

ISE Spring Meeting 2006
17-20 April 2006
Singapore

APPLICATION OF A FLOW-THROUGH TRIIODIDE DETECTOR FOR THE RAPID DETERMINATION OF PEROXIDE VALUE IN EDIBLE OILS ✓

Bahrudin Saad*, Wan Tatt Wai, Boey Peng Lim and Muhammad Idiris Saleh
Department of Chemistry, National University of Singapore, 3 Science Drive 3,
Singapore 117543. E-mail:chmbds@nus.edu.sg

*Permanent address: School of Chemical Sciences, Universiti Sains Malaysia, 11800
Penang, Malaysia. E-mail: bahrud@usm.my

1.0 Introduction

Lipid oxidation constitutes a major quality problem in the processing and storage of fats and oils, and is a major contributor to food deterioration. This process mainly involves the oxidation of unsaturated fatty acids or their derivatives present in the sample. The degradation process yields hydroperoxides as the primary oxidation products, which further degrade to yield secondary products (e.g., aldehydes, ketones, alcohols, acids) that are frequently associated with rancidity.

The primary oxidation products is normally measured by the peroxide value (PV), an index that quantitates the peroxide content by measuring how much iodine is liberated by the sample from iodide in an acidic medium in a specified time period [1]. The iodine released is complexed with soluble starch, which acts as an indicator, and the iodine is titrated against sodium thiosulfate. This method, however, is flawed by the considerable differences in the rates at which different peroxide liberate iodine from iodide [2]. The method not only uses gross amounts of toxic organic solvents (30 mL chloroform per sample), but its accuracy is affected by experimental conditions such as timing, light, and temperature.

2.0 Aim

To develop an alternative analytical method that is rapid, one that eliminates the use of organic solvents, cost-effective, and comparable to the standard AOCS method are some of the main objectives of the work.

3.0 Experimental Set-Up and Description

Oil sample (undiluted) and KI reagent are aspirated into a reaction chamber (Fig. 1). Redox reaction between iodide (in aqueous phase) and hydroperoxides (in oil layer) is accelerated by applying a short vortex mixing (30 s). The phases are allowed to be separated; an aliquot of the aqueous phase (bottom layer) was next aspirated to a triiodide sensor for detection. The sensor comprises 2-nitrophenyl octyl ether that was trapped in polyvinyl chloride as described earlier [3].

4.0 Results

The optimized procedure is linear over 0.35-28.0 PV (meq O₂ kg⁻¹) (Fig. 2). The method exhibits good reproducibility (RSD, 2.7% (n=8) for the determination of 1.1 PV) and a sampling rate of 80 samples h⁻¹ was achieved. Excellent correlation ($r^2 = 0.9949$) between the proposed method and the manual AOCS method is found when applied to the determination of PV in diverse types of edible oils (Fig. 3). Typical peaks are shown in Fig. 4

5.0 References

- [1] American Oil Chemist's Society Official Method Cd-8-53, 1996.
- [2] K. Tian and P.K. Dasgupta, *Anal. Chem.*, 71 (1999) 2053.
- [3] B. Saad et al, *Anal. Sciences*, 22 (2006) 45.

6.0 Acknowledgements

Financial support from the Universiti Sains Malaysia is gratefully acknowledged.

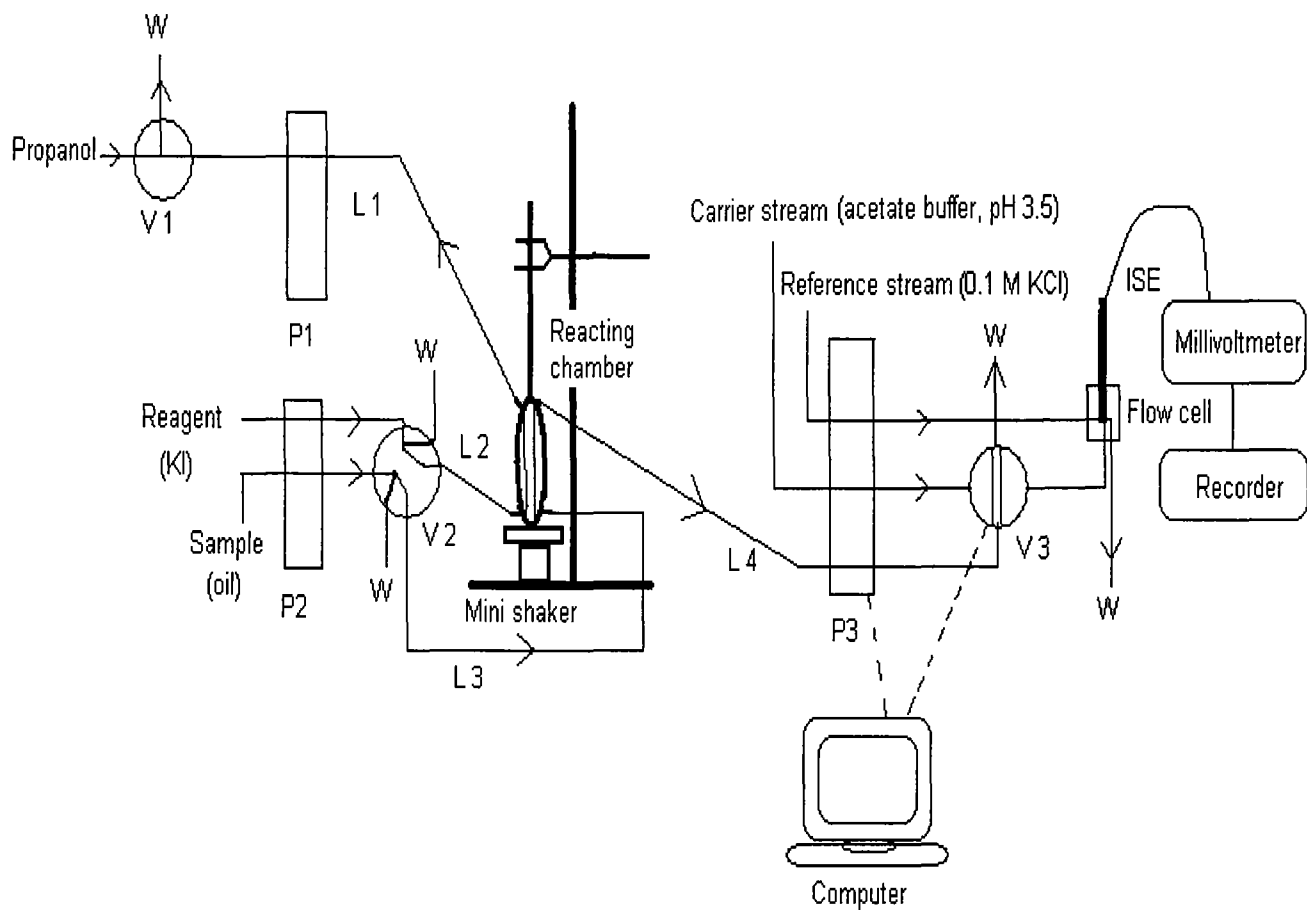


Figure 1. FIA experimental set-up

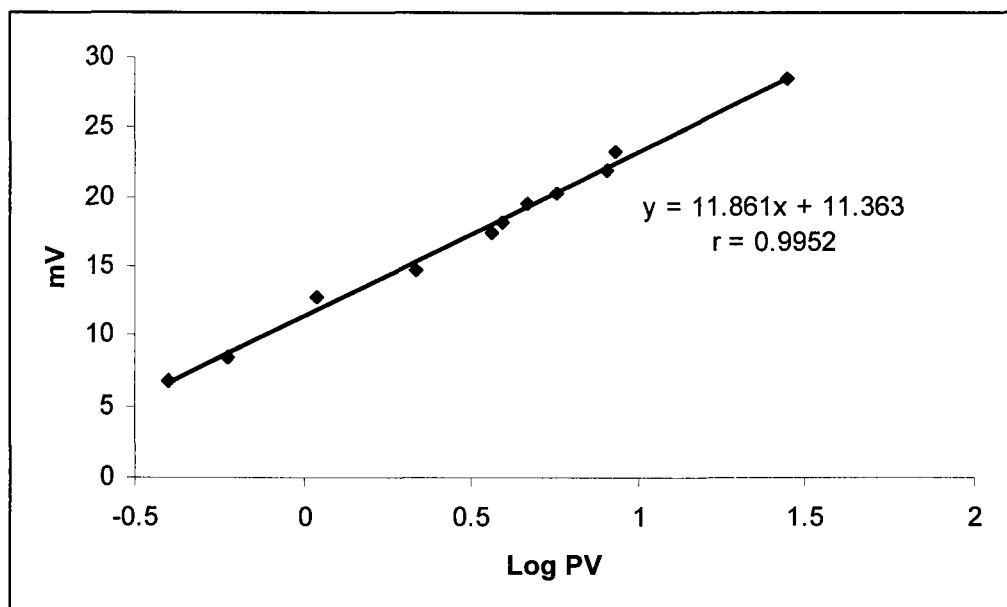


Figure 2. Calibration curve of proposed FIA method for the determination of PV

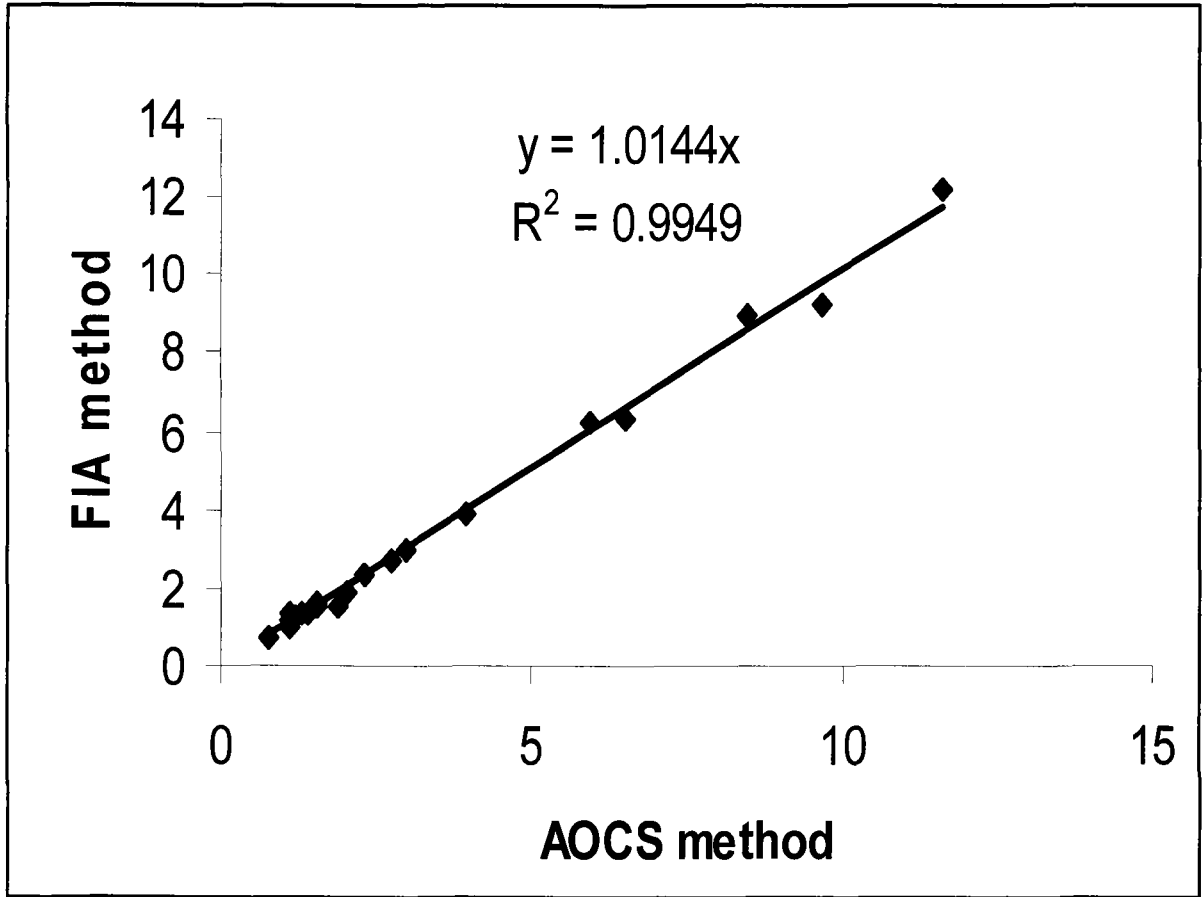


Figure 3. Correlation between the proposed FIA and the standard AOCS methods for the determination of PV in edible oils (n = 20).

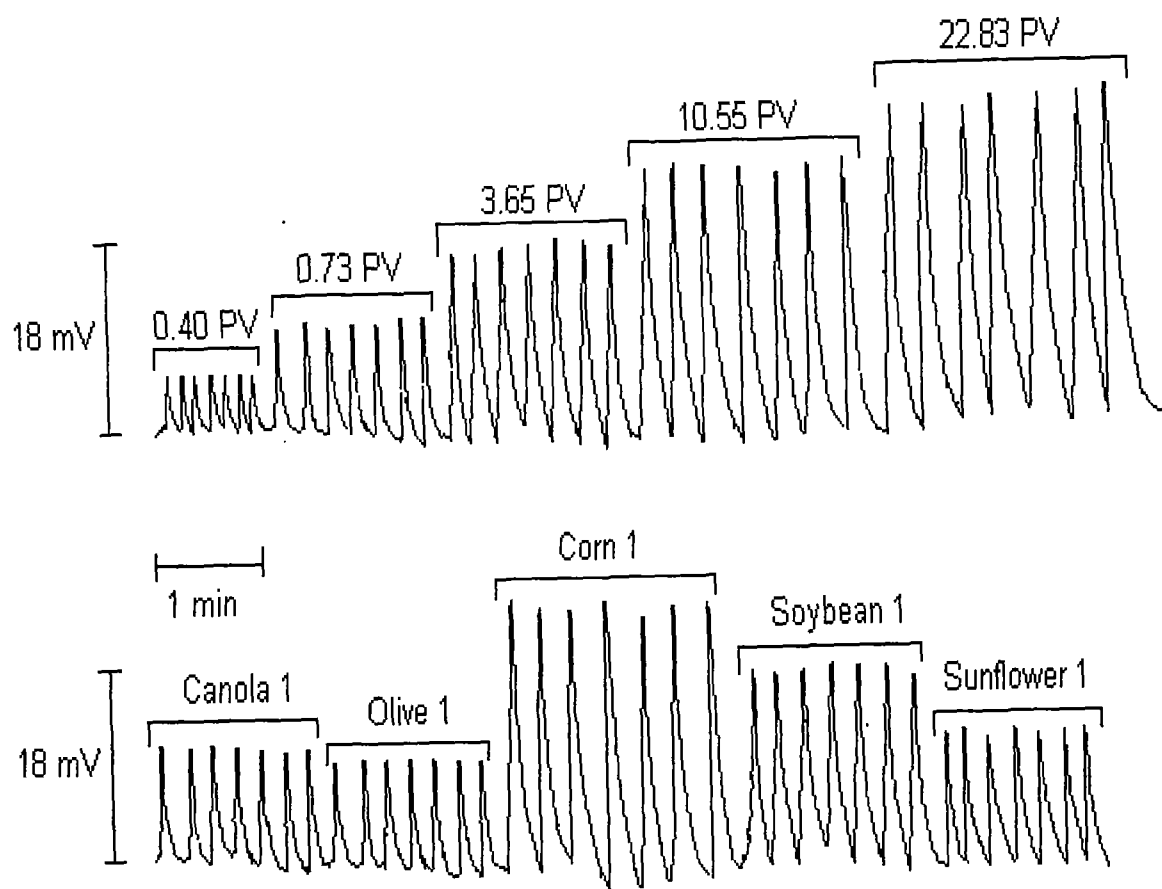


Figure 4 Typical FIA peaks of edible oil samples of the proposed FIA method