

MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Sciences onboard the International Space Station and Beyond (6)

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CIM DEVICE FOR ENZYME KINETICS EXPERIMENT ABOARD THE INTERNATIONAL SPACE
STATION

Abstract

The main objective of this experiment is to verify the differences in kinetic parameters of enzymes reaction aboard the ISS. For this experiment invertase enzyme was selected, as a case study in microgravity. It is expected that significant differences occur in the sucrose hydrolysis by invertase, due to diffusion phenomenon in microgravity. The experiment consists of two series of tests, each one with five different sucrose concentrations, to evaluate the invertase kinetics. The reaction is allowed during a period of time, after which the reactions are interrupted by addition of an enzyme inhibitor. To perform this experiment in microgravity on the ISS, CIM device was developed, with two sets of 5 chambers each, in a total of 10, to realize the mixture of two liquids and the enzyme. This compact device requires no electric power, and it can easily be operated by an astronaut manually. This device is an important evolution over the previous version, which flew on the ISS, "Centenary Mission", in March, 2006. The results were partly satisfactory, due to metal contamination in the biochemical reaction. The samples of the enzymes, after reaction, must return to earth for biochemical analysis in laboratory. It is expected that significant differences should occur in the hydrolysis of sucrose by invertase, due the diffusion phenomenon, that suffers alterations in microgravity. This experiment aims at the study of the enzymatic kinetics of invertase, which catalyses carbohydrates hydrolysis, such as sucrose, and thus producing glucose and fructose. This is sugar mostly used in food and pharmaceutical industry, because of some of its characteristics, such as a major sweetening power, and does not crystallize easily at low temperatures. Since sucrose has to get through the cells membrane of *Saccharomyces cerevisiae* yeast, for the reaction to happen, it will be possible to verify if any substantial differences in the kinetic parameters will take place during the period of time in which the experiment remains in microgravity. The study of enzymatic kinetics is fundamental for the comprehension of the enzymes action mechanism, in and out of the cells, and this may lead to the design of more efficient enzymatic bioreactors. Therefore, the study of the effects of microgravity on the enzymes action can be helpful to better understand their action mechanism on earth, and then to think of enzymatic processes and microorganisms applications, both on earth and in space.