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STUDIES ABOUT THE INFLUENCE OF SOME FOOD ADDITIVES OVER STARCH HYDROLYSIS REACTION (PART II)

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Abstract

This paper presents the influence of the vitamin C, glucose and fructose on the starch hydrolysis reaction with amylase isolated from wheat, using laser interferometry technics.

Keywords: laser interferometer techniques, starch hydrolysis, wheat amylase, vitamin C, glucose and fructose.

INTRODUCTION

In bakery, they usually use food additives as vitamin C, glucose and fructose to improve the quality of bakery products. These additives seem to influence the starch hydrolysis reaction [2]. To determine the rate of the amylase activity, the authors had created and realised a device which function principle is based on the determination of the refractive index variations at the starch hydrolysis with amylase. 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 [3].

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 (Heideger rings).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 Matrox IP 8 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 (figure 2).

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 [4,5,6].

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

Figure 1. The interferometric device

Figure 2. The Michelson interferometer

The component elements of the presented system in figure 1 are the He-Ne laser, the convergent lens, the divisor plate, the recipient with biochemical system (figure 2), the mirrors, the divergent lens, the screen, the CCD camera and the computer with a data acquisition board .

MATERIALS AND METHODS

Reagents:

1. Soluble starch supplied by Merck, Darmstadt was used in 1% concentration in aqua's solution.
2. It was used an enzymatic extract of alpha and beta amylase from wheat flour prepared by extracting 10 g wheat flour in 100 ml distillate water for 30 minute using a magnetic stirring, than centrifuging at 6000 rpm for 10 minutes. The supernatant obtain was dilute 10 times in distillate water.
3. Vitamin C, glucose and fructose were used in 0,1% concentration as aqua's solutions .

Interferometer analysis:

In the recipient located on the interferometer it was introduced 5 ml soluble starch, 2 ml distilled water, 0,5 ml glucose 0,1% (sample 1), 0,5 ml fructose 0,1% (sample 2) and 0,5 vitamin C 0,1% (sample 3) and 1 ml amylase extract as shown in table 1

Table 1

Lab techniques

	Control	Sample 1	Sample2	Sample 3
Starch	5ml	5ml	5ml	5ml
Amylase	1ml	1ml	1ml	1ml
Distillate water	2ml	2ml	2ml	2ml
Food additives 1%	0,5ml DW	0,5ml	0,5ml	0,5ml

For the samples was made a control, identically with the tests, except that in the control there was no lipid in solution.

When the amylase is introduced in tube, the hydrolysis reaction started and the rate of hydrolysis 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 3.

The presence of food additives in the medium of reaction determined the increased of the rate starch hydrolysis so these additives acted as enzymatic activators.

The greatest activator effect it had the vitamin C.

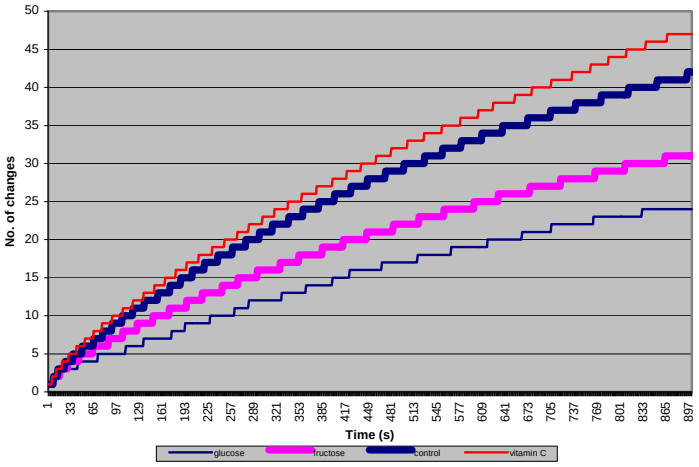

Figure 3. The influence of the vitamin C, glucose and fructose over the hydrolysis reaction of starch with amylase

CONCLUSIONS

Vitamin C, glucose and fructose are iactivators for amylase activity and increase the rate of the enzymatic reaction. These results indicated that thesefood additives could be utilised for the amelioration of the hydrolytically process of the starch with low or great amylasic activity.The laser interferometer techniques represented a new research method in the study of the kinetic reaction, required a very small reagents quantities and a very short time for analysis and also allowed the 'visualisation' of the chemical reaction in real time. This method can be used successfully in many research domains and industrial sectors.

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