

The effect of ultrasound on the enzymatic hydrolysis of starch with alpha-amylase enzyme

H. Siami¹, M.R. Housaindokht^{*1,2}, A. Nakhaeipour^{1,2}

1. Department of Chemistry, Faculty of Science, Ferdowsi University of Mashhad

2. Research and Technology Center of Biomolecules, Faculty of science, Ferdowsi university of Mashhad

Abstract

In this research, the effect of ultrasound (US) on the activity and the kinetic parameters of enzymatic hydrolysis of starch by alpha-amylase were investigated. To this aim, alpha-amylase was exposed to ultrasonic irradiation for different time intervals and a constant frequency of 20 kHz, then its enzymatic activity was measured. According to the results, the maximum activity of amylase was recorded in the absence of US and increasing the irradiation time reduced the enzymatic activity. The relative activity of amylase under irradiation time intervals of 0, 10, 20 and 30 min were 100, 92.13, 34.62 and 7.47 percent, respectively. The optimum pH and temperature for amylase activity in both, the absence and presence of US were similar ($T=50^{\circ}\text{C}$ and $\text{pH}=6$). There was no considerable change in K_m , while the results showed a decrease in the value of $V_{\max}$. In comparison with the corresponding value in the absence of US, the enzymatic hydrolysis increased when the enzyme and starch solutions were exposed to the US for 10 minutes. However, this value decreased when the solutions were exposed to US for 20 and 30 minutes. Furthermore, the effect of ultrasound on the structure of amylase were studied using viscometric and florescence spectroscopy. These results indicated that, US have equivocal effect on enzyme activity. One effect was a destructive one on the structure of amylase and the other effect was increasing the collision frequency of substrate-enzyme, and consequently, an increase in hydrolysis.

Keywords: Alpha-amylase, Starch, Ultrasound, Activity, Kinetic parameter.

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* Corresponding author E-mail: housain@um.ac.ir