**International Journal of Food Science and Nutrition**
**ISSN: 2455-4898; Impact Factor: RJIF 5.14**
**Received: 20-05-2020; Accepted: 09-06-2020; Published: 22-06-2020**
**www.foodsciencejournal.com**
**Volume 5; Issue 3; 2020; Page No. 146-149**

# Evaluation of vacuum dried tomato paste and storage study in ambient temperature

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**Abstract**
Tomato is an important fruit or vegetable in daily diet. This study deals with tomato paste were prepared using vacuum dryer. There is different variable being vacuum temperature (65°c, 70°c, 75°c) and pressure (700 mmHg) and time (1.00 hr). The determine proximate analysis and sensory evaluation. Result shows that combination of vacuum dryer 70°c temperature, 1hr time produced the best result in term of lycopene, viscosity, vitamin c and Sensory attributes. The sample $T_2$ was found to be superior to the other samples and selected for storage study (0 Day to 90 Day). This sample was stored in glass bottle. Microbial analyses and Sensory evaluation were also carried out. Result shows that the total plate count for the selected sample was found to be nil up to 0 days of storage at room temperature and yeast and mold count were not detected up to 60 days. But the total plate count had appeared to be 1.2 X $10^2$ on 30 days of storage and 5.1 X$10^2$ till 90 days. Whereas the yeast and mold were found on 90 days at level of 1.0 X $10^2$. Selected sample was found to be low for susceptibility to microbial growth in terms of total plate count and yeast/mold count. Sensory evaluation after 60 days there was changes observed and the product was acceptable.

**Keywords:** tomato paste, vacuum dryer, proximate, microbial, sensory analysis, storage study

## Introduction
Tomato (*Lycopersicon esculentum*) is one of the most widely consumed fresh vegetable in the world (Thybo *et al*., 2006). Tomato is important fruits vegetable making significant contributions to human nutrition through the world (Simnnne *et al*., 2006) [13]. Tomato is rich in water soluble vitamin such as carotenoids, vitamin B and C: it could provide 12.2% recommended daily allowance of vitamin C (Smith and Hull, 2004) [14]. It has 20-25 mg ascorbic acid per 100g. Tomato is also rich source of lycopene. Tomato fruits contain of 98.1g water/100g, 0.7 protein/100 gm, 3.1g carbohydrate/100 g, 1.3g dietary fibre/100g, 0.3 g fat/100g (ahmed Shiveare 2001) [4]. According to Brandt *et al*. (2006) in many recent studies, it has been reported that the consumption of tomatoes and tomato-based foods reduces the risk of atherosclerosis, carcinogenesis and cardiovascular disease and pays a great part in the prevention of many types of cancer.
(FAO 2007) [7] report indicates that tomato production is on the increase globally. The world's total tomato production is 113.3 million tons; China is the largest producer followed by the USA, Turkey, Italy, Egypt and India (Alam and Goyal, 2007) [3], leading to rapid development to tomato processing industries with a series of interlinked activities such as production of paste, soup, salad, juice, puree and powder. Tomato paste is highly increasing demand of international market (Tyssandie *et al*., 2004).
Packaging of the paste is very important because of protection of the product from contamination by macro or micro-organism, reduction and oxidation (Matsuoka *et al*., 2002) [11]. Effective packaging is vital to the health and welfare of the consumer. The quality, safety, and nutritional content Of packed foods have not been thoroughly researched for certain newly packed foods. The desire for higher quality and safer food with a longer shelf-life led to increased interest in the interaction between foods and food packaging (Joshi *et al*., 2002) [9].
Several works have been reported in literature on the use of plastic container and low-density polyethylene in the packaging of the tomato paste (Famurewa *et al*., 2013; Akanbi and Oludemi, 2004) [6, 2]; information is lacking on the use of aluminum foil which are readily available and cheap. This work seeks to investigate the use of aluminum foil in tomato paste packaging and storage.
Also, the aim of the present study was to investigate the development of vacuum dried tomato paste and evaluate proximate analysis and storage study of ambient temperature on shelf life of processed tomato paste.

## Materials and Methods
The experimental studies were carried out in department of Food Process Engineering, Shuats Prayagraj. Tomato were clean, washed and blanching the temperature 60ºC - 70ºC for 5 min then extraction of pulp using pulp extraction machine. The pulp was added the vacuum dryer and temperature is 65ºC, 70 ºC, 75ºC for 1hr and pressure was 700mmhg. And processed paste was added of 1kg/5g of sodium benzoate was added and hot filling 80ºC of the paste samples was packaged in glass bottle and 20 min cooling and stored at room temperature. The proximate analysis was evaluated. Just after preparation of tomato paste at the interval of 0 days up to 90 days during storage at ambient temperature and studied of self-life of tomato paste by sensory analysis and microbial analysis.


**Fig 1:** flow diagram for production of tomato paste

**Proximate analysis of processed tomato paste**

The proximate analysis of processed tomato paste that is Moisture content %, Titratable Acidity %, Total soluble solid (°Brix), pH, Vitamin C (mg/100g), Lycopene (mg/100g), Viscosity (mPa.s), (AOAC, 2000) [1].

**Microbiological analysis**

Microbial examination is the perfect quality assessment protocol performed in food products quality analysis. However, in every shelf life study of products, it is mandatory one. In the microbial study of complementary food, the total plate count (TPC), yeast and mold count were determined. The results were expressed in terms of colony forming unit (CFU)/g of sample (Ranganna *et al*. 2010).

**Total plate count**

Microbial analysis was done to determine total plate count (TPC) of the samples on the nutrient agar media for bacterial count. Nutrient agar media was prepared and the samples were serially diluted up to $10^{-2}$ dilution factor. 1g of the samples, suspended in saline solution, was transferred to the respective petri dishes of nutrient agar media. Three replicates were taken for each dilution. The inoculated petri dishes were incubated for 48 hrs at $37+1^0$C and total colonies were calculated by the following formula.

TPC (cfu/ml) = No. of colonies x dilution factor

**Yeast and mould count**

Microbial analysis was done to determine total yeast and mould count of the samples on the potato dextrose agar Media for yeast and mould count. Potato dextrose agar media was prepared and the samples were serially diluted up to $10^{-2}$ dilution factor. 1g of the samples, suspended in saline solution, was transferred to the respective petri dishes of potato dextrose agar media. Three replicates were taken for each dilution. The inoculated petri dishes were incubated in a incubator for 48 hours at $37+1^0$C for counting of yeast and mould.

**Sensory analysis**

Organoleptic scoring was done to work out the overall acceptability of the product consumer. The sensory evaluation of the product was undertaken by a panel of the judges considering the sensory evaluation of the product was undertaken by a panel of the judges considering the sensory attributes like colour appearance taste, flavour and overall acceptability on 9 point hedonic scale ranging from like to dislike extremely as narrated in the material and methods. The mean score of the different attributes and overall acceptability are reported. It is clear from the data given that in table that organoleptic rating increased at all the characters up to 30 days after storage there after declined.

**Statistical analysis**

The data were statistically analyzed for analysis of variance (ANOVA), Standard Error (S.E), critical difference (C.D) and t test following (Gupta 1997) [8].

**Result and Discussion**

The experiments were conducted for "Evaluation of vacuum dried tomato paste and Storage study in ambient temperature". i.e. (Control, $T_1$, $T_2$ $T_3$,).

Studies proximate analysis [i.e. moisture, pH, Titratable Acidity (%), Lycopene (mg/100g), Vitamin C (mg/100g), Viscosity (Pa.s)] and sensory properties, which were determined for evaluation of vacuum dried tomato paste and storage study of tomato paste were influence by glass bottle material, storage at environmental condition. The microbial analysis and sensory analysis were conducted at the interval of 0 to 90 days. The result of the study are being presented and discussed in following sectioned.

**Proximate composition of processed tomato paste**

There is a significant difference in moisture content of freshly prepared tomato paste table no 1. It was observed the moisture content of tomato paste was found to range between 79.45 to 77.39%. Maximum moisture content was recorded in control sample while minimum is observed sample $T_3$. The sample $T_2$ was found the maximum value of lycopene, vitamin C, total soluble solid, and viscosity that is (14.42 mg/100g), (19.90 mg/100g), (28 ºBrix), (2.14 Pa.s) respectively.

**Table 1:** proximate composition of processed tomato paste

| Sample | Time (Hr) | Temp (ºC) | Pressure (Mmhg) | TSS (ºBrix) | Moisture content (%) | pH | Titratable Acidity (%) | Lycopene (mg/100g) | Vit.C (mg/100g) | Viscosity (Pa.s) |
|---|---|---|---|---|---|---|---|---|---|---|
| Control | | | | 26 | 79.45 | 4.5 | 0.45 | 13.99 | 13.75 | 2.01 |
| $T_1$ | 1 | 65 | 700 | 25 | 79.00 | 4.0 | 0.35 | 13.12 | 12.10 | 1.72 |
| $T_2$ | 1 | 70 | 700 | 28 | 78.75 | 4.4 | 0.45 | 14.42 | 19.90 | 2.14 |
| $T_3$ | 1 | 75 | 700 | 27 | 77.39 | 3.9 | 0.44 | 12.51 | 12.0 | 2.12 |

*Each value is average of three determinations

**Sensory evaluation of tomato paste**

Data given in Table 2 revealed that, the overall acceptability score recorded for sample $T_2$ was found higher (8.3) followed by $T_3$ (8.1) than other samples. The overall acceptability score recorded for control sample (7.5) which was lower as compared to other samples. The sample $T_1$ had overall acceptability score (7.8). The acceptance of samples depends on the ingredient variation. The overall acceptability among samples was significantly varied statistically. Similar observation with respect to attributes colour, flavour, taste, mouthfeel and overall acceptability of tomato paste was reported by (Latpate VN *et al*., 2013) [10]. There was significant difference among the samples in context to all the sensory parameters. Overall, by considering the different sensory attributes, the formulation $T_2$ was found to be superior to the other samples and selected for further study.

**Table 2:** Sensory evaluation of processed tomato paste

| Sample | Colour and appearance | Flavour | Taste | Mouthfeel | Overall acceptability |
|---|---|---|---|---|---|
| Control | 8.1 | 7.4 | 7.4 | 7.1 | 7.5 |
| $T_1$ | 8.1 | 7.3 | 8.2 | 7.8 | 7.8 |
| $T_2$ | 8.3 | 7.8 | 8.3 | 8.1 | 8.3 |
| $T_3$ | 8.0 | 7.6 | 8.1 | 7.6 | 8.1 |
| SE± | 0.0333 | 0.0527 | 0.0204 | 0.0390 | 0.0612 |
| CD at 5% | 0.0977 | 0.1545 | 0.0598 | 0.1146 | 0.1796 |

*Each value is average of three determinations

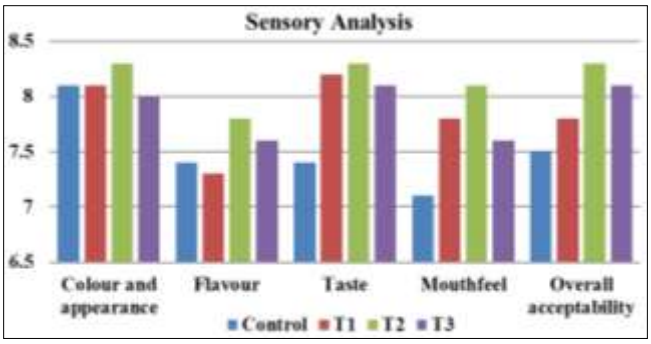


**Fig 2:** Sensory evaluation of processed tomato paste

**Organoleptic quality of tomato paste stored at ambient temperature**

Table 3 describes the sensory scoring comparison between control and $T_2$ sample. The colour and appearance of the controlled sample and $T_2$ are nearly similar however the standardized $T_2$ was slightly superior to controlled sample on fresh serving. Scoring on 30th day depicts that there is no significant difference between the two products as far as colour and appearance is concerned however the progressing days suggested that there rise a slight difference between control and $T_2$ formulation where colour perception for control goes toward mere reducing direction. Till the 90th day of evaluation-controlled sample (7.6) and $T_2$ (7.9) are found to be above acceptable level for its colour and appearance property.

Information depicted in the table 3 showed that the mouthfeel of standardized $T_2$ formulation is more preferable than the controlled sample. At day 0 and 30th $T_2$ had received (8.1) and (7.9) scoring against controlled which got rating of (7.1) and (7.0) for two intervals. On 60th day both the sample received different points for mouthfeel. However, there is slight decrease in scoring is observed at $90^{th}$ day. So we could we conclude that the textural properties of product goes on decreasing as the storage period extends.

Organoleptic evaluation of complementary food for taste attribute was analysed for 90 days. The taste of food on fresh date was rated as 7.4 for control sample and 8.3 for standardized formulation $T_2$. After 30 days there was no any change observed in the taste of food. Taste after 60 days gave deprived results and rated as 7.2 and 8.1 for control and standardized sample. The sample was further tasted after 90 days. As the product was stored at room temperature, the product lost moisture because of excessive hot climate thus change in taste was observed. The rating was given as 7.0 and 7.9 for control and standardized sample.

Flavour is one of the important sensory parameter i.e., flavour is a combination of taste, smell and aroma. On fresh date the product was rated as 7.3 and 7.8, with continuous storage of product some volatile substance might have evaporated hence after 30 days there was slight change in flavour and thus was rated to be 7.2 and 7.7 for control and $T_2$ standardized formulation. Further observation for 60 and 90 consecutive days was observed. The rating was given as 6.9 and 7.5, 6.8 and 7.2 for control and $T_2$ formulation respectively.

Overall acceptability of the product includes all the sensory attributes. The overall acceptability for control and $T_2$ was rated as 7.5 and 8.3 respectively. After 30 days there was slight deprivation in the acceptability of controlled sample and rated as 7.4 while there was no change in $T_2$. After 60 days there was changes observed and the product was acceptable. Further observation was done for 90 days. The rating was observed as 7.1 and 7.8 for control and $T_2$ after 90 days.

**Table 3:** Effect of storage on Organoleptic quality of tomato paste at ambient temperature

| Parameters | Colour and appearance | | Flavour | | Taste | | Mouthfeel | | Overall acceptability | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Days | Control | $T_2$ | Control | $T_2$ | Control | $T_2$ | Control | $T_2$ | Control | $T_2$ |
| 0 | 8.1 | 8.3 | 7.3 | 7.8 | 7.4 | 8.3 | 7.1 | 8.1 | 7.5 | 8.3 |
| 30 | 7.9 | 8.2 | 7.2 | 7.7 | 7.4 | 8.3 | 7.0 | 7.9 | 7.4 | 8.3 |
| 60 | 7.8 | 8.1 | 6.9 | 7.5 | 7.2 | 8.1 | 6.9 | 7.7 | 7.2 | 8.0 |
| 90 | 7.6 | 7.9 | 6.8 | 7.2 | 7.0 | 7.9 | 6.8 | 7.6 | 7.1 | 7.8 |

*Each value is average of three determinations

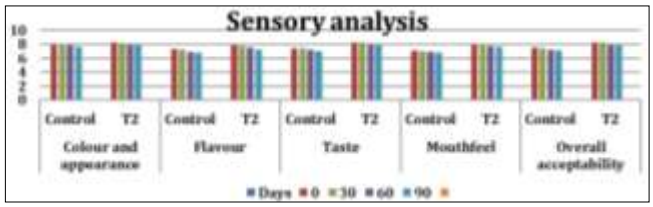


**Fig 3:** Effect of storage on Organoleptic quality of tomato paste at ambient temperature

**Microbial analysis of tomato paste stored at ambient temperature**

In the present investigation, the susceptibility of fresh complementary food to microbial growth by comparing the colony-forming units (CFU) on petri dishes inoculated with diluted complementary food suspensions. Selective growth media were used to differentiate between bacterial and mold/yeast growth. It was observed that the total plate count for the selected sample was found to be nil up to 0 days of storage at room temperature and yeast and mold count were not detected up to 60 days. But the total plate count had appeared to be 1.2 X $10^2$ on 30 days of storage and 5.1 X$10^2$ till 90 days. Whereas the yeast and mold were found on 90 days at level of 1.0 X $10^2$. Selected sample was found to be low for susceptibility to microbial growth in terms of total plate count and yeast/mold count. The findings of present investigation were close resemblance with the observations reported by (Djadouni Fatima *et al*., 2015) [5].

**Table 4:** Microbial analysis of tomato paste stored at ambient temperature

| Storage period | Microbial quality (cfu/ml) | |
|---|---|---|
| Sample ($T_2$) (Days) | TPC (cfu/ml) | Yeast and Mold count (cfu/ml) |
| 0 | ND | ND |
| 30 | 1.2X$10^2$ | ND |
| 60 | 3.2X$10^2$ | ND |
| 90 | 5.1X$10^2$ | 1.0X$10^2$ |

*Each value is average of three determinations ND – Not detected

**Conclusion**

The result of Total Soluble Solid, Moisture content, Titratable acidity, pH, Vitamin C, Lycopene, and Viscosity is best in T2 sample as compared to Control, T1, T3. The result of microbiological analysis in tomato paste selected sample was found to be low for susceptibility to microbial growth in terms of total plate count and yeast/mold count. And storage at ambient temperature fter 60 days there was changes observed and the product was acceptable.

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