appropriate preservation and packaging methods are required to prolong the shelf life, maintain quality and to reduce the loss of nutritive constituents of pink oyster mushroom. Many studies have been conducted to increase the shelf life of mushroom using different food grade preservatives and modified atmosphere packaging (MAP). Active MAP has proved an effective method to modify the physiology and prolong shelf life of fresh food by flushing the desired initial gas into the packages (Charles *et al*.,2008; Horev *et al*., 2012). However, the earlier research was conducted with sodium metabisulphite (400 ppm) as a preservative which increased the shelf life of oyster mushroom upto 12 days (Premkumar *et al*., 2020). The combination of MAP and antimicrobial packaging with pomegranate peel powder had increased the shelf life to 11 days (Lyn *et al*., 2020). The use of preservatives and MAP separately is insufficient to extend the shelf life. Hence, there is a need for the combined use of food grade preservatives and MAP to prolong the shelf life of mushroom. Therefore, this study was conducted to evaluate the combined effect of potassium metabisulphite (0.2 %) and MAP on increasing the shelf life of *Pleurotus eous*.

MATERIALS AND METHODS

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Source

Pink oyster mushrooms were grown on paddy straw were harvested from mushroom laboratory, G.K.V.K, Bengaluru. The packaging material *viz*., High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE) were procured from AICRP on Post Harvest Technology, G.K.V.K, Bengaluru. The size and thickness of HDPE and LDPE are 24×18 cm^2, 200 and 300 gauge respectively. Food grade Potassium metabisulphite (Nice chemicals, P 13029) was obtained from Department of Food Science and Nutrition, G.K.V.K, Bengaluru-65.

Preparation of sample

The fresh harvested *P. eous* was dipped in 500 ml at0.2 % food grade potassium metabisulphite (which proved a better preservative in our previous experiment) for 10 minutes (Brennan *et al*., 2000; Olotu, *et al*., 2015). The excess moisture was removed by shade drying for two minutes.

Packaging and storage

The treated pink oyster mushroom (100 g) was packed in HDPE and LDPE. The gas mixtures as given in table 1 were introduced into the packages using laboratory model packaging machine (Reepack- RV 50, Italy). The packages were sealed and stored at 4±1 ℃ in refrigerator. The stored samples were further analysed for quality parameters at different intervals (0, 6, 12, 14, 16 days) of storage.

Quality parameters

Weight loss

Weight loss of the pink oyster mushroom was determined by weighing the entire mushroom before and after storage using a digital electronic balance DS 450 (EssaeTeraoka Ltd., India) relative to the initial weight (Shao *et al*., 2021). The results were analyzed and expressed as per cent weight loss using the below formula:

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$$\text{Weight loss } (\%) = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

pH

The pH of the pink oyster mushroom was analysed by using the pH meter (Hanna instruments portable pH meter) by homogenizing 5 g of the sample in distilled water. The pH reading was recorded after a stable reading was shown. The measurements were taken in triplicates.

Protein

The protein estimation of pink oyster mushroom was done in triplicates by Lowry's method during the storage (Thimmaiah, 1999). The working standard solution (bovine serum albumin) of 0.2, 0.4, 0.6, 0.8 and 1.0 ml was pipetted out into a series of test tube. Each sample extract of 0.1 ml and 0.2 ml was pipetted out into two other test tubes. Volume was madeup to 1ml in all the test tube by using distilled water. A tube with 1ml serves as the blank. 5ml of solution C [Solution A (2% Sodium carbonate in 0.1N NaOH) + Solution B (0.5% copper sulphate in 1% sodium potassium tartarate)] was added, mixed well and incubated at room temperature for 10 min. 0.5ml of Folin-Ciocalteu reagent (FCR) was added, mixed well immediatelyand incubated at room temperature in dark for 30 min. Absorbance was read at 660nm by using UV visible spectrophotometeragainst the blank. Standard graph was drawn and the protein in the sample was calculated.

$$\text{Protein } (\%) = \frac{\text{value from graph} \times \text{total volume of extract}}{\text{aliquot volume} \times \text{weight of the sample taken for extract}} \times 100$$

Crude fibre

Crude fibre of pink oyster mushroom was estimated by the acid alkali digestion method. Sample was hydrolysed with sulphuric acid (0.225 N) and sodium hydroxide (0.313 N). The residue obtained after digestion was kept in a crucible, then dried in hot air oven and its weight was recorded (We). The

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dried residues were then ashed in a muffle furnace at 600 ℃ for 3 hours and its weight (Wa) was recorded. The difference between these two weights (We-Wa) were calculated and divided by weight of sample taken for the estimation of crude fibre and expressed in terms of percent (AOAC,2005).

$$\text{Fibre (\%)} = \frac{\text{We} - \text{Wa}}{\text{Weight of the sample}} \times 100$$

Microbiological analysis

The microbiological analysis of pink oyster mushroom was evaluated using the plate count method (Somasegaran and Hoben, 1985). Ten grams of mushroom sample was homogenised in 90 ml of sterile water. The total viable aerobic bacterial count was evaluated by the pour plate method using plate count agar (PCA). The colony forming units (CFUs) were enumerated after 24 hours of incubation. The colony count was done for three replicates.

$$\text{Total count (CFU/g)} = \frac{\text{number of colonies} \times \text{dilution factor}}{\text{weight of sample (g)}}$$

Organoleptic evaluation

Organoleptic evaluation was employed to analyse the quality of differently packaged pink oyster mushroom during the storage period at different intervals. A total of 21 semitrained panel members from Dept. of Food Science and Nutrition, G.K.V.K, Bengaluru were participated in the organoleptic evaluation of pink oyster mushroom. Appearance, aroma, colour, texture and overall acceptability were evaluated using 9point Hedonic scale. A score of 1 represents dislike extremely and a score of 9 represents like extremely (Amerine *et al*., 2013).

Statistical analysis

All data were subjected to one-way analysis of variant (ANOVA) using OPSTAT statistical software. The significant differences of the readings were determined by Duncan Multiple Range Test (DMRT) with the level of significance $p < 0.05$.Hierarchical clustering analysis and heatmap was constructed by using SR plots statistical software.

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RESULTS AND DISCUSSION

Physiological loss in weight

Physiological loss in weight (PLW) of pink oyster mushroom was observed in all the treatments(Table 2). Two components, respiration and transpiration, contribute to the weight loss of fresh food throughout the postharvest period(Wei *et al*., 2017). The PLW was significantly less in HDPE + MOP (2.76%) followed by LDPE + MOP (3.46%), HDPE + LOP (3.67%), HDPE + HOP (3.88%) and the increasedPLWwas recorded in LDPE + ATM (5.64%) followed by LDPE+HOP (4.50%), LDPE+LOP (4.10%) and HDPE+ATM (4.07%)on 16th day of storage. The PLW was recorded less in mushroom packed with HDPE + MOP (2.76%), this indicates that HDPE has a better barrier to vapour. Since HDPE covers have less permeability compared to LDPE covers, the transpiration rate was less in HDPE covers, therefore weight loss was less in HDPE covers (Borkar *et al*., 2008). The weight loss is less in MOP compared to LOP and HOP, in MOP optimum respiration will be observed, in LOP electrolyte leakage will occur hence the PLW is more and in HOP respiration will be more because of high oxygen content (Thompson, 2001).Increase in CO_2 might reduce the respiration (Dhalsamant *et al.,* 2015), hence reduced PLW was noted in MOP and LOP compared to HOP.

pH

The initial pH of fresh oyster mushrooms was 6.66 and it decreased after 6 days of storage in all treatments, ranging between 6.22 and 6.61 (Table 3). At 16th day of storage the pH was noted maximum in T2 (6.30) followed by T6 (6.36), T3 (6.30), T7 (6.03) and the minimum pH was observed in T8 (5.76). The proliferation of bacteria and their synthesis of organic acids are linked to pH decline (Aday, 2016; Heard, 2002). All packaging styles, whether those with high oxygen concentrations or low oxygen concentrations, exhibit the reduction of pH. This could be caused by high oxygen concentrations, which cause aerobic microbes to multiply more quickly (Parentelli *et al*., 2007). MOP has less decrease in pH during storage, because at higher O_2 and lower O_2 there is a possibility of occurrence of aerobic and anaerobic microbes that led

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to decrease in pH in HOP and LOP compared to MOP.As HDPE packs have less permeability to air, hence the penetration of microorganism was lessin HDPE. As potassium metabisulphite acts as a oxygen scavanger (Naik et al., 2005), it preserves from microorganism. Thereforethe combined effect of KMS, HDPE and MOP recorded the preferred range of pH (6.36) compared to others.

Protein

The fresh mushroom has the protein content of 26.98 %, the change in protein content of the mushroom sample was observed during the storage, there was gradual decline in protein content led to reduction in quality of mushroom (Table.3). When mushrooms were stored, hydrolytic enzymes such as protease and tyrosinase become active and hydrolyze proteins, causing the total quantity of protein to decrease throughout the storage period (Murr and Morris,1975; Rai and Arumuganathan, 2003). Protein level in the KMS treated sample has low protein loss during storage, this might be because the KMS not only lowers the proteinase action, yet serves as a preservative (Suguna *et al.* 1995).The protein content of the mushroom was noted higher in T2 (HDPE + MOP) about 25.88 % followed by T6 (25.82 %), T3 (25.80 %) on dry weight basis at 16th day of storage and minimum was recorded in T8 (LDPE + ATM) with protein content of 24.19 % followed by T4 (24.36 %). According to Ogiehor and Ikenebomeh (2006) LDPE bags lose more nutrients than HDPE bags, because of respiration (Wei *et al*., 2017). The protein might be utilised as a source of energy during respiration, hence loss of protein content wasobserved during storage. Therefore, protein loss was more in HOP and LOP but less in MOP.

Fibre

An excellent source of dietary fibre is the fruiting bodies of mushrooms, which are mostly made of chitin (a polymer of N-acetylglucosamine) and non-starch polysaccharides like -glucans (Wong, 2007).Fibre content of the pink oyster mushroom is one of the important parameter to be considered during storage. According to the results in table5, regardless of the packaging medium and gas composition, a progressive decline in the fibre content of mushrooms was observed as the storage duration extended.

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However, we could find the differences in fibre content in all the treatments, the samples packed in HDPE + HOP up to 16 days of storage in a refrigerator (T1) experienced a slower rate of decline in fibre content (9.69 %) followed by HDPE + MOP (9.54%). Samples stored in LDPE + ATM (9.03 %)showed the greatest reduction followed by HDPE + ATM (9.14 %). The findings of this study made it evident that samples packaged in HDPE + HOP at refrigerated temperature (T1) had least loss of fibre content throughout the storage. Respiration was higher in HOP led to dehydration. The dehydration of the mushroom increases the strength of the mushroom cell wall because the components in the cell wall, such as chitin and 1, 4-acetyl-glucosamine homopolymer, produce a rigid microfibril structure, enhancing the hardness of the cell wall (Zivanovic *et al*., 2003). The amount of fibre present in the mushroom had an impact on the change in hardness (Poltorak and Zalewska, 2007). Oyster mushrooms are firm and crisp when they are harvested, however after harvest, they decay and soften. The sample in HDPE + HOP had a higher firmness than other samples (Lyn *et al*., 2020). Additionally, during storage, enzymes that affect fibre become active, causing decrease in fibre. KMS inhibits the enzymes (Pareek*et al*., 2015) and improves the biochemical properties (Kamal *et al*., 2022). Pulp preserved using potassium metabisulphite has the highest level of nutritional stability (Saini *et al*., 2000).

Microbiological analysis (Bacterial count)

Bacterial counts wereanalysed on PCA to check how the KMS (0.2%), packing film and MAP influenced the shelf life of pink oyster mushrooms. The bacterial count of mushroomsduring different intervals of storage is represented in Table 6. On initial day the bacterial count ranges between 1.91×10^4 cfu/g to 1.99×10^2 cfu/g and there was no significant difference between the treatments. The bacterial count increase with the increase in storage period. However, the count was less in T3- HDPE + LOP+ 0.2% KMS (4.96×10^2 cfu/g) where as high in T8 (6.77×10^2 cfu/g) on 16^{th}day of storage. When compared to LOP, HOP, MOP and ATM, mushrooms packaged in the LOP condition had considerably ($p < 0.05$) reduced plate count. The concentration of O_2 and high CO_2 were primary responsible for the increase in shelf-life of

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mushrooms in MAP packaging (Antmann *et al*., 2008), low O_2 and high CO_2 concentration in the environment surrounding the product, results in a decrease in respiration rate and also inhibits microbial growth.HOP packaging showed the highest increase in bacterial count at day 16 compared to day 1. The chemicals containing SH-groups as sulfites have antimicrobial property (Beltran *et al*., 2005), hence KMS (0.2%) helps to control the growth of bacteria.

Organoleptic evaluation

The radar graph (fig 1) demonstrates the total sensory score of pink oyster mushrooms influenced by different treatments, there was a substantial change in the overall acceptability during storage. Organoleptic ratings in this study were steadily fell as storage time increased. Treatment T6 (LDPE + MOP) was able to retain much of its overall quality and recorded a highest overall score of 6.88/9 on 16^{th} day of storage. According to Hailu *et al*. (2014), LDPE scored higher on the sensory assessment scale than HDPE and it is on par with T2 (HDPE + MOP), this has the overall acceptability score of 6.71/9, based on the hedonic scale it comes under like. Mushrooms packaged in plastic films (LDPE and HDPE) have maintained the colour and flavour greatly (Nagaraju and Banik, 2019). High oxygen modified atmosphere packaging has been shown to improve sensory qualities of some food (Jacxsens *et al.,* 2001). Liu and Wang (2012) indicated that 80 % O_2 could avoid browning, retard the increase in membrane permeability and lipid peroxidation of mushrooms and showed that 80 % O_2 enhanced antioxidant and free radical scavenging enzyme activity. On the other hand, depleted O_2 also has effect on maintaining the quality of some vegetables or fruits. Low oxygen packaging may decline the respiration rate and maintain shelf-life longer or with better quality than normal air packaging. However, the extremely low oxygen may induce, in some cases, anaerobic fermentation with the accumulation of off-odours, disagreeable flavours, reduction in aroma biosynthesis and tissue injury. Therefore, the appropriate O_2/CO_2 concentration might increase the overall acceptability of the consumers. The present study reported that MOP was better for maintaining the colour, appearance, aroma and texture. Upto 14 days of storage all samples had the acceptability score of 5/9 and above. Potassium metabisulphite acts as a potent

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antioxidant and preserves colour, aroma *etc*. during storage (Naik *et al*., 2005). On 16th day of storage T1 (HDPE + HOP), T4 (HDPE + ATM), T8 (LDPE + ATM) has the acceptability score of 4.51, 2.87, 3.24, respectively and they became unacceptable to the consumers based on the sensory evaluation (Hailu *et al.* 2014).

CONCLUSION

The combination of 0.2 % KMS + HDPE + MOP has extended the shelf-life of pink oyster mushroom up to 16 days. The presence of KMS (0.2 %) in the packaging showed a better result in reaching the quality of the packaged mushroom and maintained physical parameters of mushroom such as physiological loss in weight, pH, biochemical parameters such as protein, fibre, microbiological analysis such as bacteria and overall acceptability (appearance, aroma, colour, texture) with as score of 6.71/9, based on the hedonic scale it comes under like category. Even though the LOP condition with KMS is notable in inhibiting the growth of bacteria, MOP condition is still prominent according to the sensory evaluation. Therefore, for the overall performance, KMS (0.2 %) + HDPE + MOP was found to be the best packaging for maintaining the quality and shelf life of pink oyster mushroom.

Availability of data and material: Not Applicable.

Code availability: Not Applicable.

Declaration

Consent for publication: All authors have agreed to publish the manuscript.

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Table 1: Effect of KMS (0.2%) and MAP on change in physiological loss in weight (%) of *Pleurotus eous* during storage period

Treatment	Storage period (days)				
	0	**6**	**12**	**14**	**16**
T1-HDPE+HOP	0.00	0.96 ± 0.03^{Dcd}	1.45 ± 0.04^{Cc}	2.26 ± 0.07^{Bc}	3.88 ± 0.11^{Ad}
T2-HDPE+MOP	0.00	0.08 ± 0.03^{Df}	0.83 ± 0.02^{Cf}	1.35 ± 0.04^{Be}	2.76 ± 0.08^{Ag}
T3-HDPE+LOP	0.00	0.91 ± 0.03^{Dd}	1.31 ± 0.04^{Cd}	1.83 ± 0.05^{Bd}	3.67 ± 0.11^{Ae}
T4-HDPE+ATM	0.00	1.15 ± 0.03^{Da}	1.72 ± 0.05^{Cb}	2.26 ± 0.07^{Bc}	4.07 ± 0.12^{Acd}
T5-LDPE+HOP	0.00	0.98 ± 0.03^{Dc}	1.67 ± 0.05^{Cb}	2.96 ± 0.09^{Bb}	4.50 ± 0.13^{Ab}
T6-LDPE+MOP	0.00	0.84 ± 0.02^{De}	0.96 ± 0.03^{Ce}	1.45 ± 0.04^{Be}	3.46 ± 0.10^{Af}
T7-LDPE+LOP	0.00	1.08 ± 0.03^{Db}	1.66 ± 0.05^{Cb}	2.18 ± 0.06^{Bc}	4.10 ± 0.12^{Ac}
T8-LDPE+ATM	0.00	0.82 ± 0.02^{De}	1.87 ± 0.03^{Ca}	3.64 ± 0.11^{Ba}	5.64 ± 0.16^{Aa}

*****Values are given as mean ± standard deviation. Means with same superscript, in a column (lower case) and row (upper case) do not differ significantly at P=<0.05 as per Duncan Multiple Range Test (DMRT).

Table 2. Effect of KMS (0.2%) and MAP on change in pH of *Pleurotus eous* during storage period

Treatment	Storage period (days)				
	0	6	12	14	16
T1-HDPE+HOP	6.66±0.11^{Aa}	6.22±0.10^{Bb}	6.16±0.10^{Bab}	6.13±0.10^{Babc}	5.76±0.09^{Ccd}
T2-HDPE+MOP	6.66±0.11^{Aa}	6.46±0.11^{ABab}	6.42±0.10^{ABa}	6.33±0.10^{Bab}	6.30±0.10^{Bab}
T3-HDPE+LOP	6.66±0.11^{Aa}	6.40±0.10^{Bab}	6.17±0.10^{Bab}	5.78±0.^{09Cde}	5.77±0.09^{Ccd}
T4-HDPE+ATM	6.66±0.11^{Aa}	6.32±0.10^{Bab}	6.01±0.10^{Cb}	5.75±0.09^{De}	5.63±0.09^{Dd}
T5-LDPE+HOP	6.66±0.11^{Aa}	6.40±0.10^{Bab}	6.15±0.10^{Cab}	5.97±0.10^{Ccde}	5.94±0.10^{Ccd}
T6-LDPE+MOP	6.66±0.11^{Aa}	6.61±0.11^{ABa}	6.43±0.10^{ABa}	6.40±0.10^{ABa}	6.36±0.10^{Ba}
T7-LDPE+LOP	6.66±0.11^{Aa}	6.53±0.11^{Aab}	6.18±0.10^{Bab}	6.11±0.10^{Babcd}	6.03±0.10^{Bbc}
T8-LDPE+ATM	6.66±0.11^{Aa}	6.27±0.10^{Bab}	6.11±0.10^{BCab}	6.01±0.10^{CDbcde}	5.76±0.09^{Dcd}

*****Values are given as mean ± standard deviation. Means with same superscript, in a column (lower case) and row (upper case) do not differ significantly at P=<0.05 as per Duncan Multiple Range Test (DMRT).

Table 3: Effect of KMS (0.2 %) and MAP on change in protein content (%) of *Pleurotus eous* during storage period

Treatment	Storage period (Days)				
	0	6	12	14	16
T1-HDPE+HOP	26.99±0.79^{Aa}	26.84±0.79^{Aa}	26.06±0.76^{ABa}	25.96±0.76^{Aba}	25.68±0.75^{Bab}
T2-HDPE+MOP	27.00±0.79^{Aa}	26.73±0.78^{ABa}	26.23±0.77^{ABa}	26.12±0.76^{Aba}	25.88±0.76^{Ba}
T3-HDPE+LOP	26.98±0.79^{Aa}	26.56±0.78^{ABa}	26.00±0.76^{ABa}	26.07±0.76^{Aba}	25.80±0.75^{Ba}
T4-HDPE+ATM	27.01±0.79^{Aa}	26.72±0.78^{Aa}	25.66±0.75^{Aa}	25.58±0.75^{Ba}	24.36±0.71^{Cbc}
T5-LDPE+HOP	26.9 ± 0.79^{Aa}	26.89±0.79^{ABa}	25.92±0.76^{BCa}	25.74±0.75^{Ca}	25.55±0.75^{Cabc}
T6-LDPE+MOP	27.00±0.79^{Aa}	26.58±0.78^{Aba}	26.06±0.76^{ABa}	26.06±0.76^{Aba}	25.82±0.76^{Ba}

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T7-LDPE+LOP	26.98±0.79^{Aa}	26.64±0.78^{Aba}	25.97±0.76^{ABa}	25.81±0.75^{Ba}	25.64±0.75^{Babc}
T8-LDPE+ATM	27.00±0.79^{Aa}	26.45±0.77^{Aba}	25.80±0.75^{Ba}	25.67±0.75^{Ba}	24.19±0.71^{Cc}

*****Values are given as mean ± standard deviation. Means with same superscript, in a column (lower case) and row (upper case) do not differ significantly at P=<0.05 as per Duncan Multiple Range Test (DMRT).

Table 4: Effect of 0.2 % KMS and MAP on change in fibre content (%) of *Pleurotus eous* during storage period

Treatment	Storage period (Days)				
	0	**6**	**12**	**14**	**16**
T1-HDPE+HOP	10.44±31^{Aa}	10.42±30^{Aa}	10.14±30^{ABa}	9.91±29^{BCa}	9.69±28^{Ca}
T2-HDPE+MOP	10.42±30^{Aa}	10.38±30^{Aa}	10.12±30^{Aa}	9.73±28^{Bab}	9.54±28^{Bab}
T3-HDPE+LOP	10.41±30^{Aa}	10.29±30^{Aa}	10.10±30^{Aa}	9.43±28 ^{Bab}	9.41±28^{Bab}
T4-HDPE+ATM	10.42±30^{Aa}	10.18±30^{ABa}	10.02±29^{Ba}	9.31±27^{Cb}	9.14±27^{Cb}
T5-LDPE+HOP	10.42±30^{Aa}	10.40±30^{Aa}	10.15±30^{ABa}	9.78±29^{BCab}	9.44±28^{Cb}
T6-LDPE+MOP	10.41±30^{Aa}	10.38±30^{Aa}	10.14±30 ^{Aa}	9.69±28^{Bab}	9.36±27^{Bab}
T7-LDPE+LOP	10.41±30^{Aa}	10.27±30^{Aa}	10.08±29 ^{Aa}	9.36±27^{Bb}	9.27±27^{Bab}
T8-LDPE+ATM	10.40±30^{Aa}	10.14±30^{ABa}	9.99±29^{Ba}	9.31±27^{Cb}	9.03±26^{Cb}

*****Values are given as mean ± standard deviation. Means with same superscript, in a column (lower case) and row (upper case) do not differ significantly at P=<0.05 as per Duncan Multiple Range Test (DMRT).

Table 5: Effect of KMS (0.2 %) and MAP on change in bacterial count of *Pleurotus eous* during storage period

Treatment	Storage period (Days)				
	0	**6**	**12**	**14**	**16**
T1-HDPE+HOP	1.97±0.03^{Ea}	2.89±0.04^{Dc}	3.20±0.05^{Cde}	5.87±0.10^{Ba}	6.55±0.11^{Abc}
T2-HDPE+MOP	1.95±0.03^{Ea}	2.65±0.04^{Dd}	3.16±0.05^{Cde}	4.46±0.07^{Bde}	5.17±0.08^{Ae}
T3-HDPE+LOP	1.93±0.03^{Ea}	2.10±0.03^{Df}	3.05±0.05^{Cde}	4.21±0.07^{Be}	4.96±0.08^{Ae}
T4-HDPE+ATM	1.98±0.03^{Ea}	3.20±0.05^{Db}	4.10±0.06^{Cb}	5.26±0.08^{Bb}	6.33±0.10^{Ac}

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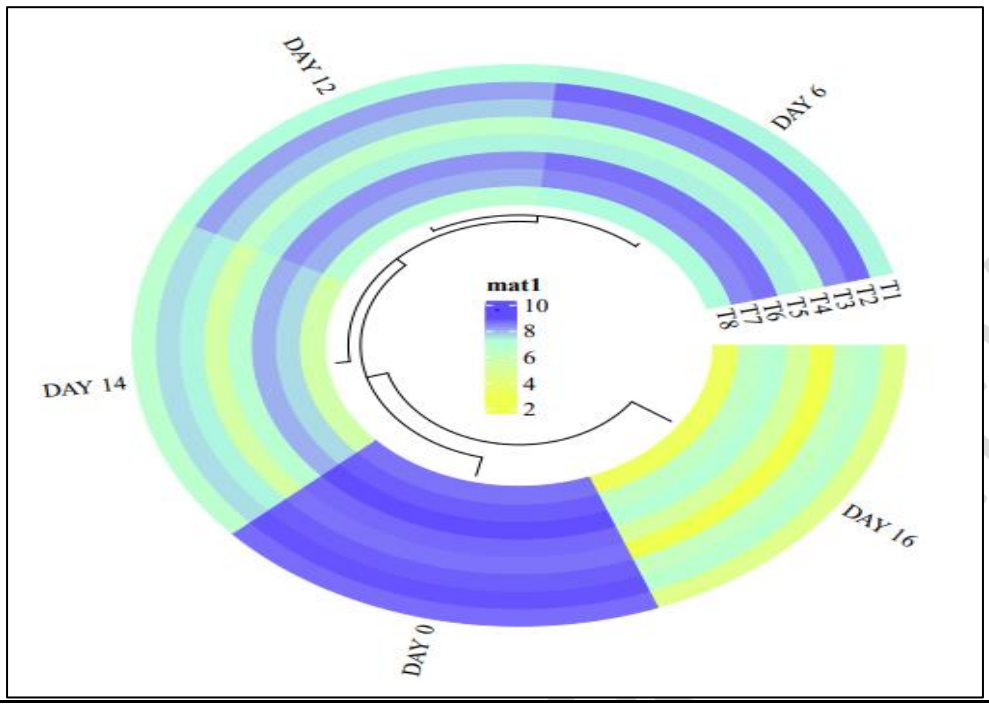

T5-LDPE+HOP	1.98±0.03^{Ea}	2.93±0.04^{Dc}	3.70±0.06^{Cc}	6.13±0.10^{Ba}	6.90±0.11^{Aa}
T6-LDPE+MOP	1.95±0.03^{Ea}	2.72±0.04^{Dd}	3.21±0.05^{Cd}	4.53±0.07^{Bcd}	5.61±0.09^{Ad}
T7-LDPE+LOP	1.91±0.03^{Ea}	2.30±0.03^{De}	3.00±0.05^{Ce}	4.78±0.08^{Bc}	5.22±0.08^{Ae}
T8-LDPE+ATM	1.99±0.03^{Ea}	3.85±0.06^{Da}	4.51±0.07^{Ca}	5.36±0.09^{Bb}	6.77±0.11^{Aab}

*****Values are given as mean ± standard deviation. Means with same superscript, in a column (lower case) and row (upper case) do not differ significantly at P=<0.05 as per Duncan Multiple Range Test (DMRT).

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Fig 1: Hierarchical clustering analysis showing effect of 0.2 % KMS and MAP on change in overall acceptability (based on sensory evaluation) of *Pleurotus eous* during storage period.

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