IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

# Dehydration and Rehydration ratio for Varieties of Oyster Mushroom with Different Drying Methods

**Chinmay Anil Chorage [*] Shanker Suwan Singh[**] R.N.Shukla[***] Dorcus Masih[****] Ajay Singh[*****]**

[*] PhD Scholar, Department of Processing and Food Engineering, VIAET, SHUATS, Prayagraj, (UP)-India

[**] Assistant Professor, Dairy Engineering, SHUATS, Naini, Prayagraj (UP)-India
shanranu80@gmail.com

[***]Assistant Professor, WCDT SHUATS Prayagraj, Uttar Pradesh, India.

[****] Assistant Professor Processing and Food Engineering Department, VIAET, SHUATS, Prayagraj, Uttar Pradesh, India.

[*****]Assistant Professor Processing and Food Engineering Department, VIAET, SHUATS, Prayagraj, Uttar Pradesh, India

## ABSTRACT

The point of this article is to present the consequence of research attended on the drying samples of Oyster Mushrooms. Three different varieties were chosen to conduct this study i.e. White, Grey and Pink Oyster Mushroom. The drying process was carried out with tray and vacuum drying process with three different temperatures (60ºC, 70ºC, and 80ºC) with three different pre-treatment's (Normal, Vinegar and Lemon juice) to determine the rehydration ratio and dehydration ratio to conclude the best drying method for oyster mushroom varieties. In comparative study of two drying method, comparing the results it was observed that the drying characteristics was having good results in tray drying followed with vacuum drying.

**Keywords:** Drying, Oyster Mushroom, Vinegar, Rehydration and Dehydration ratio.

## INTRODUCTION

In tropical and subtropical regions, pleurotus mushrooms, sometimes known as oyster mushrooms, grow profusely and are simple to artificially culture. These are wholesome foods that are high in protein, chitin, vitamins, and minerals but low in calories and fat. They also have significant concentrations of ornithine and -aminobutyric acid (GABA). Ornithine is a

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

precursor in the synthesis of arginine, whereas GABA is a non-essential amino acid that serves as a neurotransmitter. **(Jayakumar *et al.*, 2007).** Mushroom use by humans dates back to 5000 BC. There are 2,000 recognised edible mushroom species worldwide. Many ancient peoples and primitive tribes have employed some mushrooms in religious ceremonies for ages. The Romans thought that mushrooms had abilities that could provide superhuman strength, aid in locating misplaced items, and transport the soul to the realm of the gods **(Singh2017).** Mushrooms that can be eaten are a valuable food source. Because they are easily digestible, they make particularly nourishing meals for those with disabilities. They are consumed for both their significant nutritional benefits and their natural flavour and taste. According to (**Aremu et al., 2009)**, mushrooms have a higher protein content than all other fruits and vegetables on a fresh weight basis, but they fall short of the traditional protein sources of meat and dairy. Nonetheless, on a dry-weight basis, mushrooms are superior to dried peas and beans and comparable to dried yeast **(Singh 2017).** A delicacy in many nations, fresh and preserved mushrooms is prized for their distinct flavour and texture. According to FAOSTAT figures, almost 6 million metric tonnes of mushrooms and truffles were produced globally in 2010. The most typical way for keeping mushrooms for a long time is drying. Dehydration effectively protects the beneficial characteristics of mushrooms and lengthens their shelf life by preventing the growth of microbes, lowering enzyme activity, and slowing down reactions in the presence of water. **(Tian *et al.*, 2016).** The drying process, however, may have a mixed impact on product qualities due to variable dehydration circumstances and mechanisms, as well as the various compositions and types of raw materials. **(Duan *et al.*, 2015)**.

The cell structure of the raw material and, consequently, the release and bioavailability of chemicals from the food matrix can be affected by drying methods in addition to the original characteristics and composition of the material **(Dalmau et al., 2017).**

## MATERIALS AND METHODS

### 2.1. Materials used

1) Mushroom Varieties (White, Grey and Pink)

2) Tray Dryer

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

3) Vacuum Dryer

4) Vinegar and Lemon juice

The study was conducted in the department of Processing and Food Engineering SHUATS Prayagraj.

Mushroom varieties were collected from Dr. BSKKV Dapoli which were fresh, cleaned and defect free and the vinegar and lemon juice was purchased from local market of Prayagraj. **(Daniyal *et al.*, 2022)**, **( Sawhney *et al.*, 2022)**.

## 2.2. Methodology for drying characteristics of Oyster Mushrooms:

### 2.2.1. Measurement of initial Moisture Content:

In order to evaluate the moisture content of the powder samples, using AOAC (1984) method.

Percent moisture content (db) = $\frac{W1-W2}{W2}$

Where,

W1= initial weight

W2= final weight

The following formulae were used to determine the sample's moisture content.

$$\text{Moisture content with (weight basis)} = \frac{M1\text{-}M2}{M1} \times 100$$

$$\text{Moisture content with (dry basis)} = \frac{M.C.}{100\text{-}\ M.C.} \times 100$$

M. C. (Lost) = M. C. (current) – M. C. (previous)

$$\text{Rate of drying} = \frac{M.C.lost}{Time\,difference \times \frac{Wt.\ of\ bone\,dried\ materilas}{100}}$$

Where,

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

Wt. of bone dried materials = $\frac{Intital\ wt.of\ the sample \times (100 - Initial\ M.C.)}{100}$

M.C. = Moisture content of sample (%w. b. and d.b)

M1 = Wt. of sample before oven drying (g)

M2 =Wt. of samples after oven drying (g)

### 2.2.2. Moisture content of sample during drying of oyster mushrooms

Mass balance was used to calculate the moisture content of the sample during drying. Every half-hour, the sample's weight was taken and the reading reported for this reason.

The moisture content was calculated using the formula below.

$$\text{M.C.}\ \frac{\text{Wt. of the sample at desired time - wt. of bone dry materials}}{\text{Wt. of sample at nay time}} \times 100$$

### 2.2.3. Determination of dehydration ratio (Loesecke, 2005)

Reducing volume and weight is a major benefit of drying things, since it makes them easier to store and transport. An essential factor that demonstrates the sample's weight being reduced substantially is the dehydration ratio. The drying process works better the higher the dehydration ratio.

The following formula is used to determine dehydration ratio:

$$\text{Dehydration ratio}\ \frac{\text{Initial wt. of the product}}{\text{Wt. of dehydrated product}}$$

### 2.2.4. Determination of Rehydration ratio (Ranganna, 1986),( Mall *et al.*, 2022).

One of the key components in forming a foundation material for later use is the rehydration ratio. Rehydrating means adding water back into dried food. Sufficient rehydration is necessary for satisfactory grading quality. Rehydrated dehydrated vegetables are studied after reconstituting dry samples. Rehydration ratio demonstrates the product's increased originality and acceptance qualities. Three 10g samples of dry material were weighed on a torsion balance and put in a 600 ml beaker with 150 ml of distilled water. The beaker was covered and placed on an electric heater where it boiled for five, ten, and twenty minutes. The precise amount of water varied depending on the material, boiling time, and rate; too much water should not be utilised. Then taken out of the heater and poured through a funnel that is lined

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

with coarse filter paper. applied suction and slowly stirred the drain for one minute, or until the funnel's drop almost stopped. After being taken out of the funnel and weighed, the following formula was used to describe the outcome as a rehydration ratio.

$$\text{Rehydratio n ratio } \frac{\text{Weight of soaked product (WR)}}{\text{Wt. of dehydrated product (WD)}}$$

## RESULTS AND DISCUSSION

**3.1 The drying time taken to oyster mushroom to attain moisture content of 12% (w.b.) at different temperature. ( Srivastava *et al.*, 2022).**

**Table 3.1.** Drying time taken to oyster mushroom to attain moisture content of 12% (w.b.) at different temperature and treated mushroom slice.

| Drying. Temp | Tray dryer (Time of drying minutes) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | White oyster | | | Grey oyster | | | Pink oyster | | |
| | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) |
| **60$^0$C** | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| **70$^0$C** | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| **80$^0$C** | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 |

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

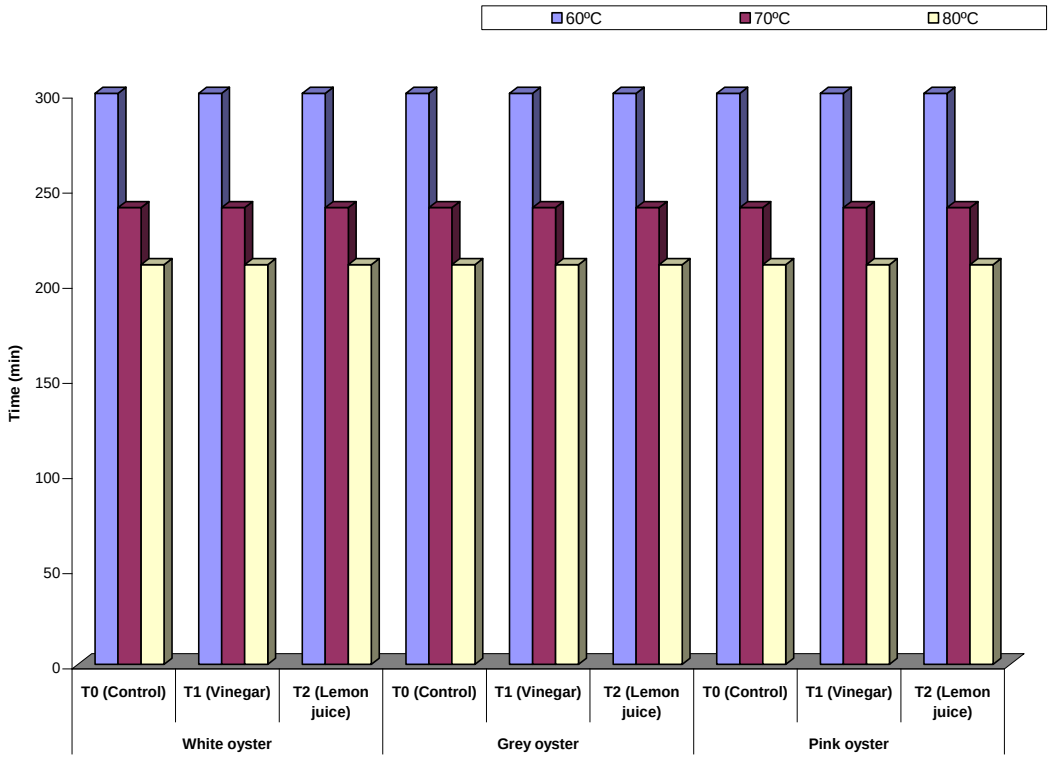



**Fig. 3.1 Drying time taken to oyster mushroom to attain moisture content of 12% (w.b.) at different temperature and treated mushroom slice.**

**Table 3.2 Drying time taken to oyster mushroom to attain moisture content of 12% (w.b.) at different temperature and treated mushroom slice.**

| Drying. Temp | Vaccum drying (Time of drying minutes) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | White oyster | | | Grey oyster | | | Pink oyster | | |
| | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) | T0 (Control) | T1 (Vinegar) | T2 (Lemon juice) |
| **$60^0$C** | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 |
| **$70^0$C** | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 |

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **80$^0$C** | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 |

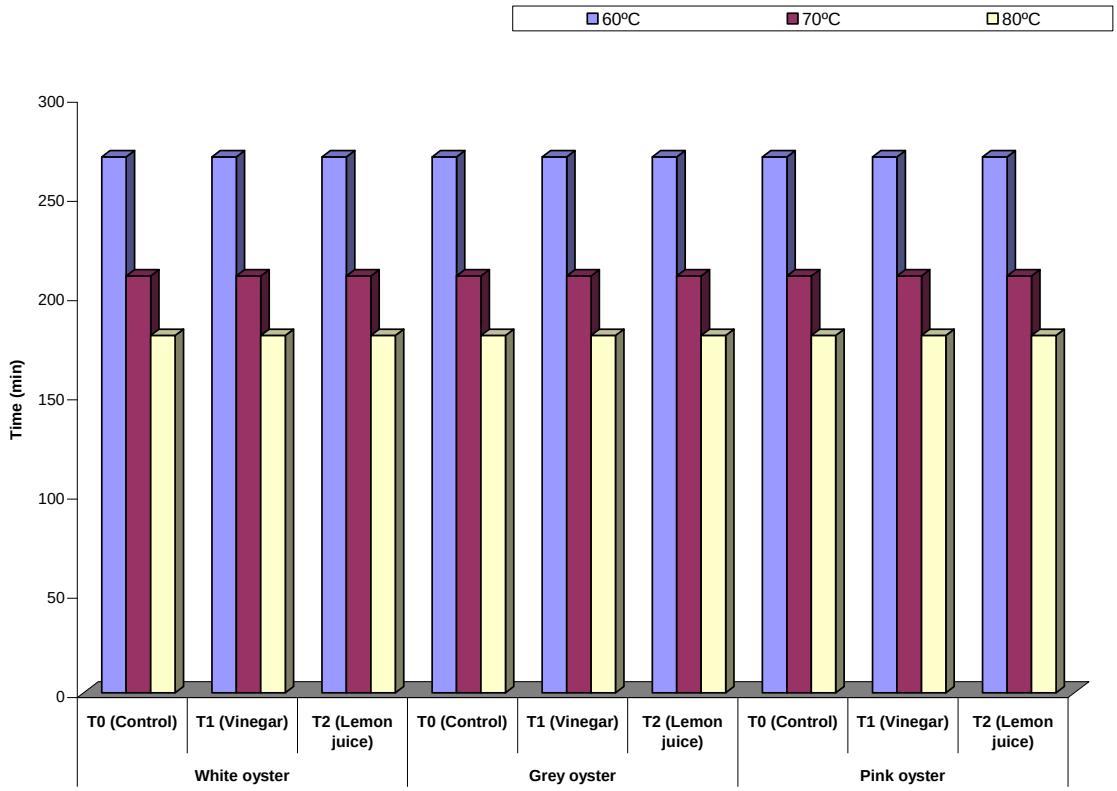



**Fig. 3.2 Drying time taken to oyster mushroom to attain moisture content of 12% (w.b.) at different temperature and treated mushroom slices.**

### 3.2 Dehydration ratio

From the table 3 and fig. 3 it has concluded that there is minute effect of three pre-treatment viz., (Control, Vinegar and Lemon juice) and three temperature viz., (60, 70 and 80$^0$C) on dehydration ratio of white, grey and pink oyster mushroom. The maximum dehydration ratio (5.700, 5.217 and 5.143) was found in treatment T8: (P1: Vinegar +T3: 80 $^0$C). Whereas the minimum dehydration ratio (3.903, 3.570 and 3.727) was found in treatment T1: (P0: Control +T1: 60 $^0$C) in tray drying method. The maximum dehydration ratio (5.267**,** 5.310 and 5.410) was found in treatment T5: (P1: Vinegar +T2: 70 $^0$C) and T4: (P0: Control +T2: 70 $^0$C). Whereas the minimum dehydration ratio (4.313, 3.910 and 3.883) was found in treatment T1: (P0: Control +T1: 60 $^0$C) in vacuum drying method.

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

**Table 3.3 Effects of temperature and various treatments on the ratio of dehydrated oyster mushrooms using the tray dryer and vacuum dryer techniques**

| | Tray dryer | | | Vacuum dryer | | |
|---|---|---|---|---|---|---|
| **Treatments** | **Oyster White Mushroom** | **Oyster Grey Mushroom** | **Oyster Pink Mushroom** | **Oyster White Mushroom** | **Oyster Grey Mushroom** | **Oyster Pink Mushroom** |
| P0: (Control) | 4.369 | 3.987 | 3.881 | 4.696 | 4.369 | 4.219 |
| P1: (Vinegar) | 4.868 | 4.632 | 4.544 | 4.997 | 4.692 | 5.044 |
| P2: (Lemon Juice) | 4.397 | 4.340 | 4.071 | 4.750 | 4.388 | 4.524 |
| **F-Test** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.051** | **0.043** | **0.015** | **0.055** | **0.032** | **0.032** |
| **S.Ed. (+)** | **0.024** | **0.020** | **0.007** | **0.026** | **0.015** | **0.015** |
| **Temperature** | | | | | | |
| T1:60ºC | 3.997 | 3.761 | 3.766 | 4.626 | 4.141 | 4.027 |
| T2: 70ºC | 4.443 | 4.511 | 4.379 | 5.074 | 5.106 | 5.018 |
| T3: 80ºC | 5.193 | 4.687 | 4.352 | 4.742 | 4.202 | 4.743 |
| **F-Test** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.051** | **0.043** | **0.015** | **0.055** | **0.032** | **0.032** |
| **S.Ed. (+)** | **0.024** | **0.020** | **0.007** | **0.026** | **0.015** | **0.015** |
| **Interaction (Treatment x Temperature)** | | | | | | |
| T1: (P0: Control +T1: 60 $^0$C) | 3.903 | 3.570 | 3.727 | 4.313 | 3.910 | 3.883 |
| T2: (P1: Vinegar +T1: 60 $^0$C) | 4.117 | 3.903 | 3.813 | 4.837 | 4.287 | 4.120 |
| T3: (P2: Lemon juice+ T1: 60 $^0$C) | 3.970 | 3.810 | 3.757 | 4.727 | 4.227 | 4.077 |
| T4: (P0: Control +T2: 70 $^0$C ) | 4.517 | 4.217 | 4.037 | 5.030 | 5.310 | 4.947 |
| T5: (P1: Vinegar +T2: 70 $^0$C ) | 4.787 | 4.777 | 4.677 | **5.267** | 4.903 | 5.410 |
| T6: (P2: Lemon juice +T2: 70 $^0$C ) | 4.027 | 4.540 | 4.423 | 4.927 | 5.103 | 4.697 |
| T7: (P0: Control+T3: 80 $^0$C) | 4.687 | 4.173 | 3.880 | 4.743 | 3.887 | 3.827 |
| T8: (P1: Vinegar +T3: 80 $^0$C) | **5.700** | **5.217** | **5.143** | **4.887** | **4.887** | **5.603** |
| T9: (P2: Lemon juice+T3: 80 $^0$C) | **5.193** | **4.670** | **4.033** | **4.597** | **3.833** | **4.800** |
| **F-Test** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.089** | **0.074** | **0.026** | **0.095** | **0.056** | **0.055** |
| **S.Ed. (+)** | **0.042** | **0.035** | **0.012** | **0.045** | **0.026** | **0.026** |

The estimated F value is bigger than the tabular F value because of pretreatment and temperature at a 5% probability level, which means that our null hypothesis will be rejected. It is therefore clear from the presented data that there is a significant difference between the levels of each variable.

As the computed F value is higher than the tabulated F value because of the pretreatment and temperature at 2, 26 degrees of freedom on a 5% probability level, our null hypothesis will be accepted, and it can be inferred from the provided data that there is no significant difference between the levels of any variable.

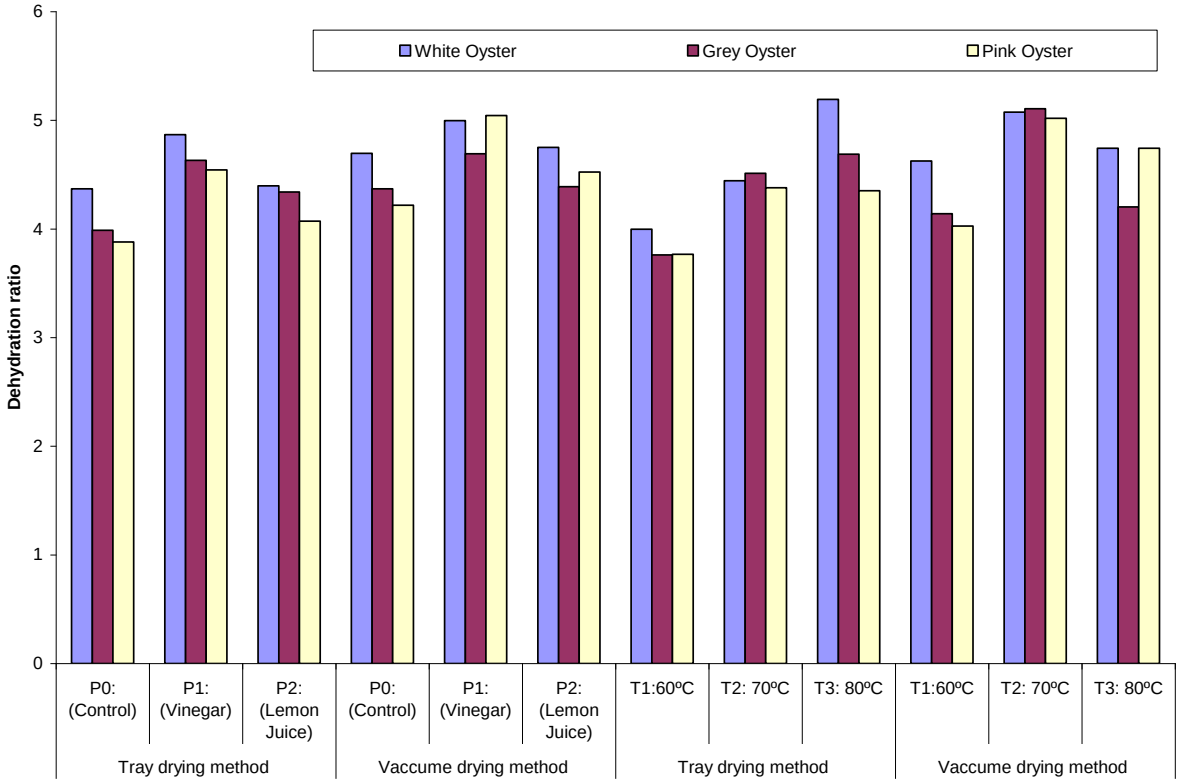
The computed F value is greater than the tabulated F value due to the interaction (pre treatment and temperature) at 4, 26 degrees of freedom on a 5% probability level, and as this

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

results in the null hypothesis being rejected, it can be inferred from the given data that there is a substantial difference between the levels of each variable.

The calculated F value is greater than the tabulated F value owing to interaction (pre treatment and temperature) at 4, 26 degrees of freedom on a 5% probability level, and since this means that our null hypothesis will be accepted, it can be inferred from the presented data that there is no statistically significant difference between the levels of any variable.



ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

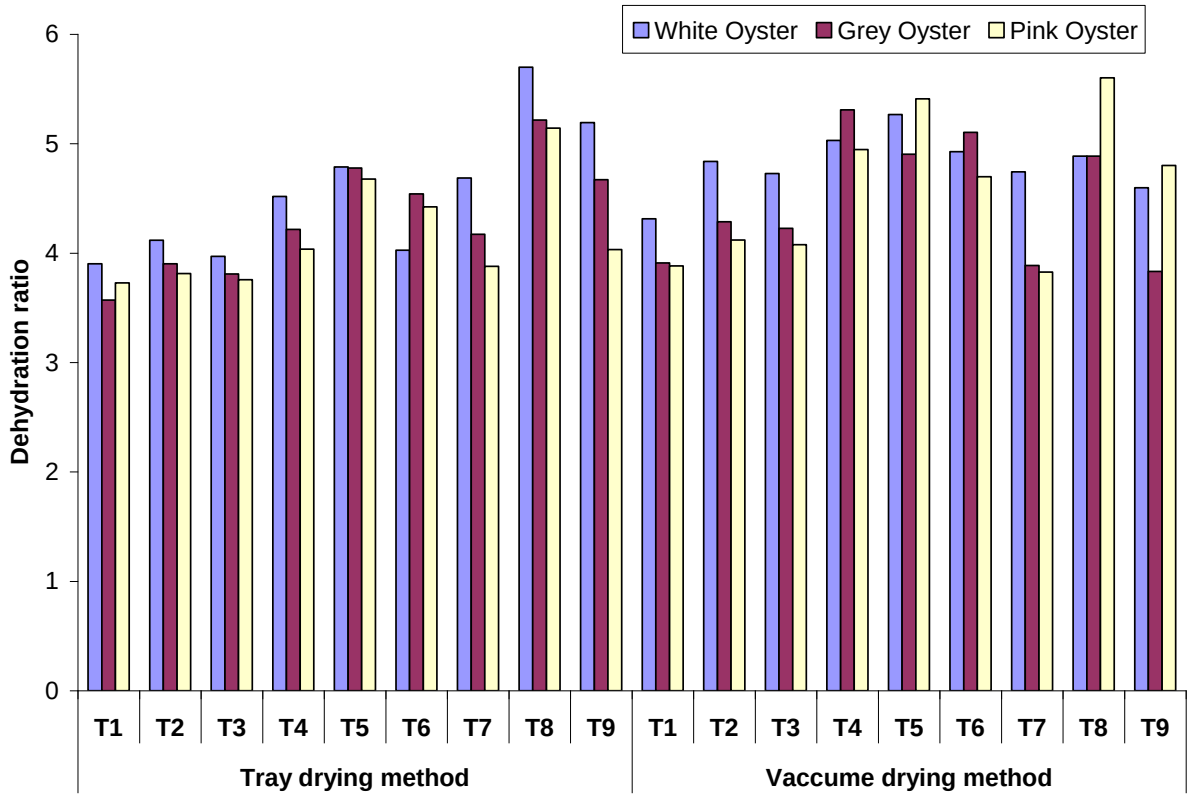



**Figure 3.3 Effect of temperature and different treatment on dehydration ratio of oyster mushroom in Tray dryer and vacuum dryer method**

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

### 3.3 Re-hydration ratio

From the table 4 and fig. 4 it has concluded that there is minute effect of three pre-treatment viz., (Control, Vinegar and Lemon juice) and three temperature viz., (60, 70 and 80$^0$C) on Re-hydration ratio of white, grey and pink oyster mushroom. The maximum dehydration ratio (3.640, 2.693 and 2.703) was found in treatment T8: (P1: Vinegar +T3: 80 $^0$C) and T5: (P1: Vinegar +T2: 70 $^0$C). Whereas the minimum Re-hydration ratio (1.897, 1.840 and 1.790) was found in treatment T1: (P0: Control +T1: 60 $^0$C), T3: (P2: Lemon juice+ T1: 60 $^0$C) and T7: (P0: Control+T3: 80 $^0$C) in tray drying method. The maximum Re-hydration ratio (2.773, 2.583 and 2.877) was found in treatment T4: (P0: Control +T2: 70 $^0$C), T5: (P1: Vinegar +T2: 70 $^0$C) and T6: (P2: Lemon juice +T2: 70 $^0$C). Whereas the minimum Re-hydration ratio (2.227, 1.770 and 1.737) was found in treatment T1: (P0: Control +T1: 60 $^0$C) and T7: (P0: Control+T3: 80 $^0$C) in vacuum drying method.

**Table 3.4. Effects of temperature and various treatments on the ratio of rehydrated oyster mushrooms using the tray dryer and vacuum dryer techniques**

| | Tray dryer | | | Vaccum dryer | | |
|---|---|---|---|---|---|---|
| **Treatments** | **Oyster White Mushroom** | **Oyster Grey Mushroom** | **Oyster Pink Mushroom** | **Oyster White Mushroom** | **Oyster Grey Mushroom** | **Oyster Pink Mushroom** |
| P0: (Control) | 2.361 | 2.159 | 1.938 | 2.411 | 2.054 | 2.106 |
| P1: (Vinegar) | 2.782 | 2.398 | 2.343 | 2.528 | 2.260 | 2.557 |
| P2: (Lemon Juice) | 2.467 | 2.214 | 2.056 | 2.397 | 2.110 | 2.222 |
| **F-Test** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.016** | **0.151** | **0.014** | **0.023** | **0.032** | **0.015** |
| **S.Ed. (+)** | **0.008** | **0.071** | **0.007** | **0.011** | **0.015** | **0.007** |
| **Temperature** | | | | | | |
| T1:60ºC | 1.958 | 1.878 | 1.812 | 2.478 | 1.979 | 1.988 |
| T2: 70ºC | 2.499 | 2.496 | 2.471 | 2.658 | 2.534 | 2.610 |
| T3: 80ºC | 3.153 | 2.398 | 2.053 | 2.200 | 1.911 | 2.287 |
| **F-Test** | **S** | **S** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.016** | **0.151** | **0.014** | **0.023** | **0.032** | **0.015** |
| **S.Ed. (+)** | **0.008** | **0.071** | **0.007** | **0.011** | **0.015** | **0.007** |
| **Interaction (Treatment x Temperature)** | | | | | | |
| T1: (P0: Control +T1: 60 $^0$C) | 1.897 | 1.930 | 1.810 | 2.227 | 1.847 | 2.017 |
| T2: (P1: Vinegar +T1: 60 $^0$C) | 2.023 | 1.863 | 1.837 | 2.620 | 2.033 | 1.973 |
| T3: (P2: Lemon juice+ T1: 60 $^0$C) | 1.953 | 1.840 | 1.790 | 2.587 | 2.057 | 1.973 |
| T4: (P0: Control +T2: 70 $^0$C ) | 2.517 | 2.270 | 2.210 | 2.773 | 2.547 | 2.563 |

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

| | | | | | | |
|---|---|---|---|---|---|---|
| T5: (P1: Vinegar +T2: 70 $^0$C ) | 2.683 | **2.693** | **2.703** | 2.690 | 2.473 | 2.877 |
| T6: (P2: Lemon juice +T2: 70 $^0$C ) | 2.297 | 2.523 | 2.500 | 2.510 | 2.583 | 2.390 |
| T7: (P0: Control+T3: 80 $^0$C) | 2.670 | 2.277 | 1.793 | 2.233 | 1.770 | 1.737 |
| T8: (P1: Vinegar +T3: 80 $^0$C) | **3.640** | **2.637** | **2.490** | **2.273** | **2.273** | **2.820** |
| T9: (P2: Lemon juice+T3: 80 $^0$C) | **3.150** | **2.280** | **1.877** | **2.093** | **1.690** | **2.303** |
| **F-Test** | **S** | **NS** | **S** | **S** | **S** | **S** |
| **C.D. at 0.5%** | **0.028** | **-** | **0.024** | **0.040** | **0.055** | **0.026** |
| **S.Ed. (+)** | **0.013** | **0.124** | **0.011** | **0.019** | **0.026** | **0.012** |

Statistically analyzed data indicated that the computed F value is higher than the tabulated F value because of the pretreatment and temperature at a 5% probability level, which means that our null hypothesis will be rejected. It is therefore clear from the presented data that there is a substantial difference between the levels of each variable.

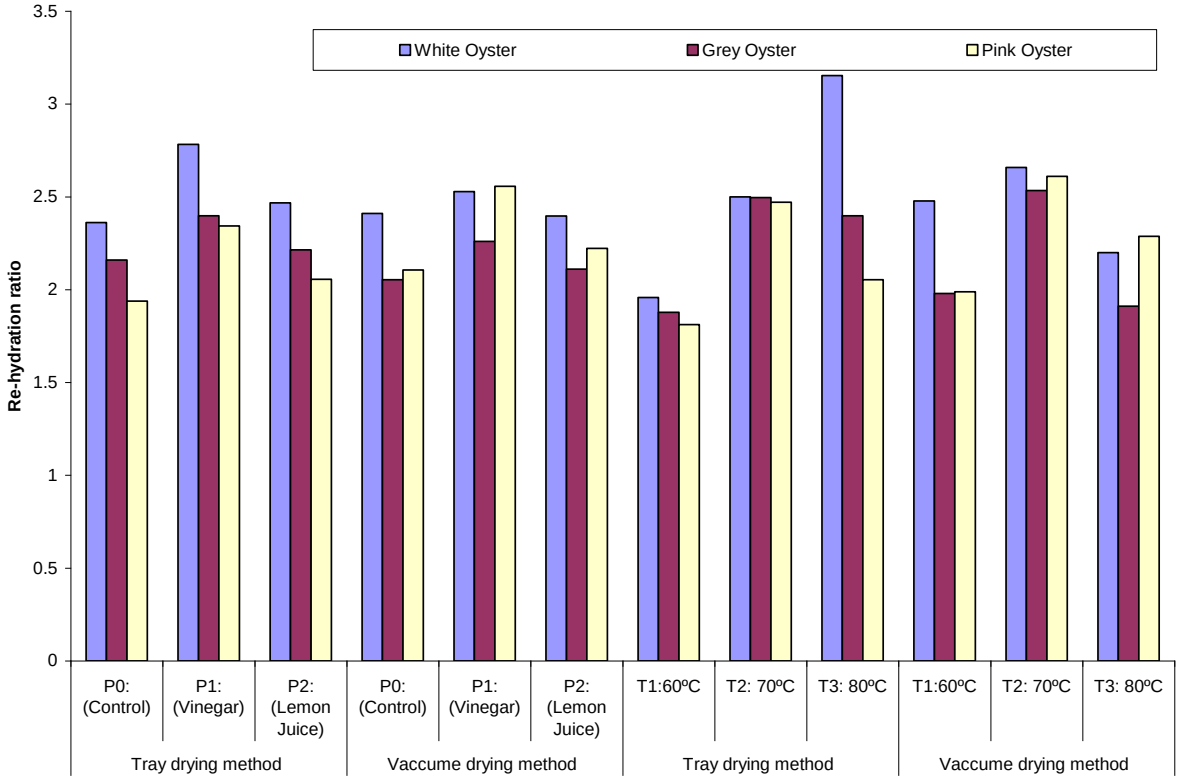
It may be inferred from the above data that there is no significant difference between the level of each variable because the computed F value is bigger than the tabulated F value owing to pretreatment and temperature at 2, 26 degree of freedom on a 5% probability level.

The computed F value is greater than the tabulated F value due to the interaction (pre treatment and temperature) at 4, 26 degrees of freedom on a 5% probability level, and as this results in the null hypothesis being rejected, it can be inferred from the given data that there is a substantial difference between the levels of each variable.

The calculated F value is greater than the tabulated F value owing to interaction (pre treatment and temperature) at 4, 26 degrees of freedom on a 5% probability level, and since this means that our null hypothesis will be accepted, it can be inferred from the presented data that there is no statistically significant difference between the levels of any variable.

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023



ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

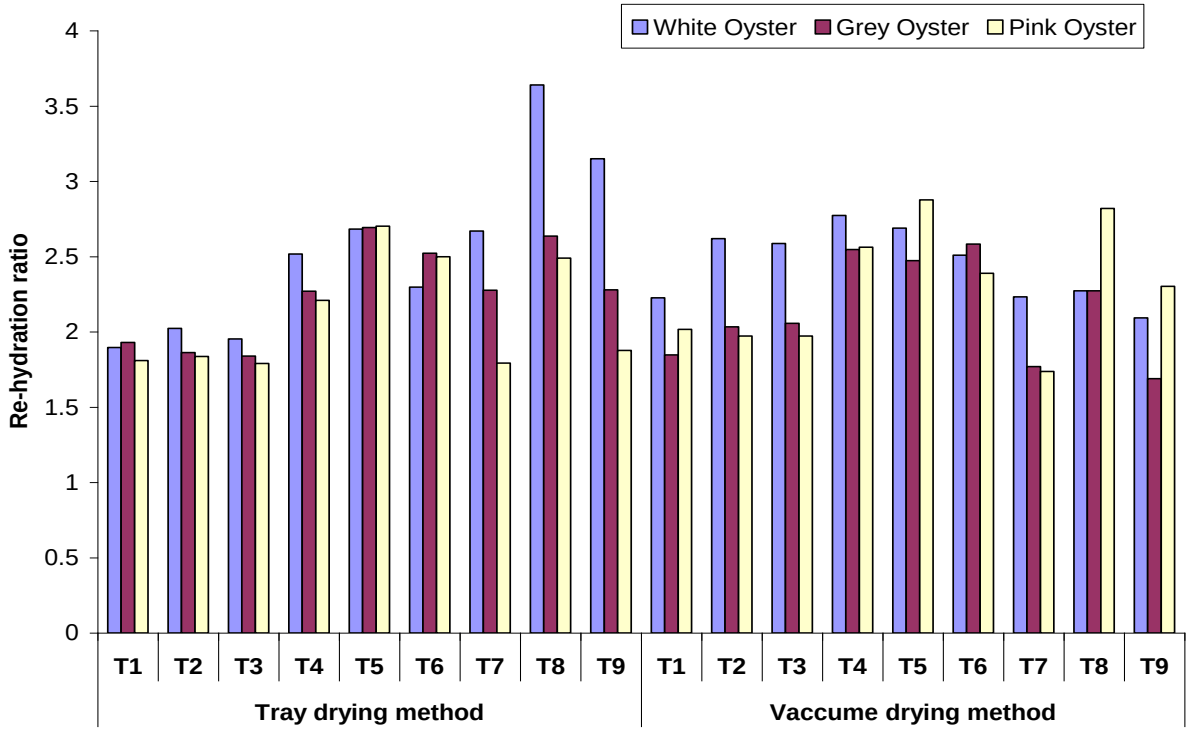



**Figure 3.4 Effect of temperature and different treatment on Re-hydration ratio of oyster mushroom in Tray dryer and vacuum dryer method**

## CONCLUSION

Drying temperature was inversely proportional to drying time and directly proportional to drying rate, in case of pre treatment, highest drying was found in T1 (Vinegar) followed T2 (Lemon Juice) and T0 Control. The dehydration and re-hydration ratio increase with increase in temperature and maximum in T1 (Vinegar) followed T2 (Lemon Juice) and T0 Control at 60, 70, 80ºC.

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023

## REFERENCES


- Aremu, M. O., Basu, S. K., Gyar, S. D., Goyal, A., Bhowmik, P. K., &Banik, S. D. (2009). Proximate Composition and Functional Properties of Mushroom Flours from Ganoderma spp., Omphalotusolearius (DC.) Sing. and Hebelomamesophaeum (Pers.) Quél. sed in Nasarawa State, Nigeria. *Malaysian journal of nutrition*, *15*(2).
- Dalmau, M.E.; Bornhorst, G.M.; Eim, V.; Rosselló, C.; Simal, S. E_ects of freezing, freeze drying and convective drying on in vitro gastric digestion of apples. Food Chem. 2017, 215, 7–16.
- Doymaz, I. (2014). Drying kinetics and rehydration characteristics of convective hot-air dried white button mushroom slices. *Journal of Chemistry*, *2014*.
- Duan, J.-L.; Xu, J.-G. E_ects of Drying Methods on Physico-Chemical Properties and Antioxidant Activity of Shiitake Mushrooms (Lentinusedodes). Agric. Food Sci. Res. 2015, 2, 51–55.
- Jayakumar T, Ramesh E, Geraldine P (2006) Antioxidant activity of the oyster mushroom, *Pleurotusostreatus*, on CCl4-induced liver injury in rats. *Food ChemToxicol*44, 1989–96.
- Singh, R. (2017). A review on different benefits of mushroom. *IOSR Journal of* Pharmacy and Biological Sciences, 12(1), 107-11.
- Tian, Y.; Zhao, Y.; Huang, J.; Zeng, H.; Zheng, B. E_ects of di_erent drying methods on the product quality and volatile compounds of whole shiitake mushrooms. Food Chem. 2016, 197, 714–722.
- Irfan, Daniyal, et al. "Prediction of Quality Food Sale in Mart Using the AI-Based TOR Method." Journal of Food Quality 2022 (2022).
- Sawhney, Rahul, et al. "A comparative assessment of artificial intelligence models used for early prediction and evaluation of chronic kidney disease." Decision Analytics Journal 6 (2023): 100169.

ISSN PRINT 2319 1775 Online 2320 7876

*Research paper*  UGC CARE Listed ( Group -I) Journal Volume 12, Iss 1,Jan 2023


- Mall, Pawan Kumar, et al. "FuzzyNet-Based Modelling Smart Traffic System in Smart Cities Using Deep Learning Models." Handbook of Research on Data-Driven Mathematical Modeling in Smart Cities. IGI Global, 2023. 76-95.
- Srivastava, Swapnita, et al. "An Ensemble Learning Approach For Chronic Kidney Disease Classification." Journal of Pharmaceutical Negative Results (2022): 2401-2409.