RESIDUAL LIPIDS DEGRADATION VIA PLASMA TECHNOLOGY, CONVENTIONAL AND ACCELERATED OXIDATION

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ABSTRACT

Residual lipids such as Waste Cooking Oils (WCOs) stand out as potential feedstocks towards renewable fuels production. However, WCOs are prone to oxidation, due to the presence of the parent's oils, which constitutes a major issue preventing their further upgrading and storage. Accelerated oxidation methods appear promising for understanding the WCOs oxidation mechanisms and the chemical conversions taking place[1]. The main goal of this work is to investigate the effects of plasma treatment on WCOs oxidation and to compare it with accelerated oxidation and ambient storage, via qualitative characterization of the oxidized products, aiming to elucidate their degradation mechanism. Non-thermal plasmas have hardly been explored in lipids oxidation. WCOs were exposed to air plasma at ambient pressure using a pin-to-oil dielectric barrier discharge (DBD) configuration. The plasma discharges were sustained by high frequency (21 kHz), alternating current (AC), high-voltage, sinusoidal signals at 32 kV peak-to-peak and were in-situ monitored using V-I measurements and optical emission spectroscopy (OES). WCOs were plasma treated at different durations up to 1 h, and free fatty acids (FFAs), total acid number (TAN), as well as ATR-FTIR spectroscopy measurements were performed. Also, accelerated oxidation experiments under controlled laboratory conditions (80^{o}C and airflow through a nizzle) were carried out at the same time periods and TAN was measured. In parallel, WCOs were stored at ambient conditions to monitor potential degradation with time. The conventional storage period lasted 4 months, during which moisture content and TAN were analyzed every month. The results obtained were compared to better understand and determine the most promising accelerated lipids aging/oxidation method, which was the plasma oxidation approach that exhibited the higher oxidation rates.

KEYWORDS: residual lipids, oxidative degradation, plasma discharges, accelerated oxidation

REFERENCES

[1] Machado M, Rodriguez-Alcalá L. M, Gomes A. M, Pintado M. (2023). *Food Re. Int.* 39, 4180–4197, doi: 10.1080/87559129.2022.2026378.