International Journal of Advanced Science and Technology
Vol. 29, No. 08, (2020), pp. 2069 – 2075

Effect of Preservatives Addition on the Shelf-Life Extension of Food Samples Using Reflectance Spectroscopy

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Abstract

Extension of shelf-life of products such as bread and meat are needed to prevent economic loss. This leads to the addition of preservatives on these food items. The present study is based on the determination of added preservatives on the sandwich bread and the meat which is available in the supermarkets that may be done to extend the shelf-life. The objective of the study is to investigate the preservatives added to extend the shelf life of bread and meat. We have used reflectance spectroscopy technique to investigate and understand thepreservatives used in the bread and meat. This is performed by recording the reflectance spectrum of two different bread samples namely bakery bread and sandwich bread at different positions for a period of 3 days. The peak of all the spectrum for three days was compared to determine the presence of preservative. The same procedure was then repeated for the meat sample and the spectral data for both fresh meat and frozen meat were obtained and analyzed to detect the presence of preservatives. The results show that there is a significant change in the spectrum between the two samples with added preservatives to extend shelf life.

Keywords- Reflectance Spectroscopy, preservatives, spectrum, bakery bread

Introduction

Bread is one of the most important food used across the world.The consumption of bread is increasing day by day because of the busy lifestyle of the people. People prefer to consume bread as it saves time. Since bread has high moisture content, it gets stale easily which leads to huge economic loss. Therefore, preservatives such as Calcium propionate, Emulsifiers and Enzymes are addedto increase the shelf life of the bread. Preservatives such as nitrates are added in meat products to increase their shelf life. But this has harmful effect on human health. Its side effect may be in the form of weakness, allergies, headache, sweating etc. Therefore, a method must be established to detect these preservatives. This paper deals with the investigation of preservatives in white bread sample and frozen meat.

Materials and methods

Sample Collection

Bread-Two different types of bread samples were collected. One from the normal bakery shop which does not have any preservative and the other is sandwich bread which has some added preservatives.

Meat- Two different meat samples were collected. One is fresh, which was freshly cut from the butcher shop and the other was frozen meat sample which was collected from the supermarket. Both types of meat were cut into three parts, each with different thickness i.e., 0.5cm, 1cm and 1.5cm.

UV-Vis Spectrometer- Spectra measurement

A UV-Vis spectrometer (Ocean Optics STS-VIS spectrometer) was used to record the spectrum. Its wavelength range is 338-822 nm. The light source used is Halogen lamp (HL-2000). Spectra suite software was used to measure the spectrum and record the data values.

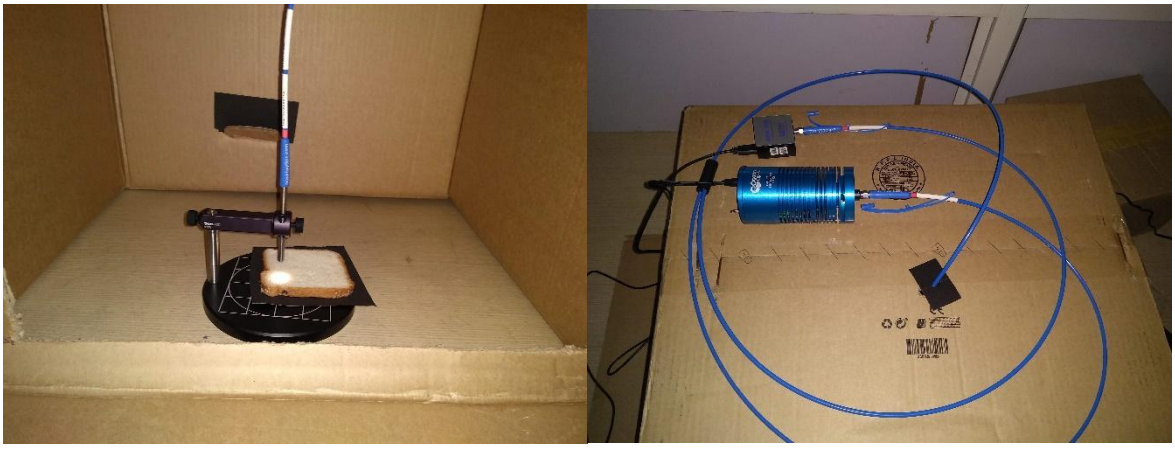

Fig 1: Taking readings of bread sample using Ocean Optics STS-VIS spectrometer.

Procedure

The setup for performing the experiment was made and the black and white spectrum were recorded. Then the bread sample was placed under the light source and spectrum was obtained and value were recorded at five different positions. This experiment was performed inside a dark room to reduce the impact of outside light. This procedure was repeated for three days and all the intensity values were recorded. Then the experiment was performed for meat sample. The readings were taken ina gap of 2 hours and all the intensity values were recorded.

Results

Reflectance spectroscopy was employed to determine the staling of bread and meat. The data obtained from the software spectra suite was plotted in sigma plot software. The spectrum obtained was used to determine the staling of preservative and non-preservative bread. Similar procedure was followed for the meat sample.

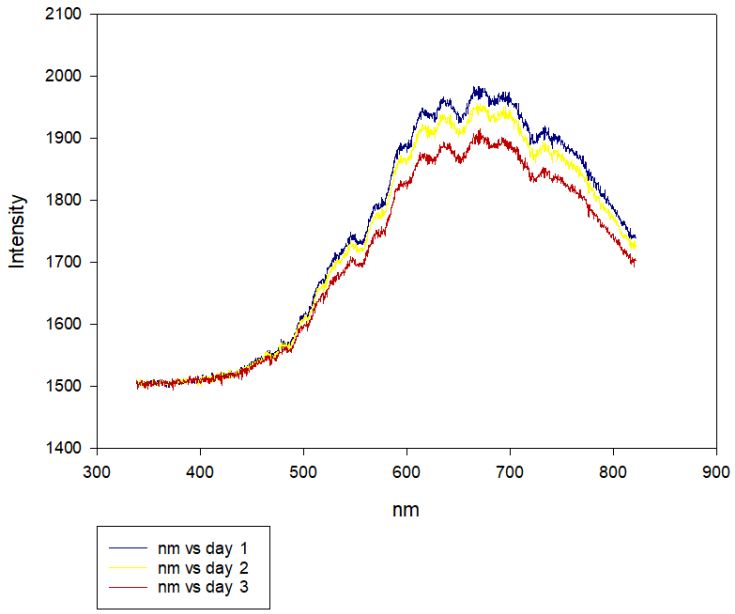

Fig 2: spectrum of non-preservative bread for continuous three days.

It is clear from the fig. 1 that on day 1, the intensity of highest peak is highest. As the time elapses, the intensity of highest peak decreases. This is because of the mould growth on the non-preservative bread which absorb more light falling through them. As a result, the intensity of reflected light decreases. As the time passes, more and more mould starts to grow and the graph further moves downward.

SAMPLE	PEAK WAVELENGTH	INTENSITY
Day 1	670	1973
Day 2	670	1950
Day 3	670	1905

Table 1: Non preservative bread data for continuous three days.

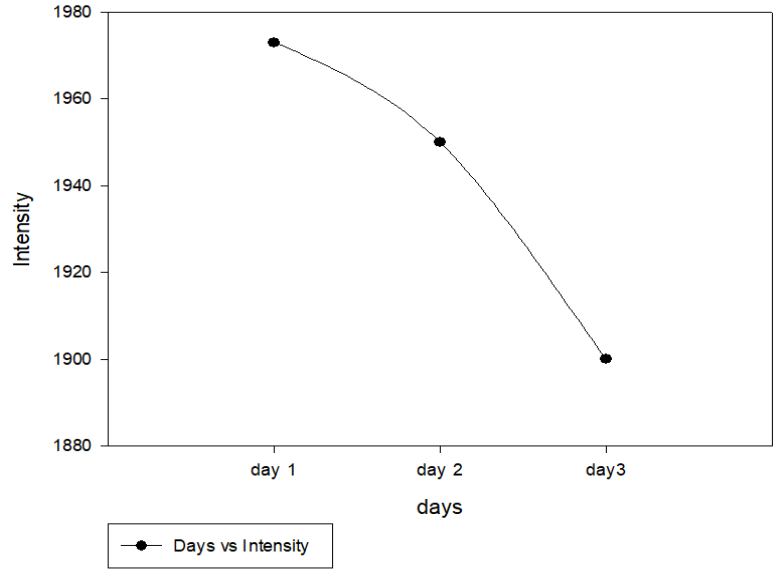

Fig 3: Non-preservative bread at 670nm.

ISSN: 2005-4238 IJAST

Theabove figure shows the intensity of highest peak at 670nm taken on successive three days. As the time passes, the graph moves downward.

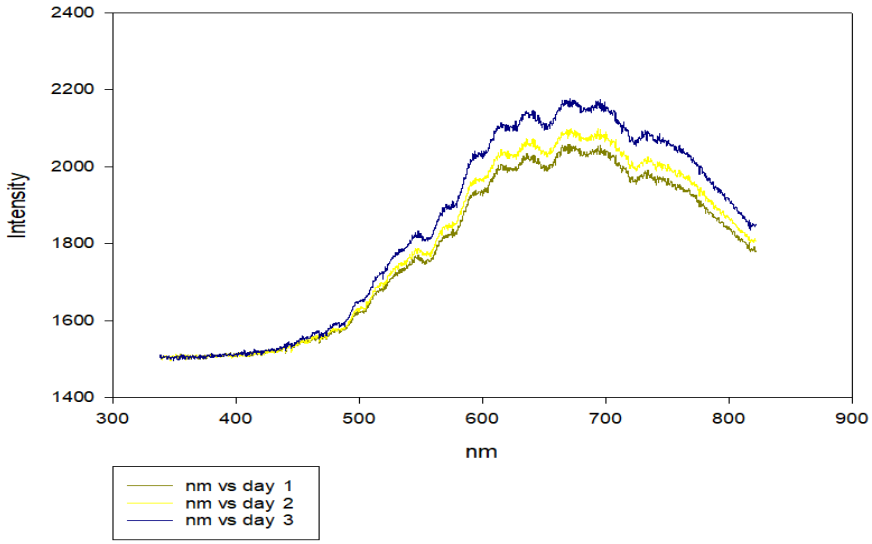

Fig 4: Spectrum of preservative bread for continuous three days.

The above figure shows that on day 1, the intensity of highest peak is lowest. As the time passes, the graph moves upward. This is because of the added preservatives which prevent mould growth. In addition, when theday passes, the bread becomes dry. This increased the whiteness of the bread and hence the intensity of reflected light increases.

SAMPLE	PEAK WAVELENGTH	INTENSITY
Day 1	670	2041
Day 2	670	2082
Day3	670	2166

Table 2: Preservative bread data for continues three days.

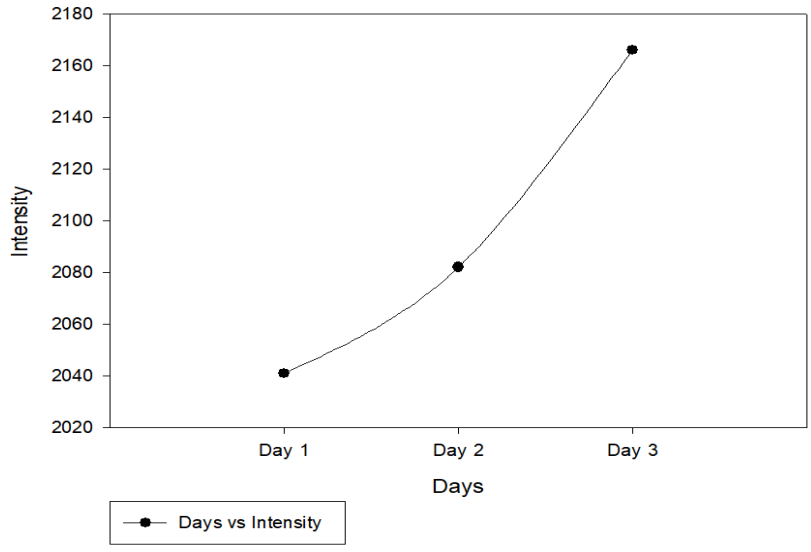

Fig 5: Preservative bread at 670nm.

The above figure shows the intensity of highest peak at 670nm. As the time passes, the intensity of highest peak increases.

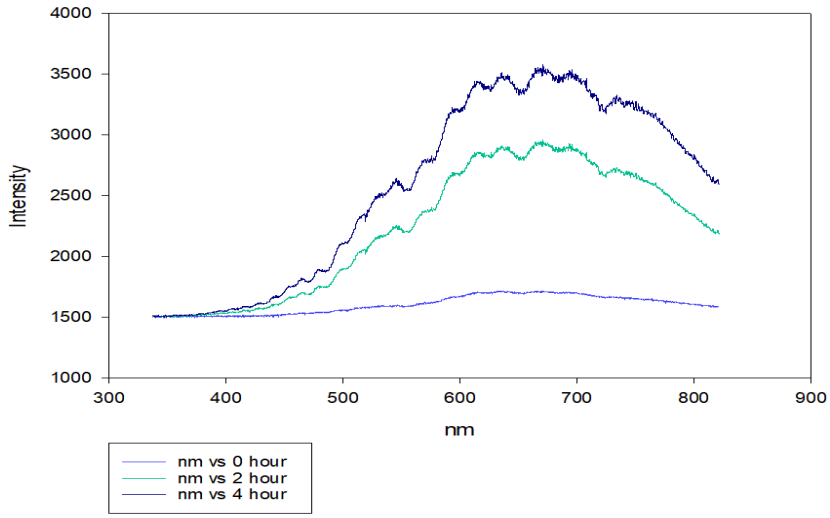

Fig 6: Spectrum of fresh Chicken breast.

Wavelength is taken along x-axis and the intensity of reflected light is taken along y-axis. It is clear from the fig.5 that at 0^{th} hour, the intensity at highest peak is lowest. As the time elapses, the graph moves upward. This is because of the pigment known as myoglobin which is responsible for the color of the meat. As the time elapses, myoglobin reacts with oxygen present in the atmosphere to form a compound known as oxymyoglobin which is responsible for the redness of the meat. As a result, the intensity of reflected light increases.

SAMPLE	PEAK WAVELENGTH	INTENSITY
0 hour	670	1706
2 hours	670	2913
6 hours	670	3501

Table 3: Fresh meat data for 0, 2& 6 hours.

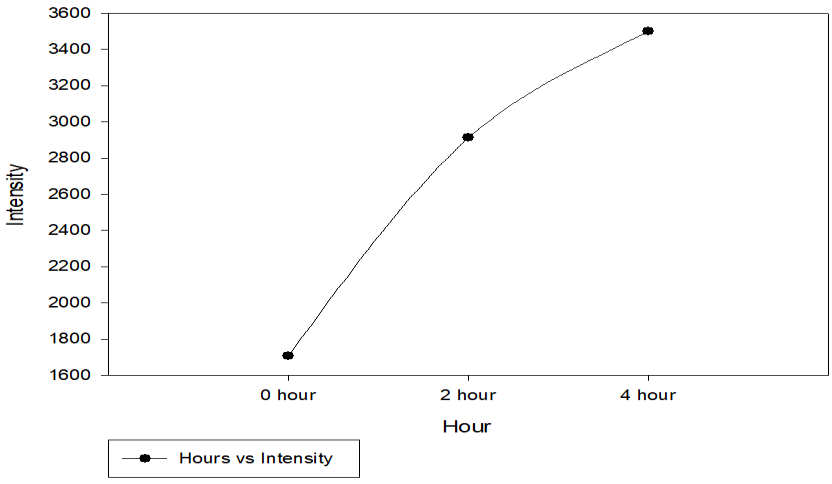

Fig 7: Fresh Chicken at 670nm.

Figure 7 shows the intensity of highest peak at 670nm. As the time elapses, the intensity of highest peak increases.

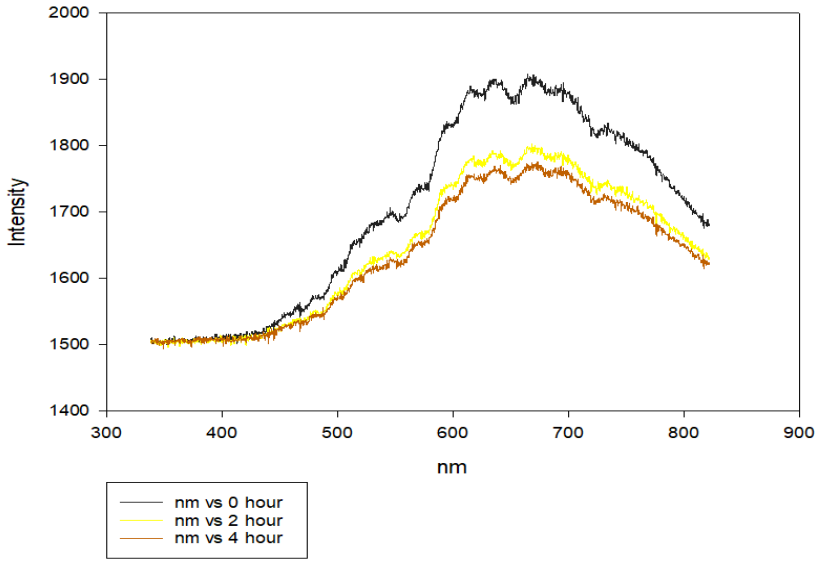

Fig 8: Spectrum of frozen chicken breast.

Wavelength is taken along x-axis and the intensity of reflected light is taken along y-axis. It is clear from the fig. 4 that at 0^{th} hour, the intensity at highest peak is highest. As the time elapses, the graph moves downward. This is because of the preservative present in the meat which prevents the oxygen to react with myoglobin.

SAMPLE	PEAK WAVELENGTH	INTENSITY
0 hour	670	1893
2 hours	670	1795
6 hours	670	1767

Table 4: Frozen meat data at 0,2& 6 hours.

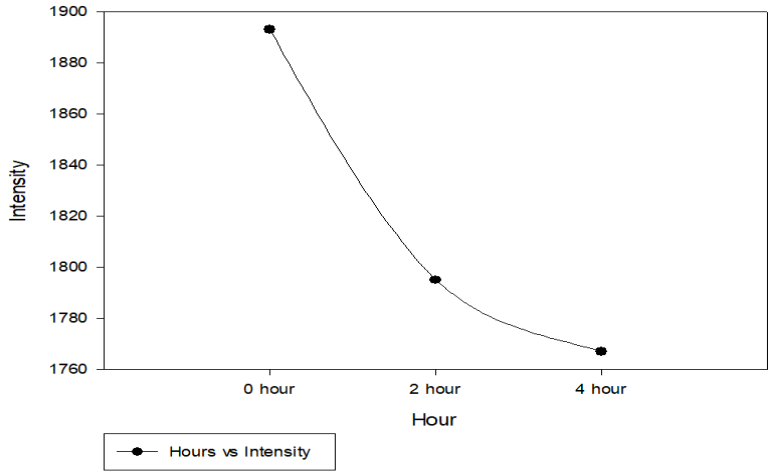

Fig 9: Frozen Chicken at 670nm.

The above figure shows the intensity of highest peak at 670nm at different time intervals. As the time passes, the intensity of reflected light decreases.

Conclusion

This study has analyzed that the addition of preservatives in food items, biological cycle of that food changes or slows down. As a result, the shelf life of the product increases due to the preservatives. But this has some impact on the amount of light reflected or absorbed by the sample.

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