Application note #20

WIDE TEMPERATURE RANGE CONTROL

Keywords: temperature regulation, water bath, stopped flow, -15℃, 85℃

Kinetics rate constants are dependent on the mixing temperature. To obtain accurate and repeatable results it is essential to control the temperature of the stopped-flow system precisely. The ability to control a stopped-flow system over a wide temperature range is important as it allows the system to be used for a broad range of applications.

Our SFM series has the widest temperature range available in a commercial system. The temperature can be regulated from -20℃ to 85℃ using a standar d circulating. A common temperature circuit is used for driving syringes, delay lines, mixers, and the observation head, so all elements can be maintained at the same temperature. An optional PT100 temperature probe can be placed in the observation head, in direct contact with the cuvette. The exact cell temperature of the cuvette is displayed in Biokine software. Observation cuvettes can be changed quickly, without draining the temperature control circuit.

Temperature performance can easily demonstrate using the Arrhenius equation:

$$\frac{d(\ln k)}{dt} = \frac{E_a}{RT^2}$$

Where:

k = constant rate

T = temperature

R = constant of perfect gas

Ea = activation Energy

Assuming that Ea does not depend of the temperature (which is a reasonable hypothesis) the

Arrhenius equation is equivalent to:

$$k = Ae^{\left(-\frac{Ea}{RT}\right)}$$

Using the natural log gives:

$$\ln(k) = \ln(A) - \frac{Ea}{RT}$$

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Demonstration:

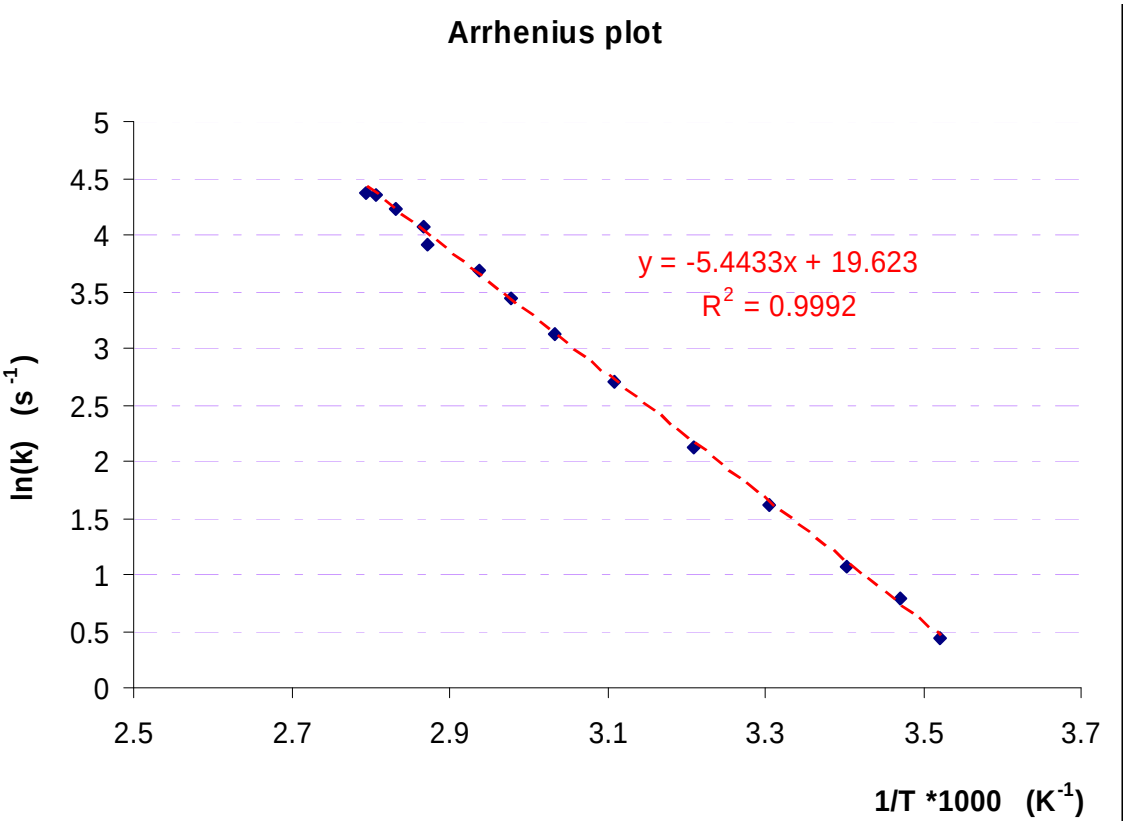
Showing that our SFM series works over a wide range of temperature.

Temperature range: 10℃ to 85℃ using a water bath

0.5 mM DNPA in DMSO 1%(v/v) is mixed with 0.2 M NaOH. A pseudo first order reaction is observed at 325 nm.

Total flow rate is set at 15mL/s using the 1cm path length cuvette.

Shots are performed at temperatures from 11℃ to 85 ℃. Each kinetic is fitted to determine the rate constant k.



Graphe1: Arrhenius plot for a temperature variation from 11℃ to 85℃

Temperature range: -17℃ to 15℃ using an isopropan ol bath

DNPA 0.5mM in DMSO 1%(v/v) is mixed with sodium methoxide 0.1M. A pseudo first order reaction is observed at 400 nm.

Total flow rate is set at 15mL/s using the 1cm path length cuvette.

Shots are performed at temperatures from -17℃ to 1 5℃. Each kinetic is fitted to determine the rate constant k.

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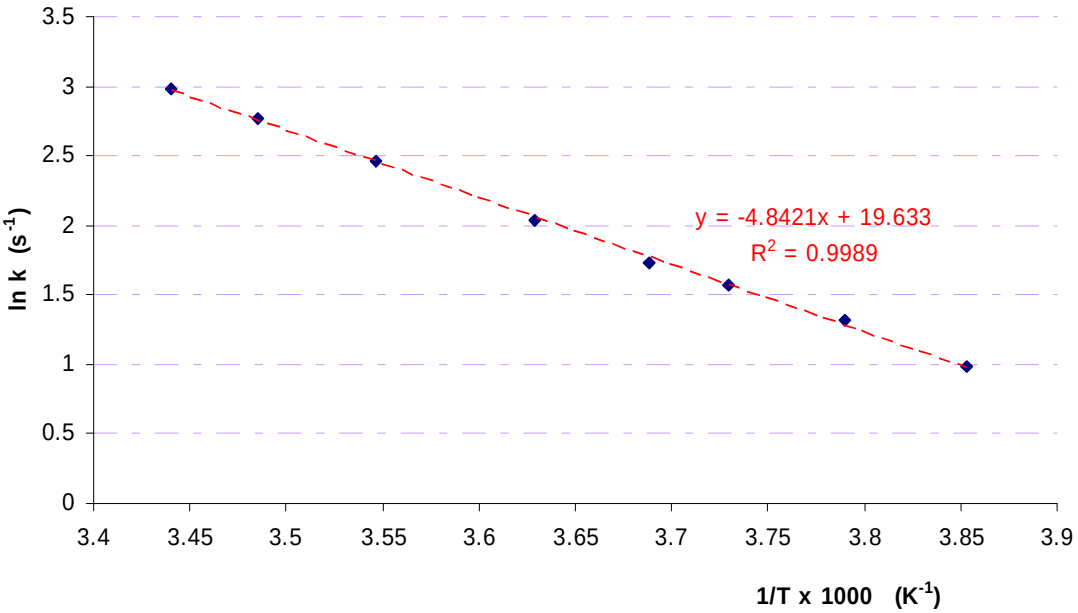

The demonstration shows that it is possible to monitor a kinetic at very precise temperatures over a wide range. Note that the temperature limits were set at -17℃ and 85℃ to match the limits of the bath. Contact the factory or your local representative for options to increase the temperature range from -90℃ to +160℃.

Please contact us for more information.

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