



Proximate Composition of Coated Tomato During Storage

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ABSTRACT

Postharvest loss is one of the major problems militating against all year access to tomato. This study investigated the proximate composition of tomato coated with gelatin, carboxyl methyl cellulose, honey and alkalinized starch, with uncoated tomatoes serving as control. Moisture content, crude protein, ash, crude fat, crude fibre and carbohydrates were determined during storage of tomato at room temperature. Results showed that the control tomato sample kept for 60 days and the moisture content, crude protein, crude fat, ash, and carbohydrates were 94.56, 0.21, 0.04, 0.15 and 4.98%, respectively. The results also showed that tomato coated with gelatine kept till 69 days and the moisture content, crude protein, crude fat, ash and carbohydrates were 91.89, 0.25, 0.07, 0.13 and 7.53%, respectively. The results further showed that tomato coated with carboxyl methyl cellulose kept for 75 days and the moisture content, crude protein, crude fat, ash and carbohydrates were 91.83, 0.12, 0.05, 0.09 and 7.74%, respectively. Results showed that tomato coated with honey kept for 90 days and the moisture content, crude protein, crude fat, ash and carbohydrates were 89.50, 0.10, 0.05, 0.06 and 10.08%, respectively. Results however showed that tomato coated with alkalinized starch kept for 90 days and the moisture content, crude protein, crude fat, ash and carbohydrates were 89.35, 0.17, 0.05, 0.07 and 10.11%, respectively. The study showed that both honey and alkalinized starch were able to preserve retain appreciable amount of nutrients in tomato for additional 30 days.

Keywords: Alkalinized starch, carboxyl methyl cellulose, gelatine, honey, tomato.

INTRODUCTION

The increasing rate of postharvest loss in foods has elicited interest and research activity in edible packaging which is motivated by both increasing consumer demand for safe, convenient, and stable foods and also awareness of the negative environmental impacts of non-biodegradable packaging waste. Although the terms edible films and edible coatings are sometimes referred to as synonyms, there is a difference in that films are preformed separately and then applied to food surface or sealed into edible pouches, whereas coatings are formed directly onto food surfaces [1], hence the use of natural polymer-based film materials and coatings in packaging for food industry, which protect food from external contamination, retarding its deterioration by extending its shelf-life and maintaining its quality and safety [2]. In addition to consumer requirements and in order to substitute petroleum-based plastic packaging, a wide variety of biopolymers that come from agro-food industrial wastes and renewable low cost natural resources [3]. The largest parts of materials used in packaging industry are produced from fossil fuels and are un-degradable, for this reason packaging materials represent a serious global environmental problem [4]. A big effort to extend the shelf life and enhance food quality while reducing packaging waste has encouraged the exploration of new bio-based packaging materials, such as edible and biodegradable films from renewable resources [5]. The use of these materials, due to their biodegradable nature, could at least to some extent solve the problem of waste [6]. Tomato (*Solanum lycopersicum*) is a universally known, widely consumable nutritious and widely grown vegetable in the world. Tomato is a delicate fruit which suffers 40 - 60% of postharvest losses [7]. Reduction in postharvest losses could bring down the unit cost of production. Many techniques such as low temperature, high relative humidity control, controlled and modified atmosphere packaging have been studied in order to overcome these problems and to extend the shelf life of tomatoes [8]. The objective of the present research therefore was to study the effect of coating materials on the proximate composition of tomato during storage.

MATERIALS AND METHODS

Materials

Matured cassava (TME 419) was obtained from the International Institute of Tropical Agriculture (IITA), Ibadan, while gelatin and carboxyl methyl cellulose (CMC) were obtained from Pascal Chemicals, Akure. Honey was obtained from Obafemi Awolowo University Teaching Hospital Complex, Ife. Tomato fruit (EVA F1) was obtained from the Federal University of Technology Agricultural Teaching Farm, Akure, Nigeria.

Production of Starch

Cassava starch was produced by using the method described by the International Institute of Tropical Agriculture, 2004 [9]. The fresh cassava tubers were manually peeled, washed with tap water and wet milled by a hammer mill. The mash obtained was solubilised with distilled water and filtered by a muslin cloth. The filtrate was allowed to settle (3 h) and the supernatant decanted, while the starch was dewatered by squeezing in the muslin cloth and dried separately in a vacuum oven at 40 °C to a constant weight for 8 h. The dried starch was milled using a double disc attrition mill and sieved. The starch product was packaged in an air tight polyethylene bag placed in plastic containers and stored at room temperature for further use.

Production of Alkalinized Cassava Starch

Alkalinized cassava starch was produced by the modification of cassava starch using aliquots of 0.1M NaOH (0.5w/v) and dried at 62 °C for 8h. The modified cassava starch was milled, sieved and packed into polyethylene films prior for further use.

Coating of Tomato

Tomato fruit was rinsed with distilled water and kept at ambient temperature. Alkalinized starch and Gelatin coat was prepared by dissolving 20g of alkalinized starch and gelatin respectively in 100ml distilled water while 10g of CMC was dissolved in 500ml of distilled water. 100% honey was used. These solutions were completely mixed using a spatula until a homogenized solution was formed. Tomato was aseptically dipped into the different prepared coating solutions for 5min. Five (5) different tomato samples were gotten and used for further analysis, they include:

- (i) Uncoated Tomatoes and stored at room temperature serves as control;
- (ii) Tomato coated with gelatine and stored at room temperature;
- (iii) Tomato coated with Carboxyl methyl cellulose and stored at room temperature;
- (iv) Tomatoe coated with Alkalinized starch and stored at room temperature; and
- (v) Tomato coated with honey and stored at room temperature.

Analyses of the Coated Tomato Samples

The proximate composition analyses were carried out according to the methods described by AOAC, 2005 [10].

Statistical Analysis

The data obtained from the experiment were in triplicates and subjected to completely randomize experimental design and statistical analysis using Microsoft excel version 2010, SPSS version 20 and Mini Tab version 17.

RESULTS AND DISCUSSION

Effect of Coating Materials on the Proximate Composition of Tomato during Storage

The results of the effects of different coating materials on the moisture content of the tomato samples for 90 days are shown in Figure 3.1. Results showed that the Control sample significantly decreased in moisture content from 94.12 to 91.80%, from day 0 to day 24 respectively; however a significant increase in moisture content was observed from 92.15 to 94.56%, from day 27 to day 60 respectively. Control sample was however observed to have been spoilt at day 63. Results also showed that tomato coated with honey significantly decreased in moisture content from 94.12 to 89.38%, from day 0 to day 75 respectively, a significant increase in moisture content was however observed from 89.41 to 89.50% from day 78 to day 90. Results of the tomato coated with carboxyl methyl cellulose (CMC) showed a significant decrease in moisture content from 94.12 to 91.25% from day 0 to day 51, a significant increase in moisture content was observed from 91.34 to 91.83% from day 54 to day 75. Tomato coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78. Tomato coated with gelatin showed a significant decrease in moisture content from 94.12 to 91.02% from day 0 to day 42, a significant increase in moisture content was observed from 91.18 to 91.89% from day 45 to day 69; tomato coated with gelatin was observed to have been spoilt at day 72. Results of the tomato coated with alkalinized starch showed an initial

decrease in moisture content from 94.12 to 91.46% from day 0 to day 9, a significant increase of 91.79% was observed at day 12, however a significant decrease was observed from 91.70 to 89.30% from day 12 to day 87.

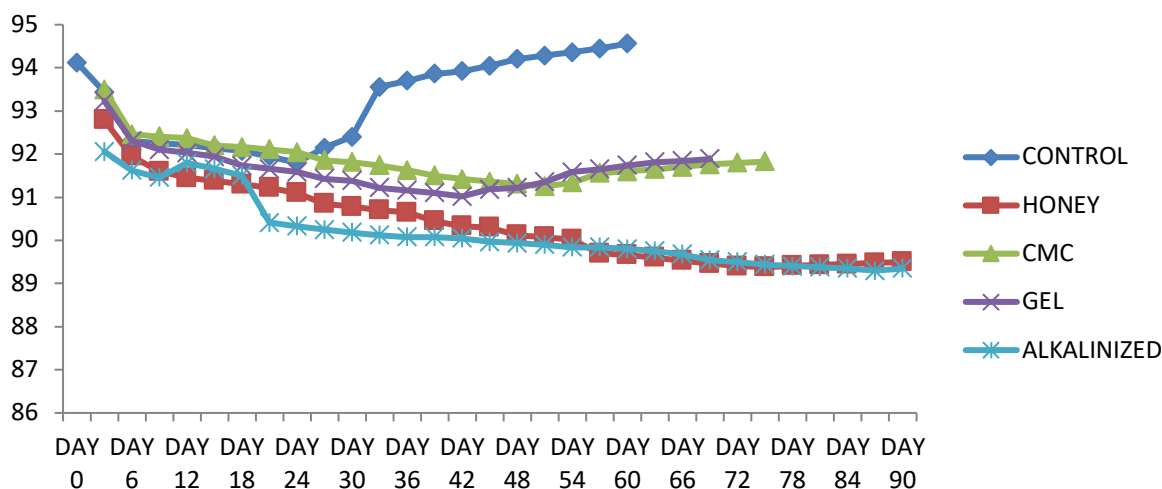


Figure 3.1: Effect of coating materials on the moisture content (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalinized starch and stored at room temperature

The moisture content however significantly increased at day 90. The significant decrease observed in the moisture content at the initial stage of storage could be due to the potency of the coating materials which has the capacity to adsorbed the water molecule from the tomato and transpiration which is the process of water movement through a plant and its evaporation from aerial parts, however the later increase in moisture content could be observed as the time at which the potency of the coating materials began to deplete which allows the infiltration of moisture content from the environment by osmotic process. This pattern of changes in Moisture content corresponds with the report by OECD, 2008 [11] on green and ripened tomato.

The results of the effects of different coating materials on the crude protein of the tomato samples for 90 days are shown in Figure 3.2. Results showed that Control sample significantly decreased in crude protein from 0.80 to 0.21% from day 0 to day 60, respectively; however control sample was however observed to have been spoilt at day 63. Tomato coated with honey showed a significant decrease in crude protein from 0.80 to 0.10% from day 0 to day 90, respectively; results of the tomato coated with carboxyl methyl cellulose (CMC) showed a significant decrease in crude protein form 0.80 to 0.12% from day 0 to day 75, respectively; tomato coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78. Tomato coated with gelatin showed a significant decrease in crude protein from 0.80 to 0.25% from day 0 to day 69, respectively; tomato coated with gelatin was observed to have

been spoilt at day 72. Results of the tomato coated with alkalinized starch showed a significant decrease in crude protein from 0.80 to 0.17% from day 0 to day 90, respectively. The results showed that alkalinized starch showed the highest potency in term of the ability to retain and preserve the crude protein for longer period of time. Though gelatin was observed to retain and preserve the crude protein in tomato than carboxyl methyl cellulose, however tomato coated with gelatin was observed to have a shorter shelf life than carboxyl methyl cellulose. Report of the study investigated by Min and Krocha, 2005 [12] showed a correlation with the values obtained in this study. The results of the effects of different coating materials on the crude fat of the tomato samples for 90 days are shown in Figure 3.3. Results showed that control tomato sample significantly decreased in crude fat from 0.50 to 0.04% from day 0 to day 60, respectively; however Control sample was however observed to have been spoilt at day 63. Tomato coated with honey showed no significant difference of 0.50% in crude fat from day 0 to day 6, however a significant decrease was observed from 0.48 to 0.05% from day 9 to day 90, respectively; results of the tomato coated with carboxyl methyl cellulose showed a significant decrease in crude fat from 0.50 to 0.05% from day 0 to day 75, respectively; tomato coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78.

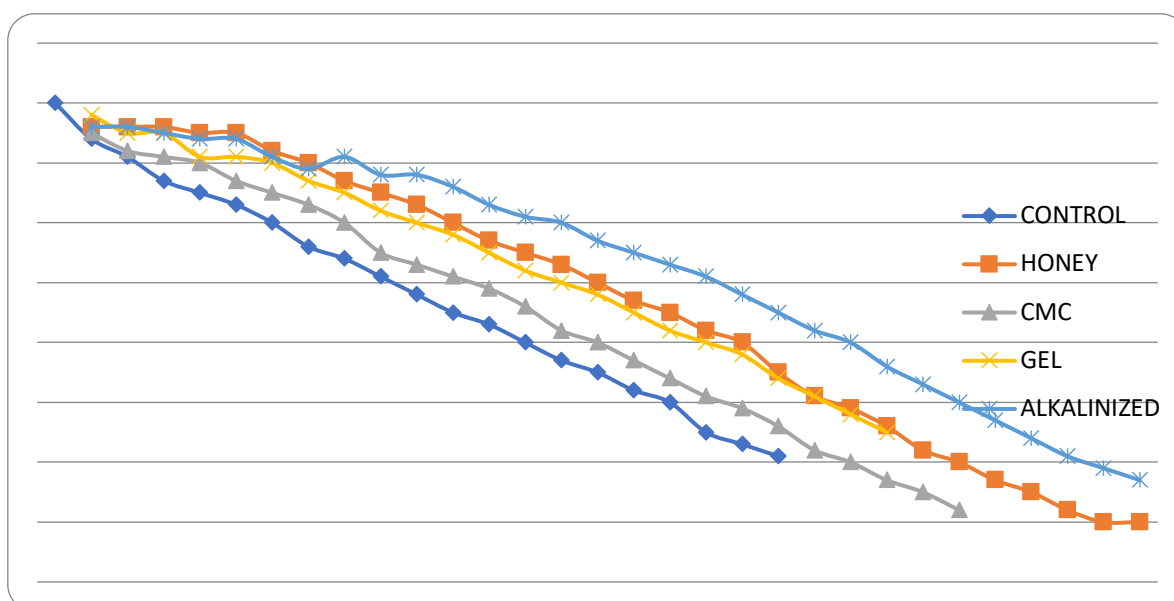


Figure 3.2: Effect of coating materials on the crude protein (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalinized starch and stored at room temperature

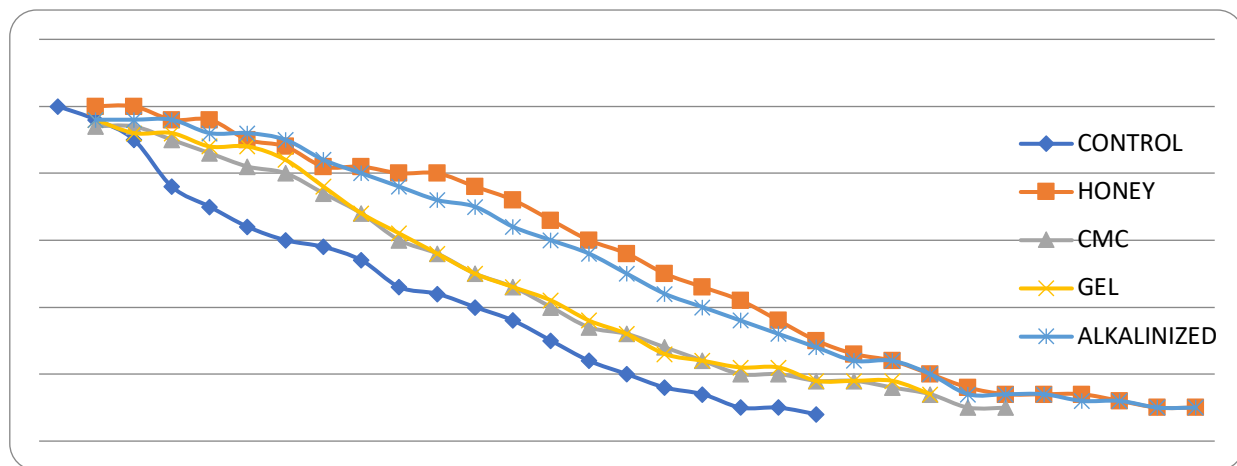


Figure 3.3: Effect of coating materials on the crude fat (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalinized starch and stored at room temperature

Tomato coated with gelatin showed a significant decrease in crude fat from 0.50 to 0.07% from day 0 to day 69, respectively; tomato coated with gelatin was observed to have been spoilt at day 72. Results of the tomato coated with alkalinized starch showed a significant decrease in crude fat from 0.50 to 0.05% from day 0 to day 90, respectively. The results showed that honey and alkalinized starch showed the highest potency in term of the ability to retain and preserve the crude fat for longer period of time. Though crude fat has the potential of causing rancidity, but significant decrease by coating materials was observed to reduce both oxidative and hydrolytic rancidity, however High intake of fatty acid has been shown to increase the level of cholesterol in the blood but can by replacing a large portion of it with high levels of unsaturated fats which is low in tomato [13].

The results of the effects of different coating materials on the ash content of the tomato samples for 90 days are shown in Figure 3.4. Results showed that Control sample significantly decreased in ash content from 0.72 to 0.15% from day 0 to day 60, respectively; however Control sample was however observed to have been spoilt at day 63. Tomato coated with honey showed a significant decrease in ash content from 0.72 to 0.06% from day 0 to day 90, respectively; results of the tomato coated with CMC showed a significant decrease in ash content from 0.72 to 0.09% from day 0 to day 75, respectively; tomato coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78. Tomato coated with gelatin showed a significant decrease in ash content from 0.72 to 0.13% from day 0 to day 69, respectively; tomato coated with gelatin was observed to have been spoilt at day 72. Results of the tomato coated with alkalinized starch showed a significant decrease in ash content from 0.72 to 0.07% from day 0 to day 90, respectively. The results showed that honey and alkalinized starch showed the highest potency in term of the ability to retain and preserve the ash content for longer period of time.

The results of the effects of different coating materials on the crude fibre of the tomato samples for 90 days are shown in Figure 3.5. Results showed that control tomato sample significantly decreased in crude fibre from 0.28 to 0.12% from day 0 to day 21, respectively; however a significant increase was observed in crude fibre from 0.15 to 0.26% from day 24 to day 36, respectively while a significant reduction was later observed from 0.24 to 0.06% from day 39 to day 60, respectively; control sample was observed to have been spoilt at day 63. Tomato coated with honey showed a significant decrease in crude fibre from 0.37 to 0.26% from day 3 to day 18,

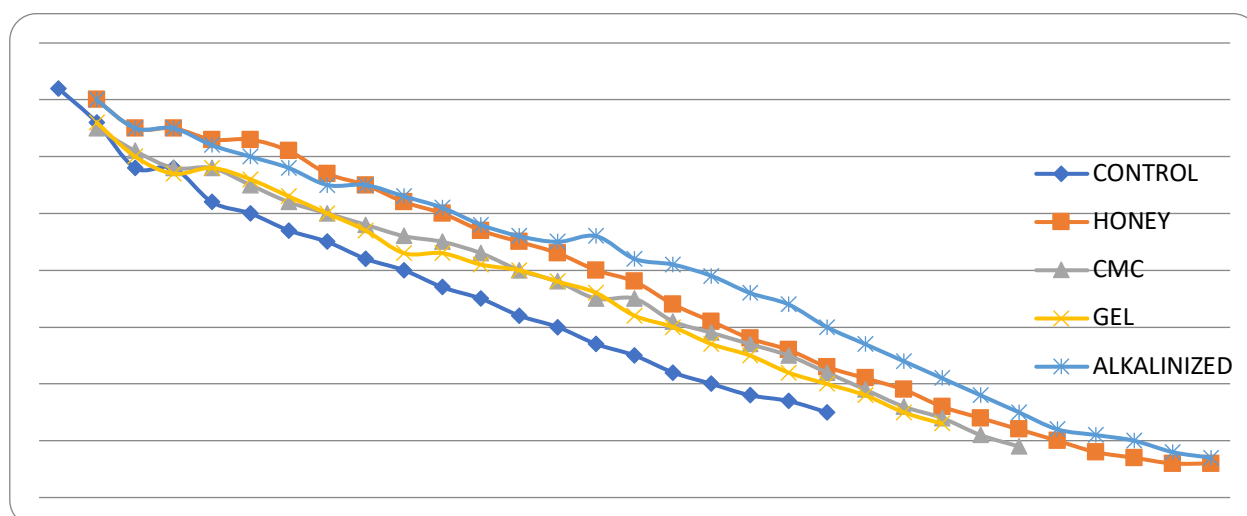


Figure 3.4: Effect of coating materials on the ash (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalized starch and stored at room temperature

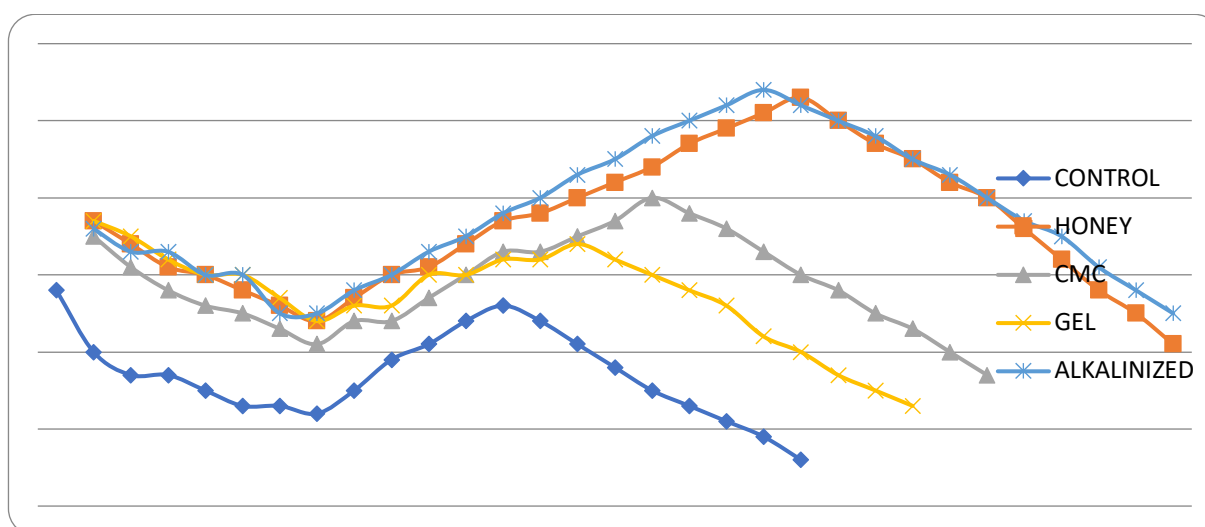


Figure 3.5: Effect of coating materials on the crude fibre (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalinized starch and stored at room temperature

Respectively, while a significant increase was observed from 0.24 to 0.50% from day 21 to day 60, however a significant reduction was later observed in crude fibre from 0.50 to 0.21% from day 63 to day 90. Results of the tomato coated with CMC showed a significant decrease in crude fibre from 0.35 to 0.24% from day 3 to day 27, respectively while a significant increase was observed from 0.27 to 0.40% from day 30 to day 48, a significant decrease was later observed from 0.38 to 0.17% from day 51 to day 75, respectively; tomato coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78. Tomato coated with gelatin showed a significant decrease in crude fibre from 0.37 to 0.24% from day 3 to day 21, respectively while a significant increase was observed from 0.26 to 0.34% from day 24 to day 42, respectively; a significant decrease was however observed from 0.32 to 0.13% from day 45 to day 69. Tomato coated with gelatin was observed to have been spoilt at day 72. Results of the tomato coated with alkalinized starch showed a significant decrease in crude fibre from 0.36 to 0.25% from day 3 to day 21, respectively while a significant increase was observed from 0.28 to 0.52% from day 24 to day 57, respectively; a significant decrease was observed at the later period of storage from day 60 to day 90.

The results of the effects of different coating materials on the carbohydrate content of the tomato samples for 90 days are shown in Figure 3.6. Results showed that control tomato sample significantly increase in carbohydrates from 3.59 to 6.82% from day 0 to day 24, respectively; however a significant decrease was observed in carbohydrates from 6.52 to 4.98% from day 27 to day 60, respectively; control sample was observed to have been spoilt at day 63. Tomato coated with honey showed a significant increase in carbohydrates from 3.59 to 10.08% from day 0 to day 90, respectively. Results of the tomato coated with carboxyl methyl cellulose showed a significant increase in carbohydrates from 3.59 to 7.74% from day 0 to day 75, respectively; tomato

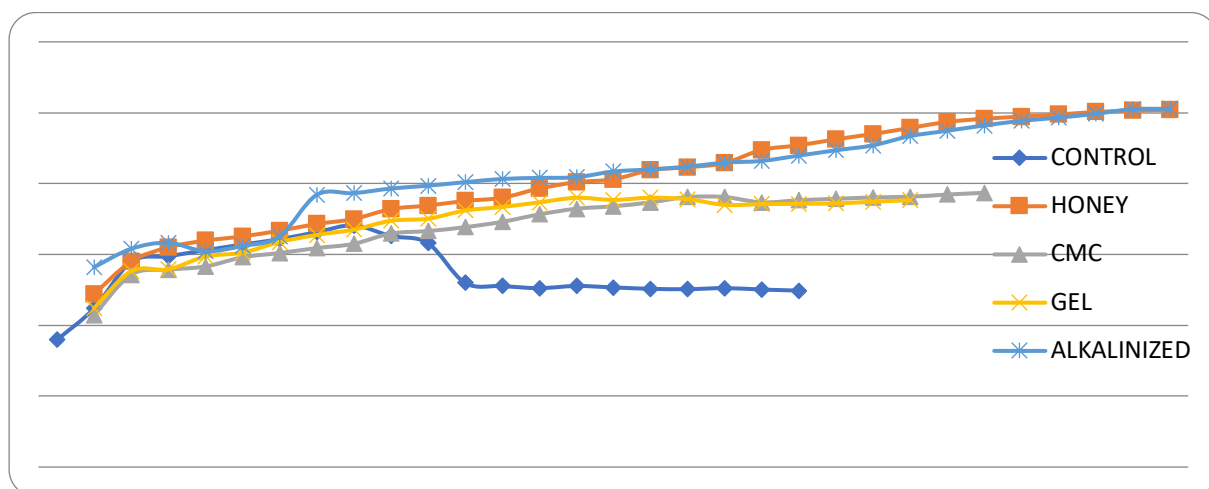


Figure 3.6: Effect of coating materials on the carbohydrates (%) during tomato storage

CONTROL: Uncoated Tomatoes and stored at room temperature serves as control

HONEY: Tomato coated with honey and stored at room temperature

CMC: Tomato coated with Carboxyl methyl cellulose and stored at room temperature

GEL: Tomato coated with gelatine and stored at room temperature

ALKALINIZED: Tomato coated with Alkalinized starch and stored at room temperature

coated with carboxyl methyl cellulose was however observed to have been spoilt at day 78. Tomato coated with gelatin showed a significant increase in carbohydrates from 3.59 to 7.60% from day 0 to day 48, respectively while a significant decrease was observed from 7.56 to 7.43% from day 51 to day 60, respectively; a significant increase was however observed from 7.44 to 7.53% from day 63 to day 69. Tomato coated with gelatin was observed to have been spoilt at day 72. Results of the tomato coated with alkalinized starch showed a significant increase in carbohydrates from 3.59 to 10.11% from day 0 to day 90, respectively. The value of carbohydrates obtained in the stored tomato samples fall within the range that Eke-Ejiofor, 2015) [14] reported.

CONCLUSION

The present study has unravelled the effect of coating materials on the proximate composition of tomato during storage. The study has shown that both alkalinized starch and honey exhibited highest potency in term of the ability to adsorb the water molecule from the tomato such that transpiration is prevented. Both coating materials were observed to also preserve and retain appreciable amounts of nutrients for additional 30days. .

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