Heidolph meets Memmert – the clever combination for cell cultivation

Category: Shakers and Mixers
Whitepaper published October 2020

heidolph
research made easy

Testing the influence of continuous shaking on the media temperature within climate chambers

There are many possibilites on how to achieve the best environment for a cell culture. Whether it is a closed system, for example an incubation shaker or the combination of shakers and climate chambers, the choices are endless. Most cell culture laboratories already have a climate chamber as a staple inventory. As incubation shakers take a lot of space, which is rare in most laboratories, the implementation of shakers and existing climate chambers comes in handy. This whitepaper describes the importance of temperature stability during cultivation. For that, the influence of Heidolph shakers on the temperature of Memmert climate chambers was tested.

The many challenges of cell culture

The use of microorganisms as productionists for different commodities gains more focus in the overall life science fields. Whether it is the bulk production of medicine, like Insuline, or the production of fine chemicals. The advantages speak for themselves, like using by-products from the process as renewable raw materials, to shorten classical multi-stage chemical processes through one fermentation stage or sometimes, biotechnological procedures are the only way to manufacture certain products. With a higher popularity in industrial as well as research fields there are many different ways on how to use microorganisms for manufacturing processes.

As there are advantages, the preparation and production also has drawbacks. For example, it's crucial to always provide a sterile environment, the overall biomass yield can differ from batch to batch as well as the composition of the used complex media.

These are just several illustrations on what's important during working with microorganisms or in the overall cell culture field. To not loose track on what is salient for once own process, it's crucial to plan the procedure thoroughly from beginning to end.

Choosing the right parameters for the process

One of the key factors for the whole process is the microbial growth. Depending on what kind of microorganism one chooses for the process, different parameters have to be considered. Those can be divided into categories, chemical and physical. Chemical parameters are the composition of nutrient media (macro- and microelements) and oxygen-concentration. Physical parameters are mainly those regarding everything around the used reactor, incubator or climate chamber. These include the pH, temperature, osmolarity and sheer stress caused by the stirring unit. Especially the temperature is an important factor for the whole process itself as it regulates chemical and enzymatic reactions within in the cell.

Climate chamber – an allrounder in every laboratory

A climate chamber is used to cultivate sheer stress sensitive cells, Agar plates and for analytical methods, like hybridization. There is also a large variety of climate cabinets one can choose from. Most models come with a temperature range of +5 °C over room temperature up to 100 °C, as well as the possibility to enrich the atmosphere with CO_2, which is an important factor in cell cultivation. If the application requires temperatures below 25 °C, a climate chamber with cooling connections and an internal cooling system is the best choice.

All the above mentioned technical features, can be found in incubation shakers as well. So what is the advantage of combining a shaker with a climate cabinet? As almost every laboratory faces space problems, it is obvious to use available resources. As maybe one does not have the need to simultaneously shake and incubate the cells on a daily basis, it's easier to place an already available shaker in the climate cabinet. Furthermore the use of shakers with different motions in one chamber is feasible, therefore the possibility of various applications at once is increasing.

Objective: Testing the influence of continuous shaking on the media temperature within climate chambers

The influence of temperature fluctuations on microbial growth is a critical variable. Heidolph tested the influence of the Unimax 1010 on temperature during continuous shaking in the Memmert HPP260 and HPP410 climate chambers.

Method: Influence of Heidolph Unimax 1010 shaker on temperature fluctuations in Memmert climate chambers

The test series are carried out with two differently sized climatic chambers. Depending on the size of the climatic chamber and the space available, a different number of shakers can be installed. The Memmert HPP260 is equipped with two shakers, the Memmert HPP410 with three shakers of the same series. The actual temperature measurement takes place inside the medium. For that, an Erlenmeyer flask with a volume of one liter is filled with 800 ml of water; the rpm was set to 80; the overall time of the experiments is 48 h.

A: Memmert HPP260 in combination with two Heidolph Unimax 1010

One Heidolph Unimax 1010 is equipped with the attachment for Erlenmeyer flasks. A second shaker – also an Unimax – is placed in the climatic cabinet. The experimental set up can be seen in figure 1. To check the temperature during the experiment, the sensor is placed inside the medium. Table 1 shows the general conditions of the experiment.
The temperature-time curve of the experiment can be viewed in figure 2. At the beginning of the experiment, the medium has a temperature of 25.6 °C and reaches the desired actual temperature of 37 degrees after 374.1 minutes. In order to obtain an exact picture of temperature fluctuations, the experiment is continued for about 48 hours. All results achieved in the experiment are summarized in the table 2.

Fig. 1: Experimental setup of two Heidolph Unimax 1010 in the Memmert HPP260

Set parameters				
Shaking frequency	Temperature	Time	Volume (water)	Humidity control
80 rpm	**37 °C**	**2,872 min**	**800 ml**	**off**

Tab. 1: Parameters used in the experiment

Results	
Time to reach set Temperature	Deviation to set temperature 37 °C
374 min	**±0.3 °C**

Tab. 2: Results of the test carried out with two Heidolph Unimax 1010 over 48 hours at 37 °C

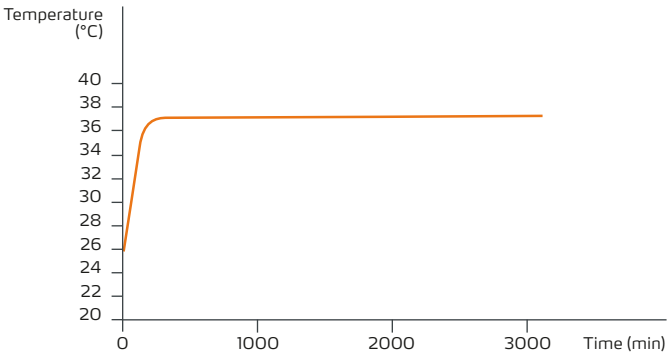

Fig. 2: Experimental setup of two Heidolph Unimax 1010 in the Memmert HPP260

B: Memmert HPP410 in combination with three Heidolph Unimax 1010

The test series is based on the experiments with the Memmert HPP260. The difference is that three shakers have place in the climate cabinet Memmert HPP410.
Three Heidolph Unimax 1010 units are placed in the Memmert HPP410. One of the shakers is equipped with the Erlenmeyer flask attachment. The media volume is 800 ml respectively; the thermometer is placed in the media. The set temperature to be reached and hold is 37 degrees, the duration of the experiment is 2,872 minutes. A speed of 80 rpm is set on the shakers. Table 3 shows a summary of all set parameters for the test series.

Set parameters				
Shaking frequency	Temperature	Time	Volume (water)	Humidity control
80 rpm	**37 °C**	**2,872 min**	**800 ml**	**off**

Tab. 3: Parameters for the test series

The course of the test series can be seen in figure 3. At the beginning of the experiment, the medium has a temperature of 22.8 °C and reaches the desired temperature – 37 °C – after 372 minutes. The experiment is carried out for 48 h so that any fluctuations in temperature can be observed precisely. As an overall result, the deviation from the set temperature is ±0,7 °C respectively. An overview of the results can be found in table 4.

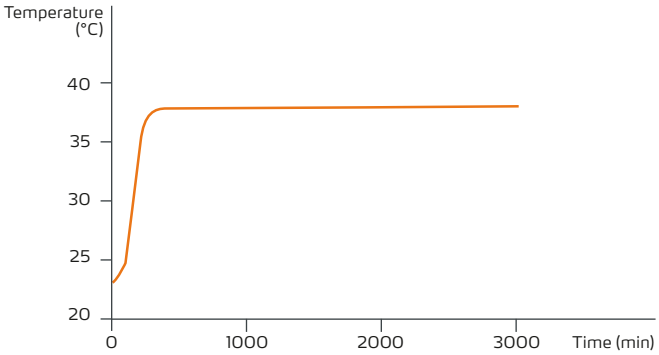

Fig. 3: Graph of temperature stability of the media during 2872 min in the climate chamber Memmert HPP410 with three Heidolph Unimax 1010

Results	
Time to reach set Temperature	Deviation to set temperature 37 °C
372 min	**±0.7 °C**

Tab. 4: Results of the test carried out with the Memmert HPP410 and three Heidolh Unimax 1010 units

C: Discussion of the result

The deviation of the temperature during the test series of the Memmert HPP260 is ±0.3 °C respectively. This deviation can be readjusted easily during the application or incubation of the cell culture. Overall the impact of two Heidolph Unimax 1010 units on the endurance of the climate cabinet is low.

The temperature fluctuation with three shakers in the Memmert HPP410 is ±0.7 °C. This is still within the scope of the variance, which means that this experimental set up is still suitable for sensitive applications.

Conclusion: Operating Heidolph shakers in Memmert climate chambers is a solution for cell cultivation

The test series prove that there are no significant temperature fluctuations during the continuous operation of Heidolph Unimax 1010 shakers in Memmert climate chambers. In addition, the growth of temperature-sensitive organisms is not impaired. Overall it is a powerful tool to push one's process forward. The test series prove that there are no significant temperature fluctuations during the continuous operation of Heidolph Unimax 1010 shakers in Memmert climate chambers. In addition, the growth of temperature-sensitive organisms is not impaired. Overall it is a powerful tool to push one's process forward.

memmert
Climate chamber HPP260

2 x Unimax 1010

Temperature increase

±0.3 °C

memmert
Climate chamber HPP410

3 x Unimax 1010

Temperature increase

±0.7 °C

For any technical questions, application support etc. please contact us under:

EUROPE / AFRICA / ASIA
ASIA PACIFIC / SOUTH AMERICA
Heidolph Instruments GmbH & Co. KG
Walpersdorfer Str. 12
D-91126 Schwabach
Phone: +49 9122 9920-0
Fax: +49 9122 9920-0

sales@heidolph.de
www.heidolph.com

NORTH AMERICA
Heidolph North America
1235 N Mittel Blvd. Suite B
Wood Dale IL 60191

Phone: +1 224-265-9600
Fax: +1 224 265-9611

custserv@heidolph.com
www.heidolphna.com

heidolph
research made easy