ASSESSMENT OF THE INFLUENCE OF SELENIUM ION OVER MINERAL OIL AUTOOXIDATION USING REFRACTIVE INDEX DETERMINATION IN REAL TIME

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Abstract

This paper presents a study about the influence of selenium ion over the mineral oil hydrolysis reaction using laser interferometer techniques. The principle of this method consists in determination in real time of refractive index changes of lipase-mineral oil biochemical system in the presence of selenium ion, using a laser interferometer which had attached a C.C.D. camera in order to acquire in real time the fringes of interference modification and to process and analyse the image and also to draw graphics.

Introduction

Mineral oils changed their chemical properties in time, due to lipase activity which hydrolysed the native fat acids and lipids from mineral oil. To determine the rate of the lipase activity, the authors had created and realised a device which function principle is based on the determination of the refractive index variations at the oil hydrolysis with lipase [1]. At each hydrolysis step it takes place a modification of the refractive index, variation that is determined in real time.

The system realised is one complete integrating. So, using a Michelson interferometer is determined the modification in real time of the interference fringes due to the refractive index variations of the biochemical starch-amylase system, modification that is acquired and processed in real time by a computer which had attached a CCD camera [2].

The Michelson interferometer used provides interference fringes, which are formed on a screen made by a white sheet of paper, and so, the visual sensor that is located on the opposite side of the screen, acquires the image in optimum conditions. On the screen appear successive images with interference fringes. The solution refractive index is changing in time, in the same way that the hydrolysis reaction occurs, so on the screen appear new interference maxims that correspond to the different hydrolysis steps. The CCD visual sensor acquires the image formed on the screen and sends it to the data acquisition board. The CCD sensor used had a density of 10000 receptors/mm^2 uniform distribute, and the total number of the receptor is 640x480, that determine a high resolution of the system [3, 4].

The program realised and elaborated in C++ language offers the possibility of acquiring and processing images, processing which consists in the determination of the number of changes in the interference fringes [5].

In figure 1 is presented the principle scheme of the conceptual and realised device.

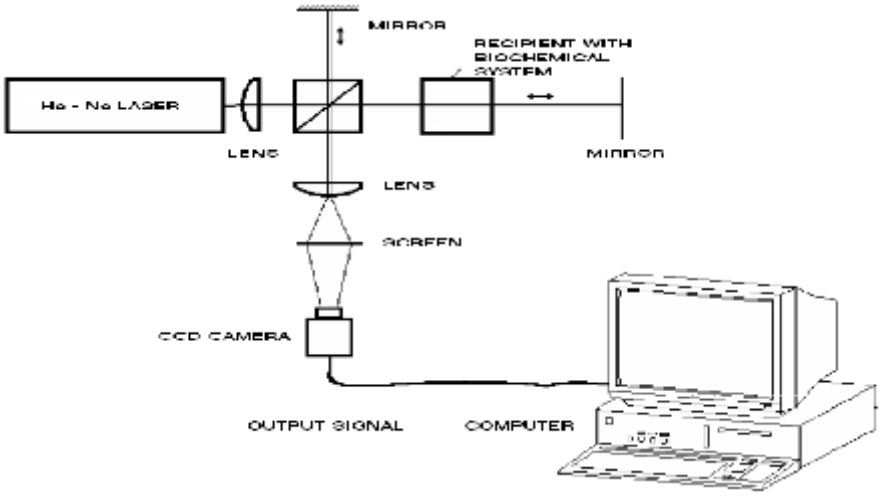

Figure 1. The principle scheme of the device

Experimental

Reagents

Oleic acid supplied by Merck, Darmstadt was used as standard substrate and as enzyme it was used an enzymatic preparate of lipase from Worthington .

As antioxidant was used a solution of Se^{2-} 1% in methanol: clorophorm: water 2:3:1.

Interferometer analysis

In the recipient located on the interferometer it was introduced 5 ml substrate oleic acid, 0,2 ml enzyme, 0,5 ml selenium and 1 ml acetate buffer pH 4,7 *(sample* named oleic acid).

For the sample was made a control, identically with the tests, except that in the control there were no selenium ions *(control).*

When the lipase is introduced in tube, the hydrolysis reaction started and the rate of reaction is expressed as the numbers of changes of refractive index in time.

Results and discussions

The graphics (numbers of changes vs. time) were realised by using a computer program made by the authors and are shown in figure 2.

The rate of hydrolysis in the presence of selenium is very increased, so selenium acted as a great inhibitor for lipase activity.

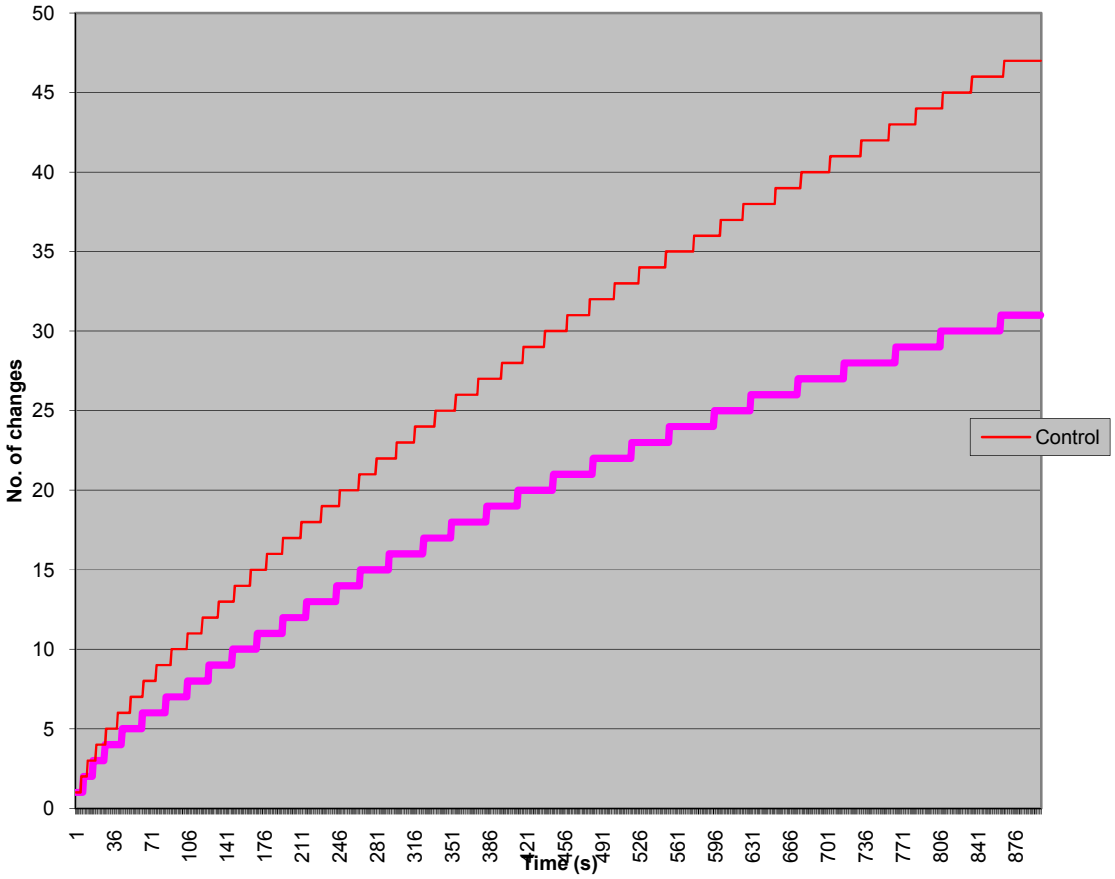

Figure 2. The influence of the selenium over the hydrolysis reaction of mineral oil with lipase

Conclusions

Selenium ions are antioxidants for lipase activity even in very small quantities. The rate of hydrolysis reaction decreased in a large manner, when selenium ions were presented in the mineral oil, so the chemical properties and the lifetime of the technical lipid materials and oils are preserved.

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The rate of hydrolysis in the presence of selenium is very increased, so selenium acted as a great inhibitor for lipase activity. Selenium ions are antioxidants for lipase activity even in very small quantities. The rate of hydrolysis reaction decreased in a large manner, when selenium ions were presented in the mineral oil, so the chemical properties and the lifetime of the technical lipid materials and oils are preserved.

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