

INFLUENCE OF BETA-CAROTENE ON OXIDATION RATE OF ITS OIL SOLUTIONS

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Maintaining vegetable oil quality during production and storage remains a critical challenge for the oil and fat industry. All lipid products undergo oxidative deterioration, with the oxidation degree primarily determined by fatty acid composition – particularly the presence and spatial arrangement of unsaturated fatty acids in triglyceride molecules. The oxidation stability is further modulated by accompanying compounds such as phospholipids, tocopherols, carotenoids, and chlorophyll, which can either inhibit or accelerate oxidation depending on their specific composition and concentration. Consequently, comprehensive evaluation of oxidation requires multiple indicators beyond just peroxide value (which reflects primary oxidation products), necessitating a more holistic analytical approach [1]. Understanding these relationships enables better prediction of oil shelf life and optimization of both production processes and storage conditions.

This study specifically investigates how fat-soluble pigments influence the induction period of oil solution oxidation, with dual objectives: enabling accurate shelf-life prediction for carotenoid-rich oils and developing non-traditional refining methods that better preserve bioactive compounds. The research demonstrated beta-carotene's compensatory effect on chlorophyll A's pro-oxidant activity through several key findings. At equivalent concentrations (0.05 g/L), chlorophyll A showed minimal interference with beta-carotene's antioxidant properties, yielding nearly identical induction periods (371 versus 373 minutes). However, in systems containing 0.10 g/L beta-carotene combined with 0.05 g/L chlorophyll A, we observed an 8.4 % reduction in induction period (408 minutes) compared to beta-carotene alone (445 minutes), clearly demonstrating chlorophyll's capacity to accelerate oxidation even in the presence of antioxidants. These results lead to three important conclusions. First, while beta-carotene can partially offset chlorophyll-induced oxidation, it cannot completely neutralize chlorophyll's pro-oxidant effects at higher concentrations. Second, the relative ratio of pigments proves critical for oxidative stability, with 0.05 g/L chlorophyll A showing negligible impact on beta-carotene's antioxidant performance [1]. Finally, the findings support developing customized refining processes that maximize retention of beneficial carotenoids while minimizing the negative effects of chlorophyll, ultimately enhancing both the shelf life and nutritional value of vegetable oils. This approach could significantly improve oil quality parameters while maintaining compliance with industry standards and regulations.

References:

1. Петік, І. П., Литвиненко, О. А., Пономарьова, М. С., Діхтярь, А. М., Андрєєва, С. С., Баландіна, І. С., & Карюк, А. О. (2024). Вплив концентрації бета-каротину і хлорофілу на швидкість окиснення їхніх олійних розчинів. *Інтегровані технології та енергозбереження / Інтегровані технології промисловості*, (3).