# DETERMINATION OF TEMPERATURE EFFECTS ON KINETIC PARAMETERS BY MICRORESPIROMETRY

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**Introduction.** Mathematical models, which have been developed over years, are the main tool to describe and control microbial kinetics. Most of these models are based on kinetic parameters describing the relationship between the bioprocess and the limiting substrate. Typically, the determination of kinetic parameters is based on the measurement of substrate concentration during batch or continuous cultures. This method is time demanding and is often a source of frustration due to the difficulty to obtain coherent experimental data (1). The latter has been identified as the main reason of stagnation in the field of bioprocesses modeling and explain why very little has been done to understand, within others, how environmental factors affect kinetic parameters. Respirometry, which is the measurement of oxygen consumption rate under controlled conditions, offers an alternative to calculate kinetic parameters, with less experimental effort (2). The aim of this work was to assess the effect of temperature on the maximum specific growth rate ($\mu_{max}$) and the half saturation constant ($K_S$), by microreactor respirometry, using an activated sludge consortium as biological model.

**Methods.** Biomass used in respirometry tests was obtained from an activated sludge reactor operated continuously with acetate as sole carbon source. Respirometry tests were done in a Micro-24 MicroReactor System (Pall Corporation, USA), according to the pulse respirometry method, previously described (3). $\mu_{max}$ and $K_S$ were determined by Monod model fitting to experimental respirograms, at 9 different temperatures, from 20 to 36 °C.

**Results.** Figure 1 shows the temperature effect on $\mu_{max}$, with a "traditional" bell-shape curve with an optimal temperature around 30°C. Figure 1 also shows that temperature had a clear exponential effect on $K_S$. Figure 2 shows a theoretical estimation of temperature effects on $\mu$ for several substrate concentrations; In that Figure, $\mu_{max}$ and $K_S$ were estimated from Figure 1 (dotted lines).

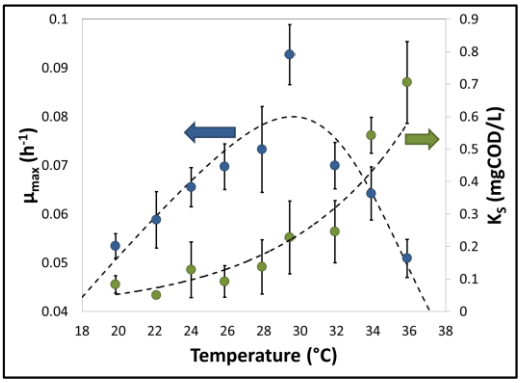


**Fig.1** Effect of temperature on $\mu_{max}$ and $K_S$ (20-36°C).

As shown in Fig. 2, these results indicate that the optimal temperature depends on substrate concentration. This finding, to the best of our knowledge, has not been reported before and should be confirmed by additional experiments.

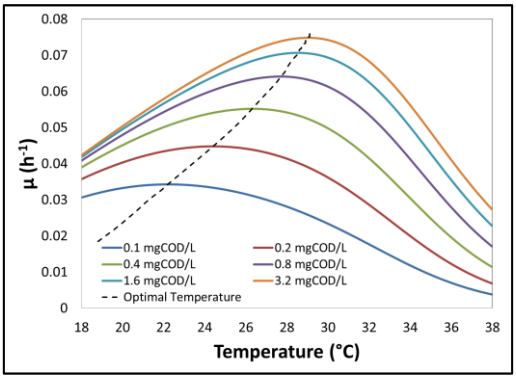


**Fig.2** Theoretical effect of temperature on μ for several substrate concentrations.

**Conclusions.** Microrespirometry is a powerful tool for the determination of kinetic parameters. Temperature significantly affects $\mu_{max}$ and $K_S$.

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**References.**

1. Kovarova K. and Egli T. (1998). *Microbiol Mol Biol R*. Vol. (62):646-666.
2. Spanjers H., Takacs I., Brouwer H. (1999). *Water Sci Technol.* Vol. 39(4):137–145.
3. Ordaz, A., Oliveira, C.S., Aguilar, R., Carrión, M., Alves, M. y Thalasso, F. (2008). *Biotechn. Bioeng.* Vol. 100 (1): 94-102.