Protecting Beef Meat from Lipid Oxidation Using the Power of Texan Honeys

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Abstract

This study evaluates the antimicrobial and antioxidant properties of two Texan honeys (23H-50 and 23H-76) and one Manuka honey (M-256) in preventing lipid oxidation in ground beef patties. The research investigates pH, moisture, phenolic, and flavonoid contents of the honeys, employing spectrometric assays and protocols outlined by the International Honey Commission. Ground beef patties, with varying treatments including honey and sodium tripolyphosphate (STPP), were cooked and stored, and lipid oxidation was assessed over a 14-day period via peroxide value and color changes. Results indicate that M-256 outperforms STPP in preventing lipid oxidation, while 23H-76 exhibits moderate inhibition. 23H-50 demonstrates comparable efficacy to STPP initially but declines by day 3. Texan honeys with high antioxidant properties and low pH, like 23H-50, show promise in lipid oxidation prevention. Further research is needed to understand the longevity of honey's preservation activity.

Introduction

- Meat spoilage: biochemical process driven by intrinsic and extrinsic factors.
- Intrinsic factors: moisture, pH, nutrient content, oxidative stress, inherent enzymes.
- Extrinsic factors: temperature fluctuations, inadequate storage, oxygen exposure.
- Sodium tripolyphosphate (STPP): chemical food preservative improving water retention, juiciness, tenderness, color preservation, and lipid oxidation prevention.
- Consumers are seeking natural alternatives to STPP due to health risks associated with consumption.
- In ancient Egypt honey was used to embalm bodies in the “process of mummification.”
- Honey as a natural preservative : organic acids, amino acids, enzymes, flavonoids, and phenolic acids which aids in the antimicrobial and antioxidant activities.
- Antimicrobial properties: phytochemicals, low pH and moisture help inhibit bacterial growth by creating an inhospitable environment.
- Antioxidant properties: flavonoids, phenolic acids aid in neutralizing free radicals and reactive oxygen species (ROS) during lipid oxidation.

Objective

1. To evaluate the antioxidant and antimicrobial properties of 2 Texans honeys and 1 Manuka honey in preventing lipid oxidation, by examining pH, moisture, phenolic, and flavonoid contents.
2. By incorporating honey into ground beef patties and examining lipid peroxidation via peroxide value and color changes over a 0-14 days period, this research seeks to provide valuable insights into the antimicrobial and antioxidant properties of Texan and Manuka honeys, and explore their meat preservation activity.

Materials and Methods

- **Honey Samples:** 2 Texan Honeys (23H-50 and 23H-76) was obtained from Bexar county according to the map below. 1 Manuka Honey (M-256) samples were obtained from the lab.
- **pH and Moisture**: pH levels and moisture content was determined according to International Honey Commission (IHC) guidelines.
- **Total Flavonoid Contents (TFC) and Total Phenolic Contents (TPC)** were measured via spectrometer assay
- **Meat sample Preparation**: Fresh ground beef from Alibaba International Market was portioned into five (100g) patties, one patty as blank (beef with no treatment). One patty with 0.05g STP (control), three patties with 10g of honey each (samples).
- Patties were cooked until 76.7℃ and Stored at 18℃.
- **Peroxide Value:** Iodometric Titration Method is used

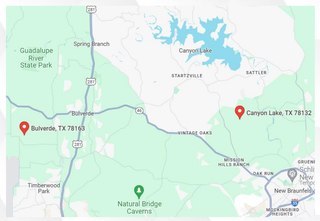


Figure 1. Location of Honey samples

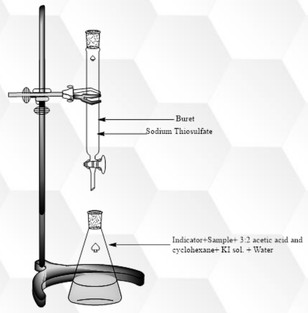


Figure 2. Iodometric Titration Setup

Results

Honey Sample	TPC	TFC	pH	Moisture %
23H-50	294.4	130.22	4.49	16
23H-76	137	77.26	4.58	16.5
M-256	162.8	71.487	3.64	19

Figure 3. Antioxidant and Antibacterial Properties of Honeys

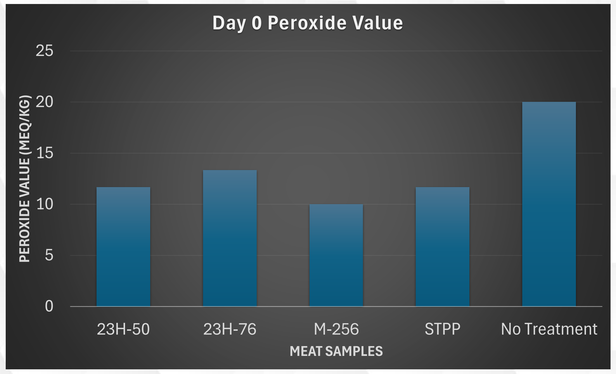


Figure 4 Peroxide Values of the Ground Beef Samples with Honey and STPP treatments at the first day of the experiment

Results

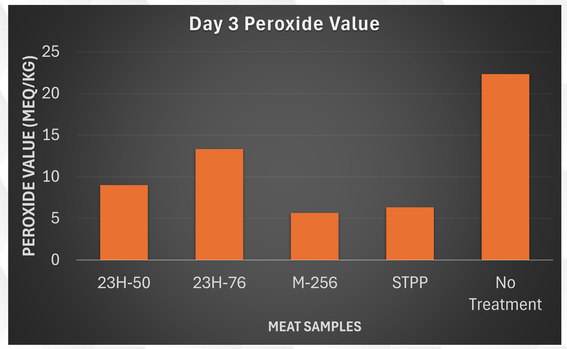
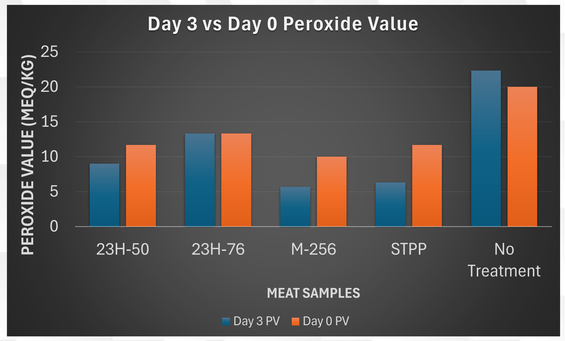


Figure 5. Peroxide Values of the Ground Beef Samples with Honey and STPP treatments after 3 days

Figure 6. Comparison of Peroxide Values of the Ground Beef Samples with Honey and STPP treatments at day 0 and day 3



Conclusions

- M-256 prevents lipid oxidation in beef better than STPP.
- 23H-76 does inhibit lipid oxidation but not as much as STPP.
- 23H-50 shows similar performance to STPP at day 0, but declines on day 3.
- Texan Honeys with high antioxidant properties and low pH (23H-50) can prevent lipid oxidation.
- Future studies like prevention of raw meat and treatment with different types of honeys.

References

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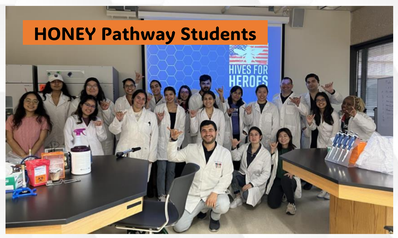
Acknowledgements



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