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New sensor for industrial enzymatic catalysis detection

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PURPOSE OF THE ABSTRACT
The use of enzymes in the industry is in constant growth, reaching a global market worth 7 billion $ in 2022. Industry sectors using enzymes and their applications are numerous such as biofuel production, baking, feed additives or fruit juice treatment, to name only a few. Alongside an increasing use, the necessity of detecting and measuring enzymatic activity represents an important concern. Zymoptiq (https://zymoptiq.com/en/), a French start-up created in 2019, invented an innovative method for measuring hydrolase and lyase enzymatic activities [1]. This method relies on the immobilization of a substrate and its degradation when it is incubated in the presence of enzymatic activity. The immobilized substrate has to be specific of the characterized enzyme. These substrates are usually biopolymers, which can be immobilized using a cross linker.
Among the most used enzymes in the industry, some however catalyse the hydrolysis of small molecules. Zymoptiq's measurement method was not initially designed for the analysis of such enzymes, the limiting step being the substrate immobilization, which usually requires a polymer to work properly. Phytase is one of the most commonly used enzymes in the animal feed industry. With a market size valued at 570 million $ in 2022, it dominates this industry. Phytase is responsible for the step-wise hydrolysis of ester phosphate bonds of phytic acid, leading to the release of inorganic phosphate. It is added in the feed of monogastric animals, which do not express sufficient phytase activity. Besides being the main source of inorganic phosphate, which allows bone growth, in plants (70-80%), phytic acid also acts as an anti-nutrient component by chelating other metallic cations essential to animal growth and can lead to water eutrophication, making its hydrolysis by phytase important for the animal and the environment [2].
This poster will focus on the comprehension of the physico-chemical phenomena allowing the detection of phytase activity based on the progressive destabilization of a spherical shaped deposit (fig 1B) of a suitable substrate. Such structures, which break down when incubated in the presence of a growing phytase activity, are shown in figure 1. This study addresses substrate availability when trapped in a microstructure through a kinetic study using free or trapped phytic acid, we will propose a degradation mechanism of the used immobilized structure and the effect of its conformation on the degradation kinetics.

FIGURES

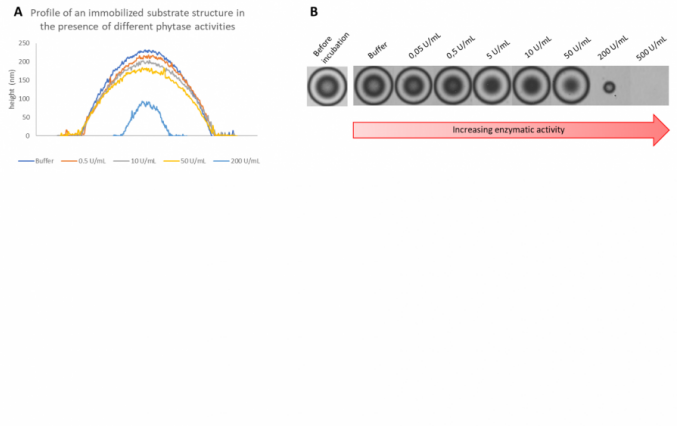

FIGURE 1

Figure 1

AFM profile (A) and microscope observation (B) of an immobilized substrate incubated in the presence of different phytase activities showing its progressive degradation.

FIGURE 2

KEYWORDS

industrial biocatalysis | phytase | immobilized substrate | hydrolysis

BIBLIOGRAPHY

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