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Dielectric Measurements for Monitoring the Storage of Vegetable Oils

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INTRODUCTION & AIM

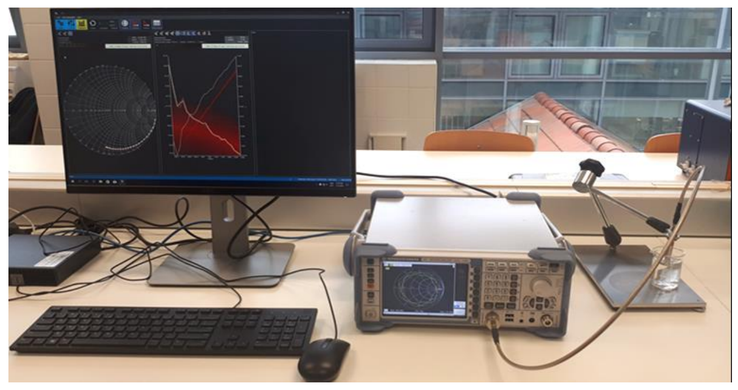
During the storage of vegetable oils, various chemical and physicochemical changes occur that can significantly affect oil quality and safety. Several indicators and methods are known for monitoring these changes, such as measurements of viscosity and colour, and the determination of peroxide value and free fatty acid (FFA) concentration.

Depending on the applied measuring frequency, dielectric parameters are considered sensitive to chemical, physical, and structural changes. Changes in the concentration of polar compounds (e.g. FFAs, aldehydes, peroxides, and water) also influence dielectric behavior.

Dielectric measurements are non-destructive methods suitable for real-time detection, and therefore have great potential for application in vegetable oil quality monitoring.

In our research, the 16-month storage of different edible oils was investigated through the determination of peroxide value, dielectric constant, and loss factor in the 200–2400 MHz frequency range.

METHODS

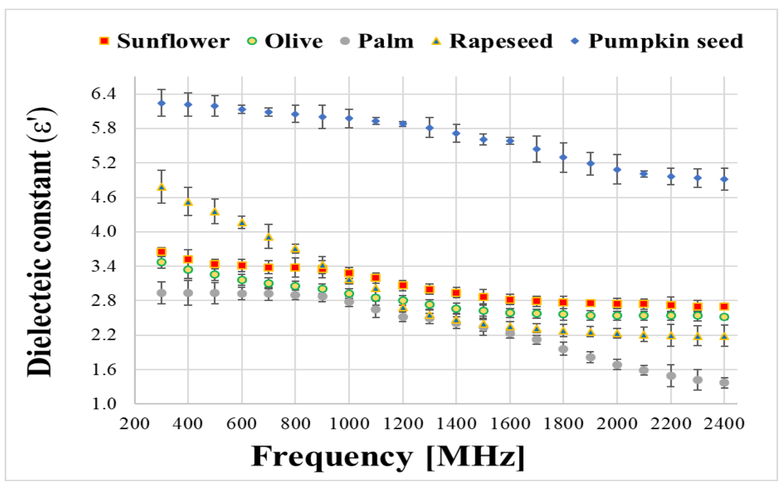


DAK 3.5 dielectric sensor with ZVL3 VNA

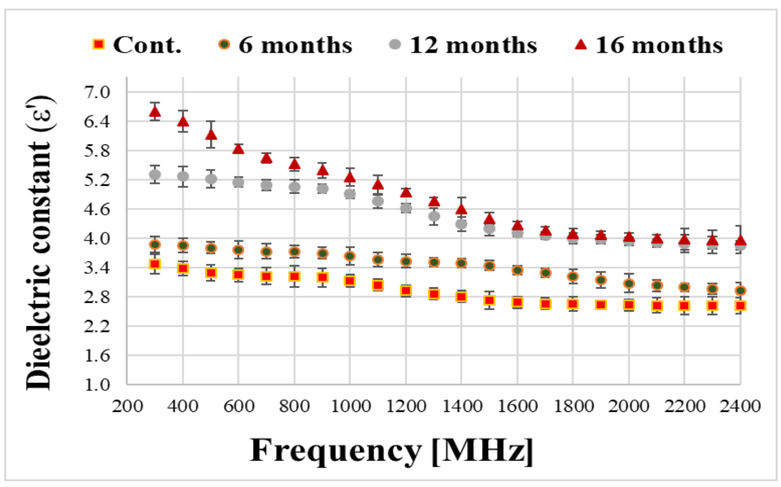
Hanna HI83730 PV photometer

- ✓ **Sunflower, olive and pumkin seed oil**
- ✓ **16 month storage at ambient temperature**
- ✓ **Dielectric parameters measured at 25°C in the frequency range of 200-2400 MHz**
- ✓ **Peroxid value by photometric method**

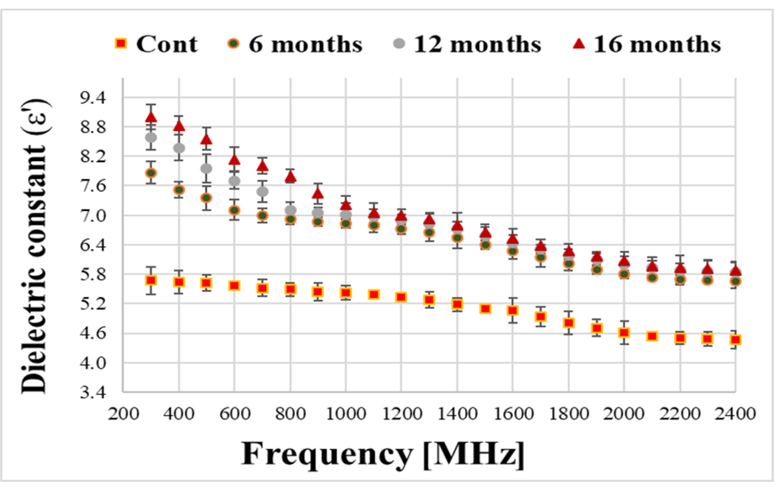
RESULTS



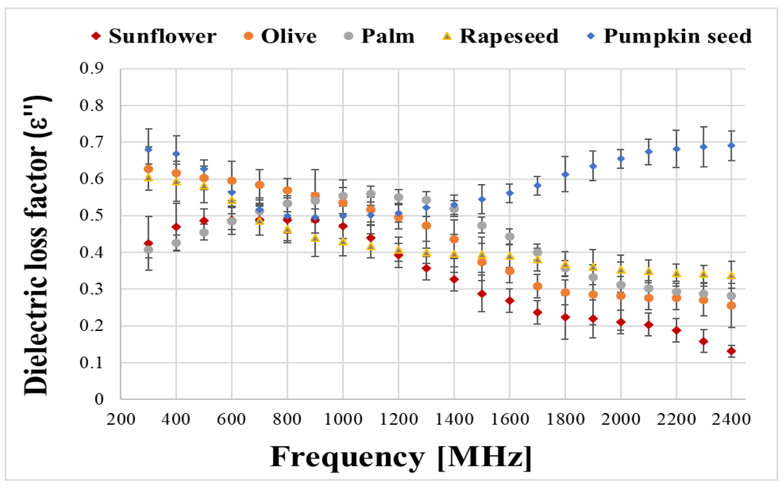
Dielectric constant of different vegetable oils



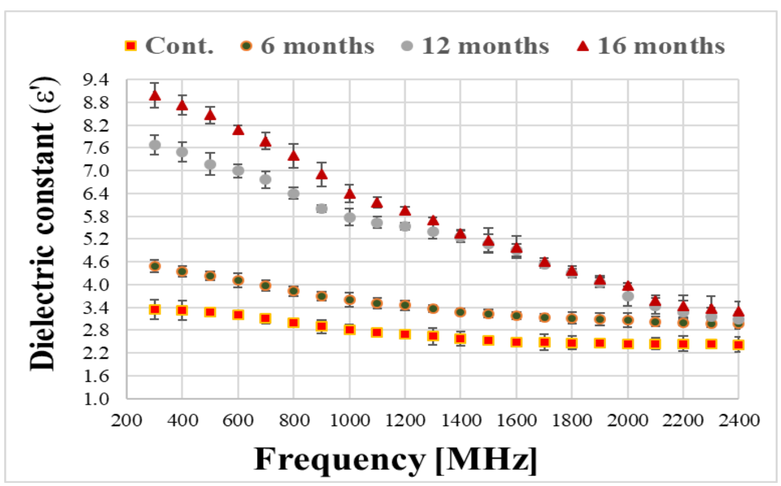
Dielectric constant of sunflower oil during storage



Dielectric constant of pumpkin seed oil during storage



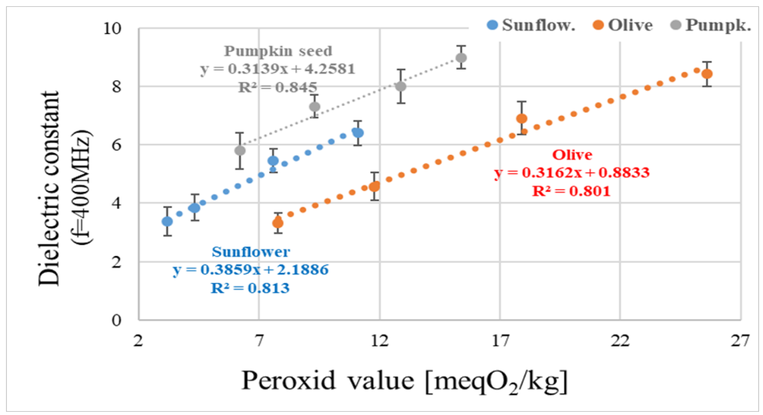
Dielectric loss factor of different vegetable oils



Dielectric constant of olive oil during storage

CONCLUSION

During the 16-month storage period, both the dielectric constant and the loss factor increased with time. Strong linear correlation (R > 0.9) was observed between peroxide value and dielectric constant in the frequency range of 300–500 MHz. The changes occurring during storage can be effectively monitored by measuring dielectric parameters.



FUTURE WORK

- **Testing the dielectric monitoring method for other edible oils**
- **Detailed chemical parameters and correlation analysis**
- **Widen the measuring frequency range**

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