

## Synergistic effect of rosemary, sage and citric acid on fatty acid retention of heated flaxseed oil

### ABSTRACT

A study to optimize the use of oleoresin rosemary extract (OR), sage extract (OS) and citric acid (CA) in flaxseed oil during heating was performed using response surface methodology (RSM). Results showed that the natural antioxidants used in this study retarded oil deterioration, as evidenced by retention of fatty acids profiles. Results from this study revealed that the addition of OR and OS effectively retarded flaxseed oil deterioration after 20 times of frying of potato chips. Five type of fatty acids, namely C16:0, C18:0, C18:1, C18:2 and C18:3 were found in the oil, with all fatty acids having very good correlations with addition of natural antioxidants used during the frying. Mathematical models to predict the fatty acid composition of flaxseed oil after the frying could be developed with high confidence for all types of fatty acids. Therefore, for optimization purposes, the use of the ratio of saturated to unsaturated fatty acids was chosen because it covers all individual fatty acids present in the oil. After 20 fryings, the ratio best predicted the efficacy of natural antioxidants in preserving flaxseed oil with R<sup>2</sup> of 0.954. Further analysis showed that after 20 fryings, all three antioxidants had a significant effect on the ratio. Based on these results, a combination of 0.064% oleoresin rosemary extract, 0.061 sage extract and 0.041% citric acid can be recommended for use in flaxseed oil before deep-fat frying.

**Keyword:** Citric acid; Optimization; Flaxseed oil; Response surface methodology; Rosemary; Sage