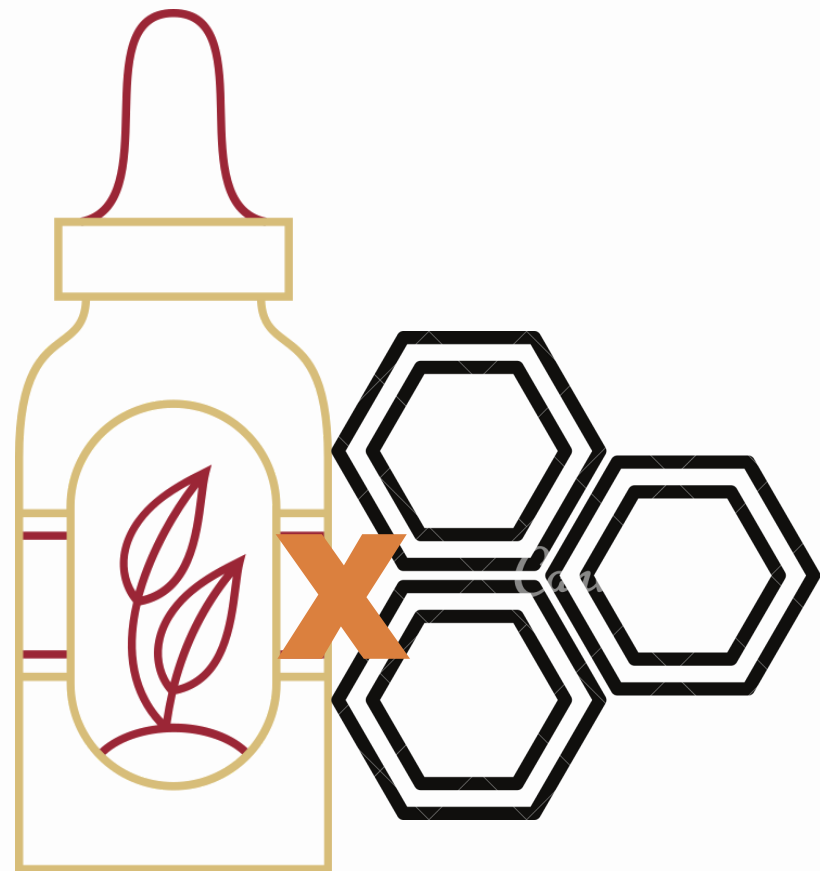




**BEESWAX AND CASTOR OIL TO
IMPROVE THE MOISTURE
BARRIER AND TENSILE
PROPERTIES OF PECTIN BASED
EDIBLE FILMS FOR FOOD
PACKAGING APPLICATIONS**

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INTRODUCTION

- **The global food packaging market size was valued at USD 362.9 billion in 2022 and is expected to expand at a compound annual growth rate (CAGR) of 5.7% from 2023 to 2030.**
- **The changing eating habits and the quickening pace of life have impacted the food packaging industry.**
- **Offers the benefit of stable shelf-life, and safety, which have boosted the industry's growth.**
- **Moreover, the shrinking household size, rising disposable income, and the increasing population are also expected to positively impact the food packing market growth.**

Contd.

- Smart packaging which monitor enviromental conditions will benefit the future generation.



METHOD

- Pectin based films with additives like bees wax, castor oil, and clove oil were developed.
- The experiment was done by 2^3 (two-level, three-factor) statistical design of experiments.
- Process Conditions:
 - pH:3
 - Relative humidity: 60%
 - Temperature: 40 C



DISCUSSION

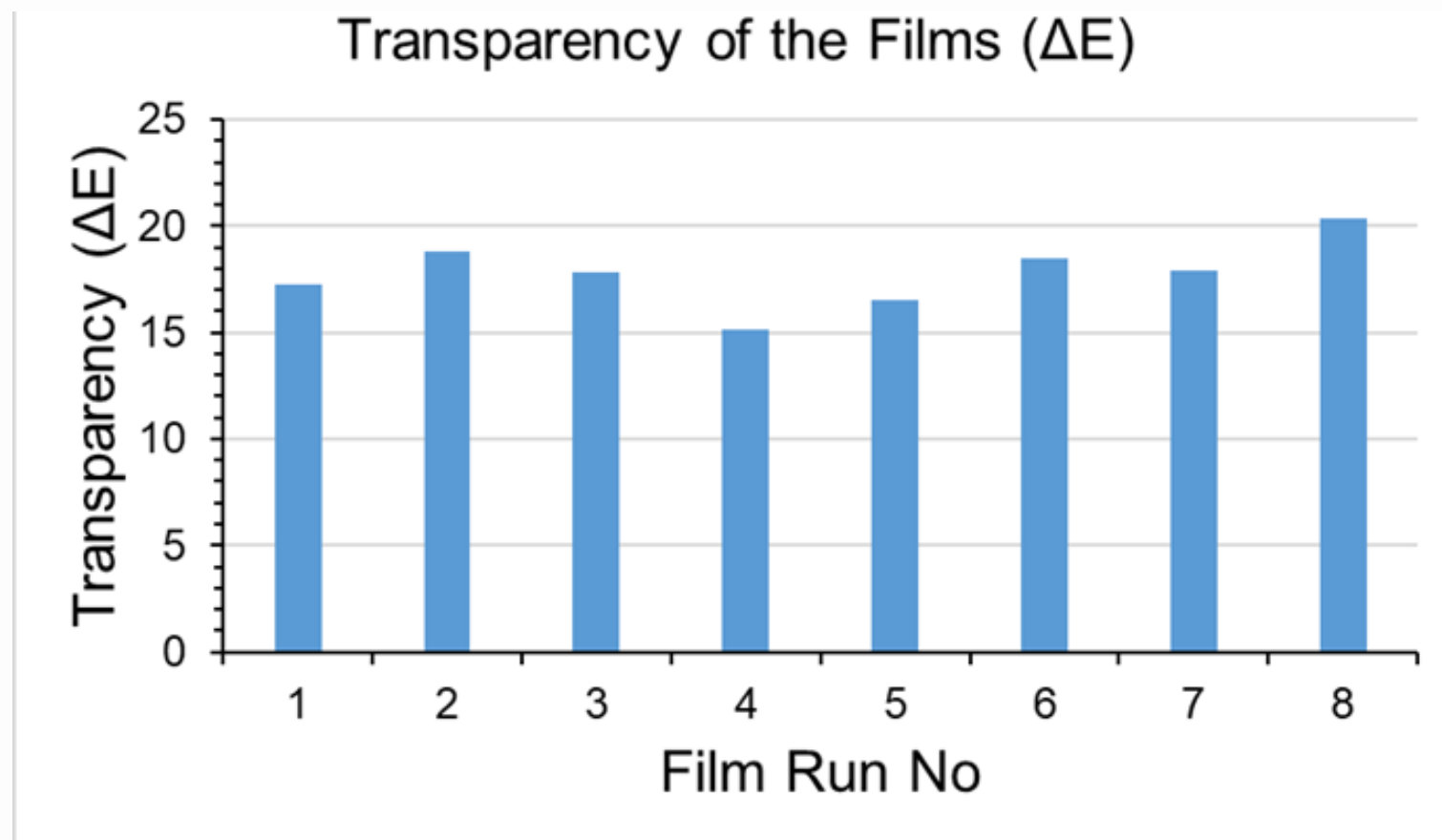
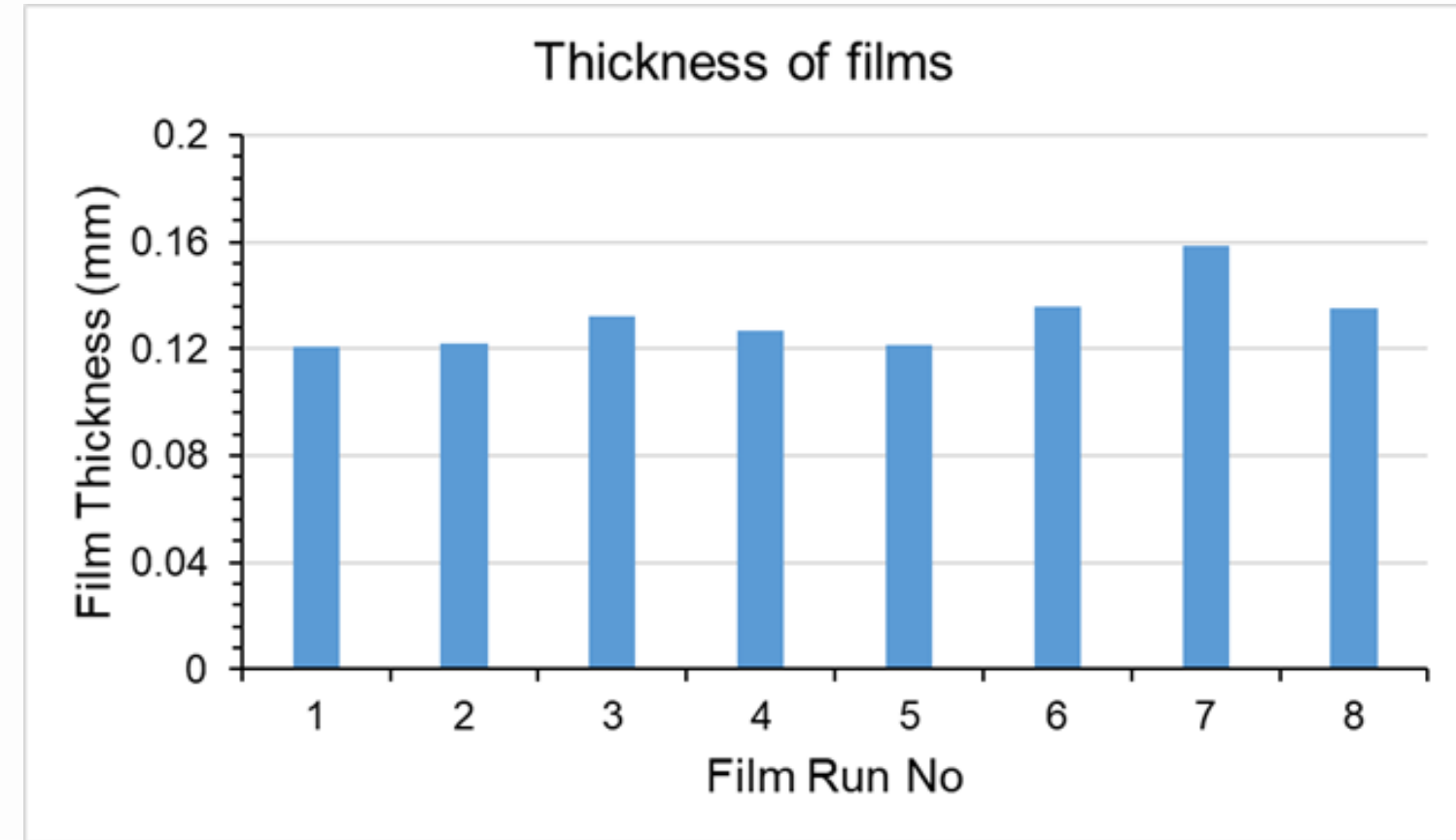
Run No	Castor Oil (% w/w of pectin)	Bees Wax (% w/w of pectin)	Clove Oil (% w/w of pectin)
1	5 (low)	5 (low)	2 (low)
2	15 (high)	5	2
3	5	10 (high)	2
4	15	10	2
5	5	5	4 (high)
6	15	5	4
7	5	10	4
8	15	10	4

Table 1: According to 2^3 statistical analysis

RESULTS

Thickness

We can be confirmed from Figure that the thickness of the films was in the range of 0.12 ± 0.004 – 0.15 ± 0.004 mm.



Transparency

The transparency parameter ΔE of the films was observed to be in the range of 15 ± 2 to 20 ± 2 . The ΔE values less than 50 usually referred to as transparent films. Therefore, the bees wax, castor oil and clove oil integrated pectin films developed in the present work are transparent.

RESULTS

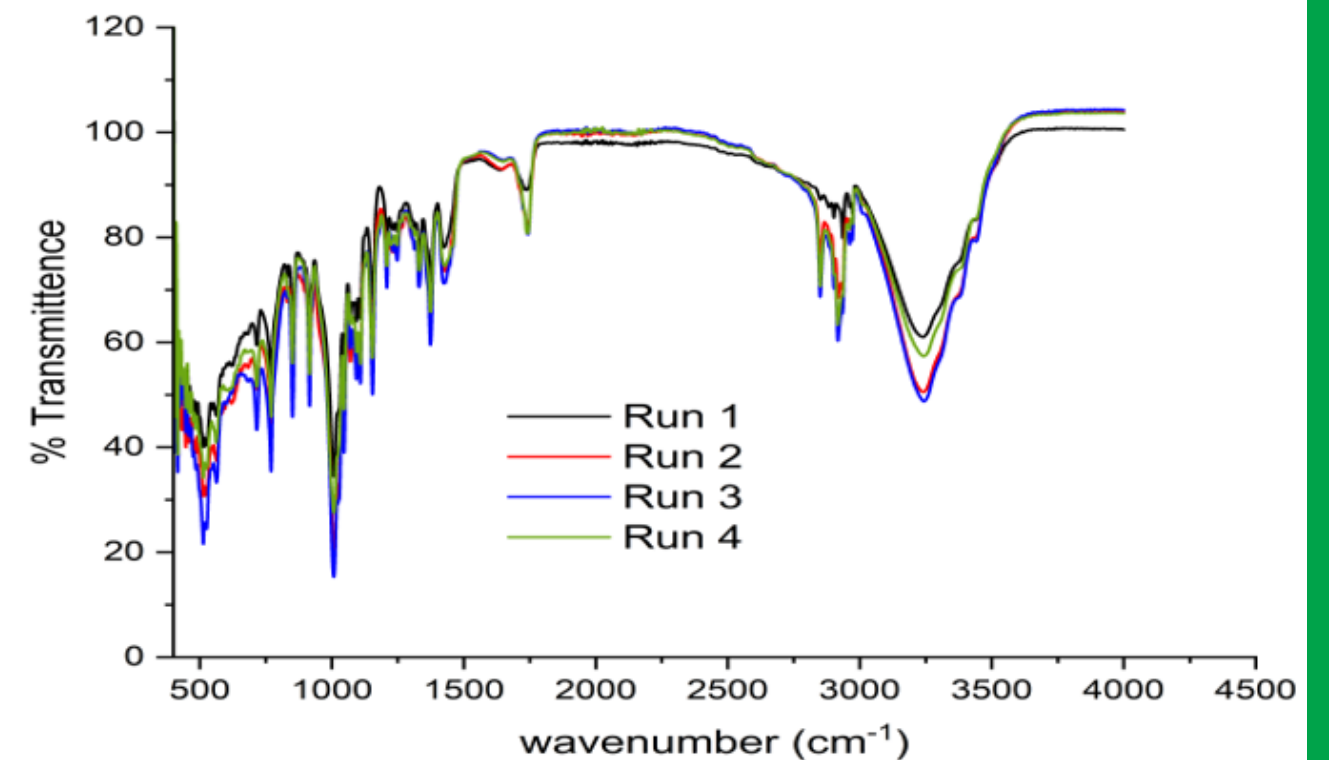
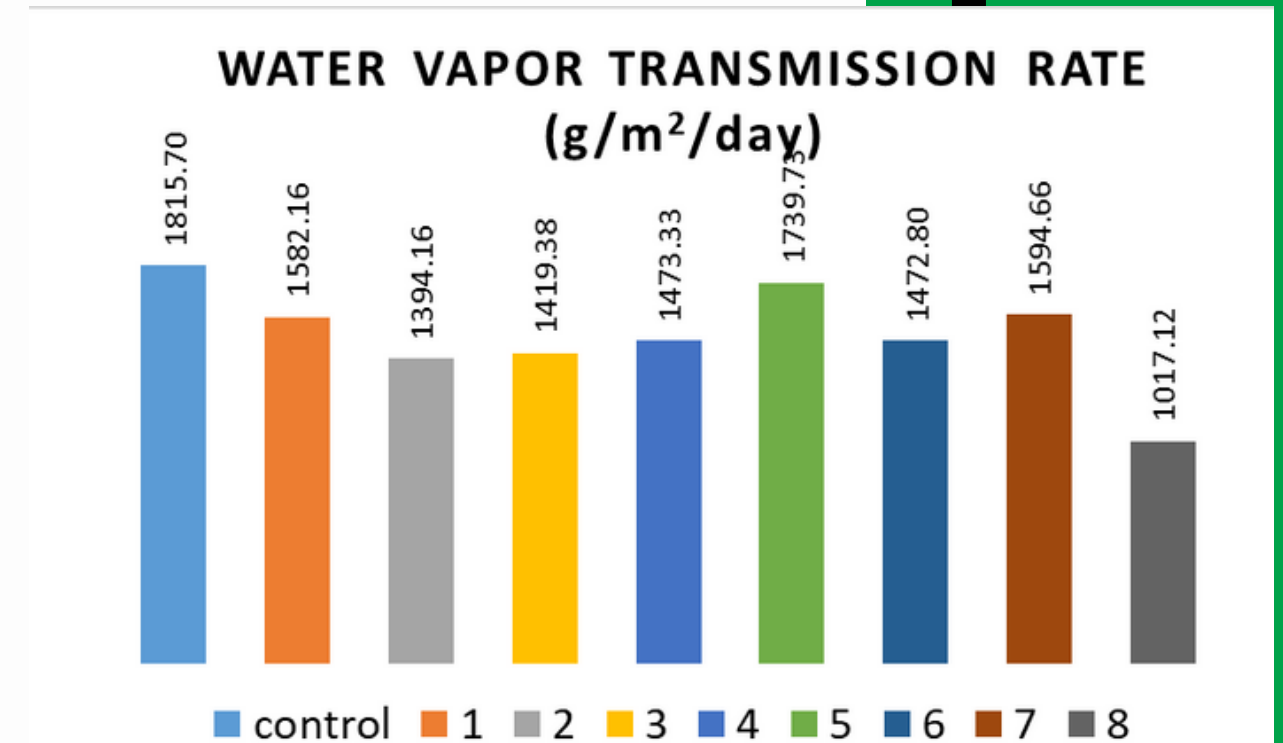
Water Vapour Transmission Rate (WVTR)

The WVTR values of integrated pectin films are in the range of 1017.12 g/m²/day – 1739.73 g/m²/day. Whereas The WVTR of control pectin is 1815.70 g/m²/day.

Depicts the hydrophobic nature of integrated components, bees wax, castor oil, and clove oil has contributed towards a significant reduction in WVTR value.

Fourier Transform Infrared Spectroscopy (FTIR)

The Figure shows that all the films are of the same nature with only a slight difference in the intensity of transmittance. It is also clear that no chemical transformations happened during the film forming process and solvent evaporation.



CONCLUSION

- THE FILMS DEVELOPED WERE THIN, TRANSPARENT AND EASILY SOLUBLE IN WATER.
- THE FILMS SHOWED EXCELLENT MOISTURE BARRIER PROPERTIES COMPARED TO CONTROL PECTIN FILMS.
- THE FILMS WERE ALSO FOUND TO BE BIODEGRADABLE.
- THE RESULTS SUGGEST THAT PECTIN-BASED FILMS WITH BEES WAX, CASTOR OIL AND CLOVE OIL HAVE THE POTENTIAL TO BE USED AS EDIBLE PACKAGING MATERIALS WITH ENHANCED MECHANICAL, BARRIER, AND ANTIMICROBIAL PROPERTIES.

REFERENCES

1. OPTIMIZATION OF PROCESS CONDITIONS FOR THE DEVELOPMENT OF PECTIN AND GLYCEROL BASED EDIBLE FILMS: STATISTICAL DESIGN OF EXPERIMENTS
[HTTPS://DOI.ORG/10.1016/J.EJBT.2021.11.004](https://doi.org/10.1016/J.EJBT.2021.11.004)
2. R. K. DHALL (2013) ADVANCES IN EDIBLE COATINGS FOR FRESH FRUITS AND VEGETABLES: A REVIEW, CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION, 53:5, 435-450,
[DOI:10.1080/10408398.2010.541568](https://doi.org/10.1080/10408398.2010.541568)
[HTTP://DX.DOI.ORG/10.1080/10408398.2010.541568](http://dx.doi.org/10.1080/10408398.2010.541568)
3. CORTES-RODRÍGUEZ M, VILLEGAS-YEPEZ C, GONZALEZ JHG, ET AL. DEVELOPMENT AND EVALUATION OF EDIBLE FILMS BASED ON CASSAVA STARCH, WHEY PROTEIN, AND BEES WAX. HELIYON 2020;6:E04884. [HTTPS://DOI.ORG/10.1016/J.HELIYON.2020.E04884](https://doi.org/10.1016/J.HELIYON.2020.E04884)
PMID: 32984596

REFERENCES

5. FOOD SCIENCE AND QUALITY MANAGEMENT ISSN 2224-6088 (PAPER) ISSN 2225-0557 (ONLINE) VOL 3, 2012 WWW.IISTE.ORG
6. CASTOR OIL AND COCOA BUTTER TO IMPROVE THE MOISTURE BARRIER AND TENSILE PROPERTIES OF PECTIN FILMS
7. JOURNAL OF POLYMERS AND THE ENVIRONMENT
[HTTPS://DOI.ORG/10.1007/S10924-022-02581-4](https://doi.org/10.1007/s10924-022-02581-4)
8. FOOD BIOPROCESS TECHNOL [HTTPS://DOI.ORG/10.1007/S11947-017-2030-0](https://doi.org/10.1007/s11947-017-2030-0) BIODEGRADABLE FILMS BASED ON GELATIN AND PAPAYA PEEL MICROPARTICLES WITH ANTIOXIDANT PROPERTIES