Evaluation of zooplankton potential CO_2 production: isocitrate dehydrogenase (IDH) enzyme activity

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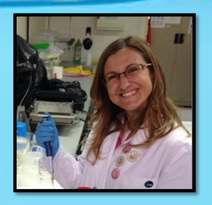
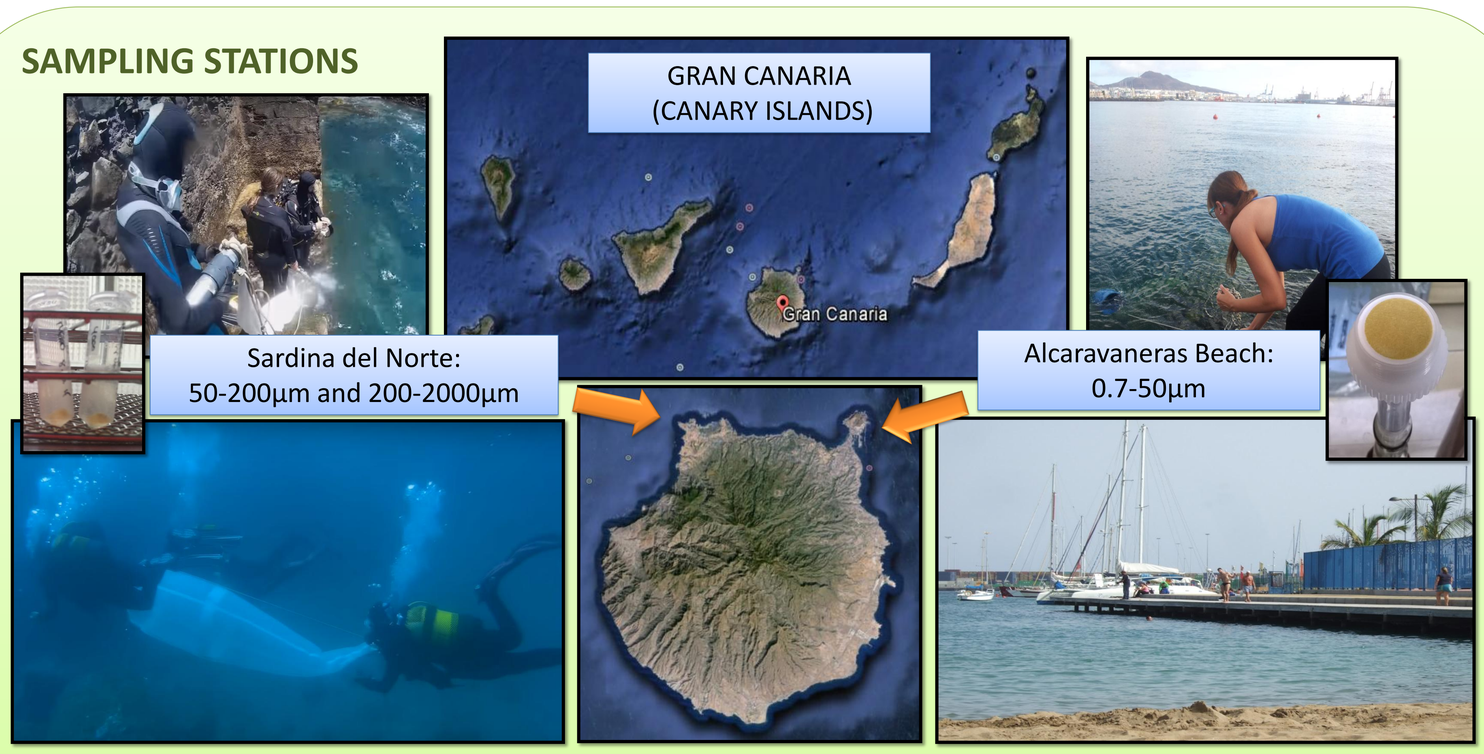


ABSTRACT

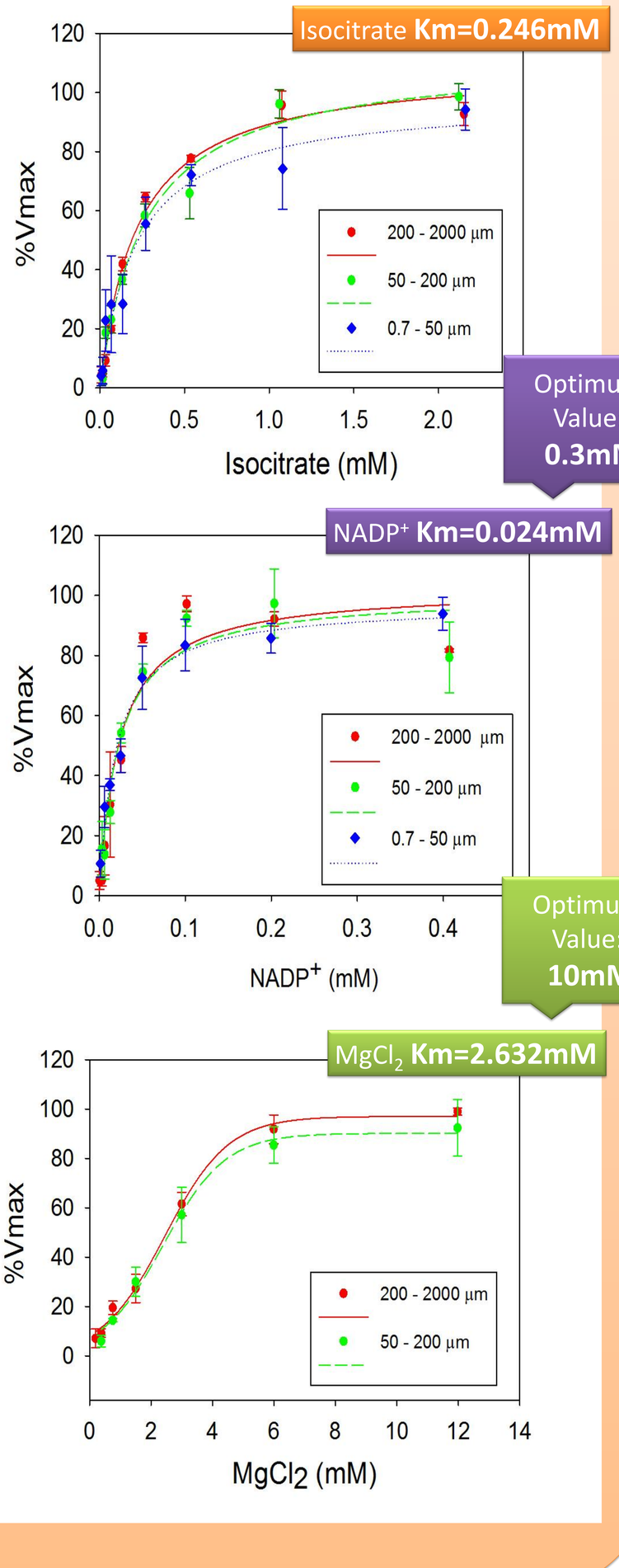
Isocitrate dehydrogenase (IDH), a CO_2 producing enzyme, plays a key role in the Krebs cycle, being responsible for the emission of one of the three CO_2 molecules related to this central phase of cellular respiration. Using a modified IDH methodology, we have assayed IDH activity in the marine planktonic community and have calculated its potential CO_2 production. This measure will improve estimations of the impact of plankton on ocean carbon flux and carbon sequestration in the deep ocean. Samples of different plankton fractions (from 0.7 to 50 µm, from 50 to 200 µm and from 200 to 2000 µm) from the Canary Island coastal waters were used to develop and validate this method. Although more experiments are needed, this methodology is leading to a better understanding of cellular respiration in marine samples. Thus, other points of view about the role of plankton communities within the food chain, new knowledge about vertical carbon flux and new estimations about the current sequestering capacity for anthropogenic CO_2 by these plankton communities are emerging.

SAMPLING STATIONS



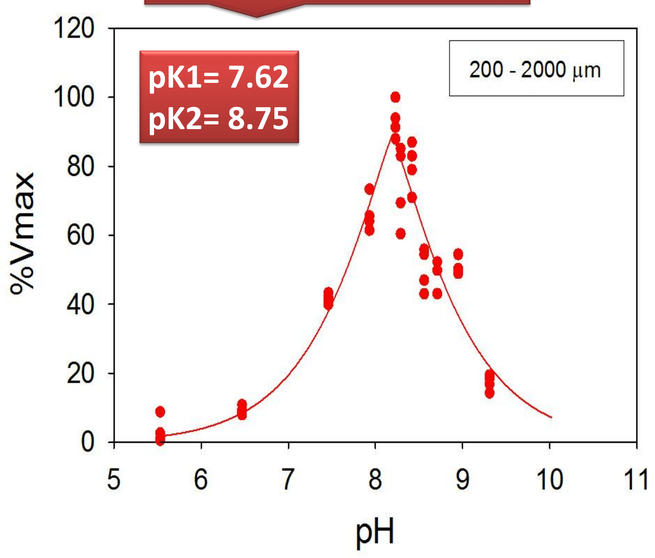
AFFINITY OF NADP⁺-IDH FOR SUBSTRATE AND COFACTORS

Optimum Value: **2mM**

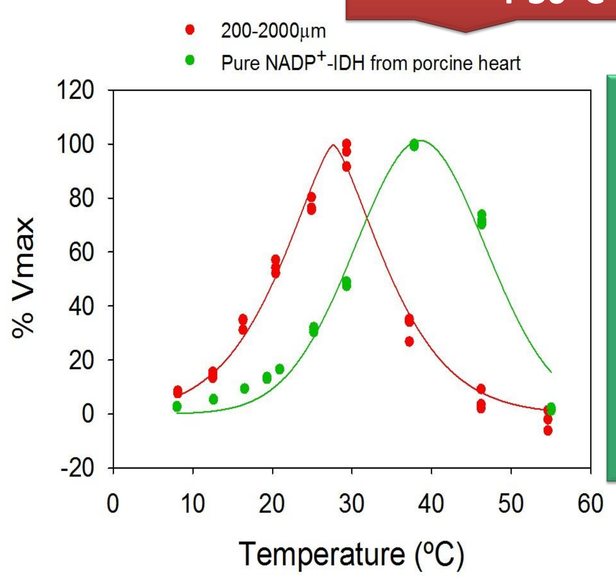


EFFECT OF pH, TEMPERATURE AND CENTRIFUGATION ON NADP-IDH ACTIVITY

Plankton Optimum Value: **pH 8.2**

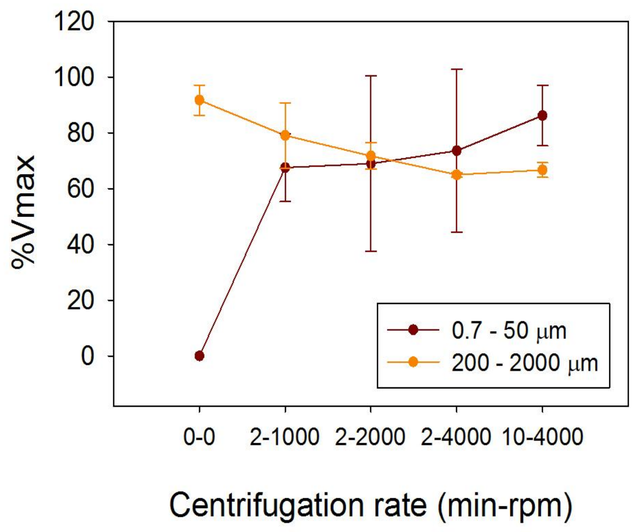


Plankton Optimum Value: **T 30ºC**



Mammal Optimum Value T: 40ºC Enzymatic differences between homeotherms and poikilotherms

High values in 200-2000µm samples at low levels of centrifugation



High values in 0.7-50µm samples at high levels of centrifugation

CONCLUSIONS:

Plankton potential CO_2 production can be measured by analyzing the NADP⁺-IDH activity under substrate-saturating conditions: 2mM Isocitrate, 0.3mM $NADP^+$, 10mM $MgCl_2$; at pH 8.2 and with an Arrhenius temperature relation. Optimal levels of centrifugation depends on the nature of the samples.

IDH activity is a new tool for assessing potential CO_2 production measurements. It may increase our knowledge of:

- **The metabolic state** of marine communities.
- **Spatial and temporal resolution** of vertical **C flux** in the ocean by the assessment of the ratio CO_2 production/IDH activity.

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