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ACCELERATED SHELF LIFE STUDY OF *ZINGIBER OFFICINALE* PASTE

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ABSTRACT

The present works focus the accelerated shelf life stability of *Zingiber officinale* paste. All the analysis has been carried out periodically at 0^{th}, 30^{th}, 45^{th} and 60^{th} day. The results have shown that, pH of the paste decreases due to chemical reaction. The acidity of the paste moderately increases at 30°C, 40°C and 50°C due to the conversion of sugar into acids. Free fatty acids are slightly increased due to lipase action. Sensory analysis reveals that low temperature storage enhances the stability of ginger paste because of colour, flavour and aroma maintained in the paste even after 60 days.

KEYWORDS: *Ginger paste, maillard reaction, free fatty acids, microbial and sensory analysis*

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INTRODUCTION

Now a day's shelf life study of the food products is important, because of their benefits to human health[1, 2]. Shelf life studies can give essential information to the product developers, enabling them to authenticate that the consumer will get a high quality product for a particular period of time after production. The temperature, water and browning are the main factors, which contributes to the science of shelf life studies[3]. *Zingiber officinale*, one of the most widely used species of the ginger family is a common condiment for various foods and beverages[4]. Accelerated shelf life testing (ASLT) is an alternate to all other methods used by industries. To the best of our knowledge accelerated shelf life test of spice paste yet not been reported.

MATERIALS AND METHODS

Plant materials

Zingiber officinale Roscoe was collected from foothills of pechiparai Horticultural Research station. Sample was identified (Zingiberaceae family) and authenticated by Botanical Survey of India, TamilNadu Agricultural University Campus, Coimbatore, TamilNadu, India (No.BSI/SRC/5/23/2013-14/Tech-1876. Ginger paste was prepared using the standard procedure[5]. In a typical procedure, the outer layer of the ginger was removed then it's cut into the small pieces. Fresh ginger paste is prepared by grinding the small pieces using a blender mixer. The pH of fresh paste was found to be 5.9. Then, 50g of the fresh paste mixed with 5g sodium chloride and 0.25g of citric acid. After adding the preservatives the pH of ginger paste got reduced to 3.7. The prepared paste samples were stored in separate glass containers and maintained at four different temperatures (5ºC, 30ºC, 40ºC and 50ºC) a period of sixty days.

Physico chemical analysis

pH, Acidity, Free fatty acids, Peroxide, Microbial and Sensory analysis were carried out by standard protocol[6]. Maillard reaction was observed by using UV-visible spectra diluting 1g of sample in 15ml of distilled water and centrifuging the solution at 3000rpm for 20 min. The absorbance was observed at 420 nm[7].

Colour estimation

The colour estimation of the prepared samples were carried out using Hunter Ultra Scan XE spectrophotomer in the reflection mode as it is the easiest method to confirm a colour of the paste and to determine the quality of the products. The equipment was standardized using standard white reference tile (*L**= resemble to Munsell value, *a**= denoted as red-green axis, *b**= denoted as yellow-blue axis). The colour of the paste was determined by black painted glass cells (L=0). Total reflectance of paste was estimated in 0th day and 60th day. Colour difference was measured using Hunter-Scot field's equation.

$$\Delta E = \sqrt{(\Delta a^2 + \Delta ab^2 + \Delta L^2)}$$

Statistical analysis

Values were expressed as mean ± S.D (n=3).

RESULTS AND DISCUSSION

Moisture is one of the essential parameter of storage study, because less moisture is suggestible for more stability. pH of the paste decreases due to chemical reaction. The measured pH values of ginger paste during the storage periods have been given in Fig. 1. In the present work ginger paste pH value was found to be 3.7±0.05 on the 0th day. Slight change in the pH value of the ginger paste was observed on 30th day, 45th day and 60th day for all samples maintained at 5ºC, 30ºC, 40ºC and 50ºC. This may be due to the dissociation of organic compounds present in the sample, as reported by Gupta and Ravishankar, 2005. At ambient temperature, 6-gingerol was having maximum stability, when pH was 4 but at high temperature, the pH was between 1 to 3.6 because of dehydration of 6-gingerol into 6-shogaol [9]. On 30th day and the subsequent days (45th day, 60th day) the acidity was found to have higher values and varied between .13% ± 0.005 to .14% ±0.005 for all the samples maintained at 5ºC, 30ºC, 40ºC and 50ºC. This is due to the conversion of sugar into acids as reported in the literature[10]. In acid medium 6-gingerol are more stable than in alkaline medium because of its acidic methylene protons[11]. Browning reactions of *Zingiber officinale* paste have been Fig. 2. Browning was a major problem to optimize the temperature of the spice paste. It's an irreversible reaction because the reactive components were activated during processing. Citric acid plays a main role in the prevention of enzymatic browning to inhibit phenolase activity and prevent the auto oxidation[12]. But in *zingiber officinale* paste, the brown pigments increased from 0.070 to 0.425, 0.070 to 0.527, 0.070 to 0.630, 0.070 to 0.800 for the samples maintained 5ºC, 30ºC, 40ºC and 50ºC respectively. From the results, it was observed that faster color degradation occurred in the samples maintained at high temperature which is due to non enzymatic reaction. Slow colour degradation occurs in the samples maintained at low temperature (5ºC) also. Similar results have been reported by Ahmed et al., 2004. It was found that the browning of ginger paste is due to fructose, asparagines and ascorbic acid[14]. Colour is an important aspect because the consumer observes the colour before purchasing a spice paste. Also, loss of pigment is an important concern to the processor[15]. The Hunter color *L*, a** and *b** values of fresh ginger paste were 64.3, 4.13 and 30.6 respectively. Effect of storage temperature on the Hunter *a** value is shown in the Fig. 3. On 60th storage day *a** value of ginger paste was found to decrease significantly with increase in temperature. Similar results have been observed by Ahmed et al., 2001. In 0th day, FFA value of the ginger paste was constant for all samples maintained at different temperatures. But in later days, FFA was found to increase from 9.65 to 9.85±0.025, 11.16±0.152, 12.8±0.1, and 17.33±0.060 for the samples maintained at 5ºC, 30ºC, 40ºC and

50ºC respectively due to lipase action which leads to increase in free fatty acids. Lipase activity does not affect the rancidity of the food products[17]. In the microbial analysis, highest microbes (<18) were observed in ginger paste maintained at 30ºC. The microbes were quickly contaminated by air and produce high amount of molds and yeast in the paste. It was observed that the oxidation reaction occurs slowly during the storage period. Similar result has been reported by Jensen et al., 2011. The level of microbes was constantly found >6 in 5ºC, 8 to 18 cfu/g in 30ºC maintained samples, may be due to oxidation which precedes the rate of peroxide decomposition. But for the samples maintained at 40ºC and 50ºC the level of microbes increases from 4 to 16 cfu/g and 5 to 12 cfu/g, because the formation is higher than decomposition. The sensory analysis (30 panellists) found that the ginger paste stored at 5ºC paste was having colour, flavour and aroma similar to fresh ginger paste even after 60 days of storage.

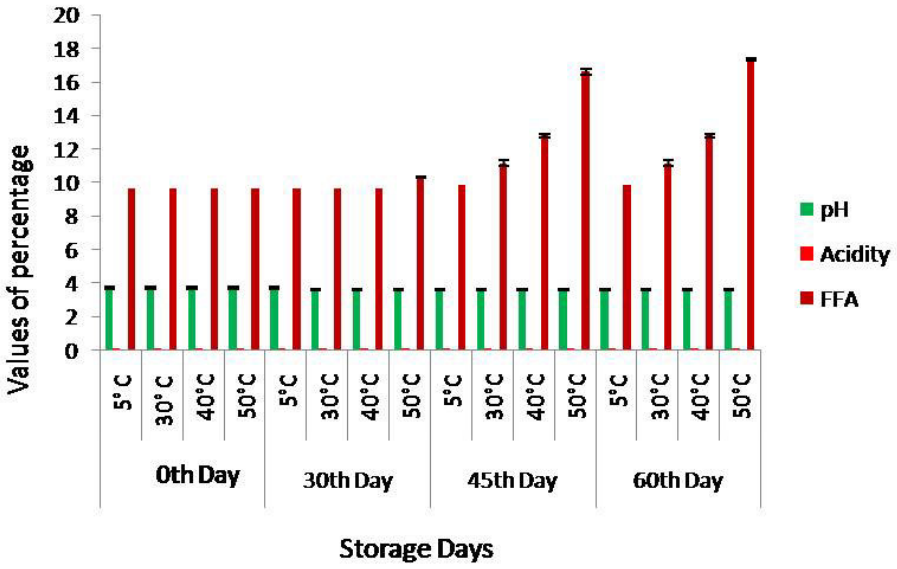

Figure 1
Physico-chemical analysis of Zingiber officinale paste

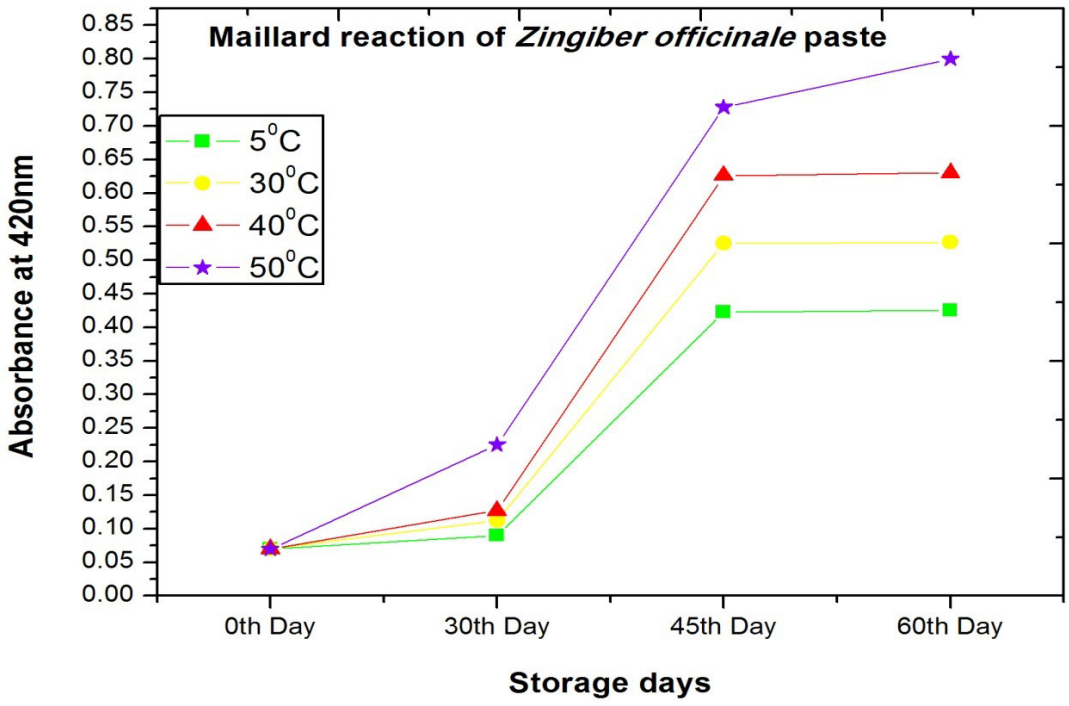

Figure 2
Maillard reaction of Zingiber officinale paste

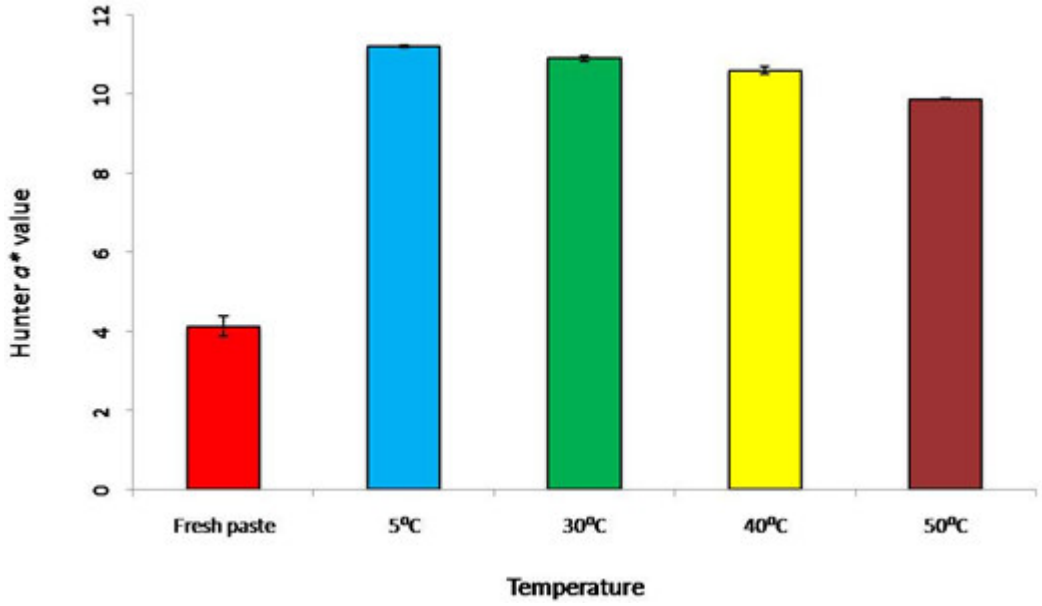

Figure 3
Effects of storage temperature on the Hunter a*value

CONCLUSION

Ginger paste was prepared and maintained at four different temperatures 5ºC, 30ºC, 40ºC and 50ºC for 60 days. The shelf life studies the maximum greening was observed when the paste was stored at 5ºC and sensory analysis revealed that colour, flavour and aroma are maintained even after sixty days. The sample maintained at 5ºC was microbiologically safe even after sixty days.

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