Biological Forum – An International Journal **13(3a): 696-699(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Utilization of Green Tea Tincture as Natural Preservative for Tuna Fish during Chilled Storage

Suraj P. Patel*, Aditya Singh and Jitesh Solanki
Department of Fish Processing Technology, College of Fisheries Science, Kamdhenu University, Veraval, (Gujarat), India.

(Corresponding author: Suraj P. Patel)*
(Received 26 July 2021, Accepted 30 September, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Green tea scientifically known as *Camellia sinensis* are steeped into hot water to make green tea, which is very popular beverage all around the world. It contains natural phenols and antioxidants catechins. Moreover, catechins contains epigallocatechin -3-gallate (EGCG). That is present abundantly in green tea. Catechin is the main component that prevent the oxidation in fish sample which is under experimental observation. Three samples have been taken for experiment. Fish samples are dipped in the already prepared solutions of 5% & 10% and control (Distilled water). After treatment samples have been observed for 7 days. Treated fish samples showed positive results compared to controlled fish sample, and better-quality control because oxidation has been inhibited to some extent due to antioxidation effect of green tea. The observation is done by torrymeter, whiteness meter & sensory evaluations. These instruments are valuable in assessing freshness and colour of fish samples.

Keywords: Green tea, tincture, *Auxist hazard*, antioxidants, catechins, quality control, freshness, lipid oxidation.

INTRODUCTION

Sea food is consumed all over the world because of its delicious taste & high nutritional value. Seafood contains high value protein, minerals, different fatty acids plus various amino acids like docosahexaenoic acid (DHA) & eicosapentaenoic acid, which are very important for neurodevelopment, vitamins, etc. (WHO, 2010) All though seafood has very high nutritional value, the most important aspect is to maintain the freshness of the seafood after harvesting until it's consumption because seafood is highly perishable. Intrinsic and extrinsic aspects are the significantly affecting the quality of fish. Mostly microbial activities are the reasons for deterioration of the quality seafood by formation of free amino acids, ammonia and volatile compounds (Penny *et al.*, 2002). Physical damage also can reduce the quality. And fat oxidation is also the important factor to lead the quality of seafood towards deterioration.

Lipid oxidation is major cause which deteriorate the quality of seafood. Sea food contains polyunsaturated fatty acid that is susceptible to degradation by oxidation. Thus, reaction of the fat with oxygen produces unpleasant odour and flavour in fish. Fats are degraded and convert into free fatty acids (Secci & Parisi 2016). In present time because the fat oxidation is major problem to maintain the quality of seafood. Researchers has developed different antioxidants like butylated hydroxy anisole (BHA), Butylated hydroxytoluene (BHT), propyl gallate (PG), and Tert-butyl hydroquinone (TBHQ) (Halliwell *et al.*, 1995). These are the antioxidants use to prevent the oxidation in seafood and aren't harmful towards consumers. Now-a-days researchers have also use natural antioxidants that are extracted by plants and herbs. This is very natural and there are no health issues to apply on seafood to control the quality by inhibiting fat oxidation (Suyani *et al.*, 2020). Green tea is a normal tea that is prepare by the leaves of Camellia sinensis by steeping or brewing in hot water or alcohol. Catechins contains epigallocatechin -3-gallate (EGCG) (Leung *et al.*, 2001).

Green tea consists polyphenols include epigallocatechin gallate, epicatechins, flavanols, epigallocatechin-3-gallate, which is a type of catechin is the component which reduce the oxidation of fat and ultimately retain the quality of the seafood at some extent with comparison to the no treated fish (Sang *et al.*, 2011). Main aim of the experiment is to maintain the quality of fish using antioxidant present in a green tea by means of making the tincture of green tea of different concentration and observe the final result in degradation of each sample which are taken for the experimental observation and comparison of the most and the least degrade sample during the time period of 7 days.

MATERIALS AND METHODS

A. Sample preparation

Green tea tincture. Take 40 g of green tea in a powder form by use of weighing machine. Take this 40 g of green tea powder in a flask and add 160 ml of water by measuring with the help of measuring cylinder. After taking this material in to flask close the mouth of the flask with the help of cork or cotton and put this flask

into the water bath. After placing the flask into water bath set the temperature at 70°C and keep it until 1 hr and 30 mins. After that take the flask out of the water bath and let it cooldown itself. Then remove the crude liquid out of the flask with the help of clean linen cloth in the beaker. Then fill this liquid in the centrifuge tube and put it into the centrifuge machine for 5 mins at 5000rpm, and then start the centrifuge machine. After the application of centrifuge, the heavy particles will settle down and the pure tincture are fill into small glass bottles. Store it into 3-4°C until its final use as different solutions.

Dip Treatment: To prepare the dip treatment of fish chunks in different concentration three beakers are taken. Beaker A (5%) with 285ml water and 15ml tincture. Beaker B(10%) containing 270ml water and 30ml tincture. Lastly, Beaker C (Controlled) with 300 ml water. After making three different solutions put the fish chunks into solution & wait until 1 hr and 30 mins. After dipping the chunks into different solutions pack it into plastic bags after draining extra solution from the fish chunks.

B. Analytical methods

The experiment is held on the tuna fish which is analysed for 7 days and observation is done on every 2 days of intervals. And during this period of 7 days the samples are held in the chilled storage. And the parameters to be analysed are freshness, colour, pH and sensory evaluation. For the evaluation of freshness Torrymeter is used and it displays the reading of the sample on the display of the device. There are sensors on the device that must be in contact with the surface of the sample and readings are display on the screen. Three reading are required. For the analysis of the colour of fish samples colorimeter is used and it shows the result in L(lightness), a (redness) and yellowness. And for the sensory analysis the organoleptic test is done by scoring the odour, colour, appearance and overall acceptability of the fish samples. 9 points of hedonic scales are given by the selected candidates which are selected for sensory evaluation. And the pH is measured by the pH meter. Before measuring the pH of the sample PH meter is needed to be calibrated first in different standard buffer solution of 4.0, 7.0 and 10.0. After calibrating, the meter is ready to find out the pH of sample.

Statistical analysis. All the statistical analysis was done in triplicates and data obtained were compared and analysed under Microsoft excel version 2019 software.

RESULT AND DISCUSSION

Freshness (Using Torrymeter). Freshness of fish is measured using fish freshness meter. It is potable and robust as well as can be used in any situation. It is used in fish processing industries or quality control laboratory. It helps to take rapid measurement. The average value of freshness is displayed over the LED screen. To measure the freshness, we need to place the sensor strip on the fish sample. It shows the in the grade from 0 to 16 (Solanki *et al.*, 2016) The sensors are made as they do not affect the surface of the fish during reading. As per the data and graph of freshness we can easily conclude that the freshness of sample T2 has very low degradation in quality which is treated by 10 % solution green-tea where another two sample has comparatively high degradation in quality than sample T2.

Table 1: Mean freshness value of control T1(5 %), T2(10%) and T3(control).

Days	T1	T2	T3
0(raw material)	7.2	7.1	7
1	7	7.1	6.9
3	6.9	7	6.7
5	6.7	6.8	6.5
7	6.6	6.8	6.4

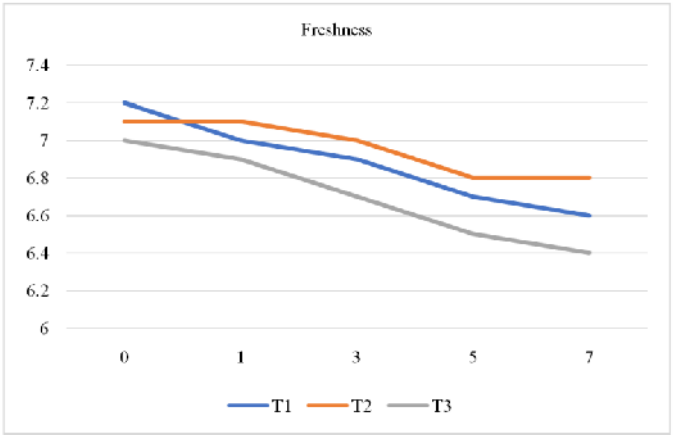

Fig. 1. Pictorial representation of mean freshness value.

Colour (using whiteness meter). To evaluate the colour of the T1, T2, T3 sample, A device is use called colorimeter. It shows the result in three different colours as L (lightness) a (redness and greenness) b (yellowness and blueness) (Fofandi Durga *et al.,* 2019). Meter shows the value of different colour. In this experiment the sample are treated with green tea tincture so colour will be influenced by the tincture. The data and graph of colour of different samples shows that at the end of the day 7 the sample T3 has the highest L-value (which is stands for the lightness). In case of a-value as the value decrease the greenness is increase as it is contras to the redness so here T3 has highest greenness value and T2 has highest redness value. And the b-values stands for yellowness and blueness value as the result shows the T3 sample has the highest b value means it is becoming yellow in colour with respect to the time.

Sensory evaluation. For the sensory evaluation 3 panellists are selected. The panellists evaluate the colour, odour, appearance based on the 9 points hedonic scale (AOAC, 2000) The colour of the sample (T3) controlled is better than T1 and T2 because it is not treated with green tea and it retain the redness more effectively than the other sample, but at the reach of the day 7 the colour in sample is also reduced. But in the case of the odour, appearance overall acceptability the sample T2 has retain the freshness more effectively then the T1 and T3.

Table 2: L* a* b* values before (whiteness meter) mean value ± std. dev.

26/08/21 (DAY 0)	T1(5%)	T2(10%)	T3(C)
a	0.7±0.26	0.2±0.1	0.20.15
b	6.2±0.21	9.3±0.21	7.5±0.26
L	30.4±0.32	36.2±0.51	33.4±0.15

Table 3: L* a* b* values after treatment (whiteness meter) mean value ± std. dev.

Days	T1(5%)	T2(10%)	T3(control)
1	a= -2.5±0.1	a=-2.7±0.2	a=-2.6±0.17
	b=7.47±0.40	b=9.0±0.25	b=8.4±0.20
	L=33.5±0.20	L=37.4±0.32	L=35.7±0.70
3	a=-3.1±0.06	a=-3±0.1	a=-3.5±1.85
	b=7.4±0.40	b=8.6±0.15	b=8.7±0.29
	L=35.3±0.30	L=36.4±0.35	L=35.2±0.20
5	a=-3.7±0.15	a=-3.40.17	a=-3.8±0.15
	b=7.6±0.3	b=8.9±0.15	b=9.4±0.26
	L=34.3±0.25	L=37.3±0.26	L=39.0±0.35
7	a=-3.70.15	a=-3.80.05	a=-4.4±0.25
	b=7.70.26	b=8.40.15	b=9.70.1
	L=35.30.35	L=38.00.15	L=40.40.4

Table 4: Scores for sensory evaluation(mean value ± std. dev.).

Storage period (Days)	Chunk samples	Appearance	Colour	Odour	Overall acceptability
0 (Before treatment)	T1(5 %)	8±1	8.7±0.58	8.3±0.58	8.3±0.58
	T2(10%)	7.7±0.58	8.3±0.58	8±1	8±0
	T3(control)	7.7±1.52	9±0	9±0	8.3±0.58
1	T1	6.7±1.15	8.3±0.58	6.7±1.15	7.3±0.58
	T2	7.3±0.58	7.8±0.58	7±1	7.7±0.58
	T3(control)	6.7±0.58	8.7±0.58	6.7±1.15	7±1
3	T1	6.3±0.57	6.7±0.58	7±1.73	6.3±0.58
	T2	6.7±0.57	6.3±0.58	7.3±1.52	7.3±0.58
	T3(control)	6±1	7.7±0.58	6.3±0.58	5.7±0.58
5	T1	5.7±0.57	5.7±0.58	6±1	5.3±0.58
	T2	6.3±0.57	5.7±0.58	6.7±0.58	5.7±0.58
	T3(control)	5.3±0.57	7±0	5±1	4.3±0.58
7	T1	5.3±0.57	5.3±0.58	5.7±0.58	4±0
	T2	6.3±0.57	5.7±1.15	6.3±0.58	5.3±0.58
	T3(control)	4.7±1.15	6.3±0.58	4.3±0.58	3.3±0.58

pH value: We measure pH to evaluate if the fish became acidic or alkaline. For this process pH meter is used. A small piece of fish sample (T1) is taken into a small beaker and homogenised with distilled water. Before measuring the pH of the sample pH meter is needed to be calibrated first in different standard buffer solution of 4.0, 7.0 and 10.0. After calibrating, the meter is ready to find out the pH of sample T1. And same method is applied for T2 and T3 for measuring the pH. As the result and the graph shows the variation in the pH of different samples. In the end of the day 7 the change in pH in sample T3 is very high and in the sample T2 has less changes in pH. Trends in pH: T2<T1<T3. Lower pH points to the possibility of spoilage in fish chunks (Swatland, 2002).

Table 5: pH values for fish samples (mean value ± std. dev.)

Days	T1	T2	T3
Day 0(raw material)	6.2 ± 0.03	6.1 ± 0.01	6.1 ± 0.07
Day 1	6.1 ± 0.12	5.9 ± 0.13	6.0 ± 0.08
Day 3	5.9 ± 0.12	5.7 ± 0.03	5.7 ± 0.04
Day 5	5.6 ± 0.03	5.7 ± 0.02	5.7 ± 0.02
Day 7	5.5 ± 0.02	5.6 ± 0.02	5.4 ± 0.02

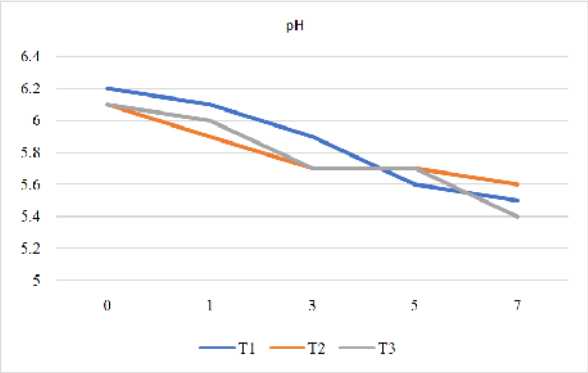

Fig. 2. Pictorial representation of mean pH value.

CONCLUSION

This research data is to evaluate the effect of green tea tincture on *Auxisthazard chunks.* And fish chunks divided into three groups and each group, treated with different solutions (T1, T2, and T3). Result of different parameters like pH, freshness, colour, and sensory analysis are studied. So, based on the data (at the end of the 7th day), the most desirable sample was T2 (10% solution) compared to T1 and T3. About pH, sample T2 was moderately spoiledat the end of 7th day. Colour of T1 and T2 samples changed to greenish colour due to the effect of green tea tincture, and T3 sample which was the controlled one. Whiteness meter reading shows that the lightness increased by a noticeable amount. In the terms of overall acceptance, the T2 sample is most acceptable than the other samples.

Conflicts of Interest. None.

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How to cite this article: Patel, S.P., Singh, A., and Solanki, J.(2021).Utilization of Green Tea Tincture as Natural Preservative for Tuna Fish during Chilled Storage. *Biological Forum – An International Journal*, *13*(3a): 696-699.