

# Kuhner shaker

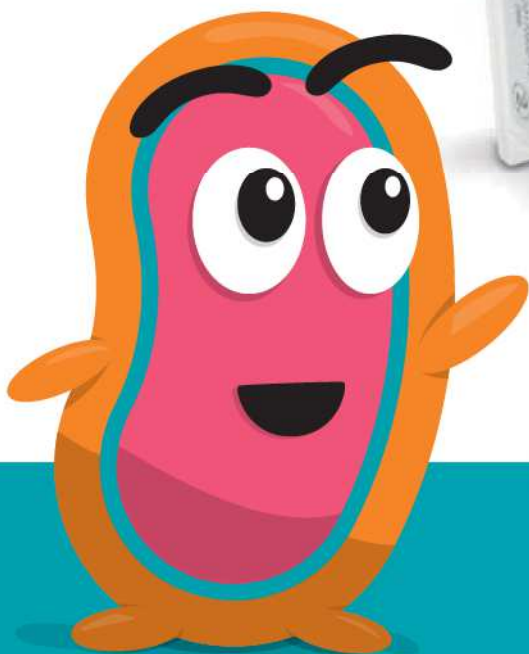
## Feeding Technology

### Intelligent

# Feeding Products

### for Maximum Cell Efficiency

The Kuhner Feeding Technology allows a reliable screening on a microliter scale to ensure optimum strain selection.



# Are you searching for the **most productive cell strain** for a fed-batch process?

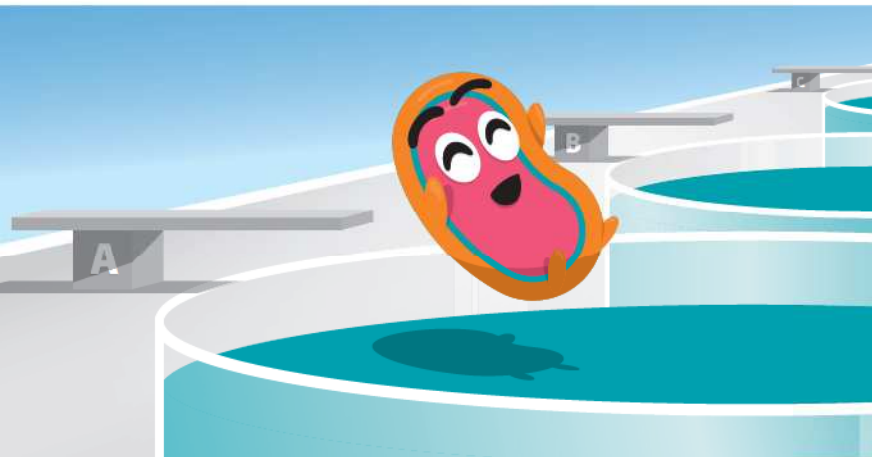
## **Feedy**

Nutrition expert for microorganisms and cell cultures



Have you ever thought about what your cells need to effectively produce?

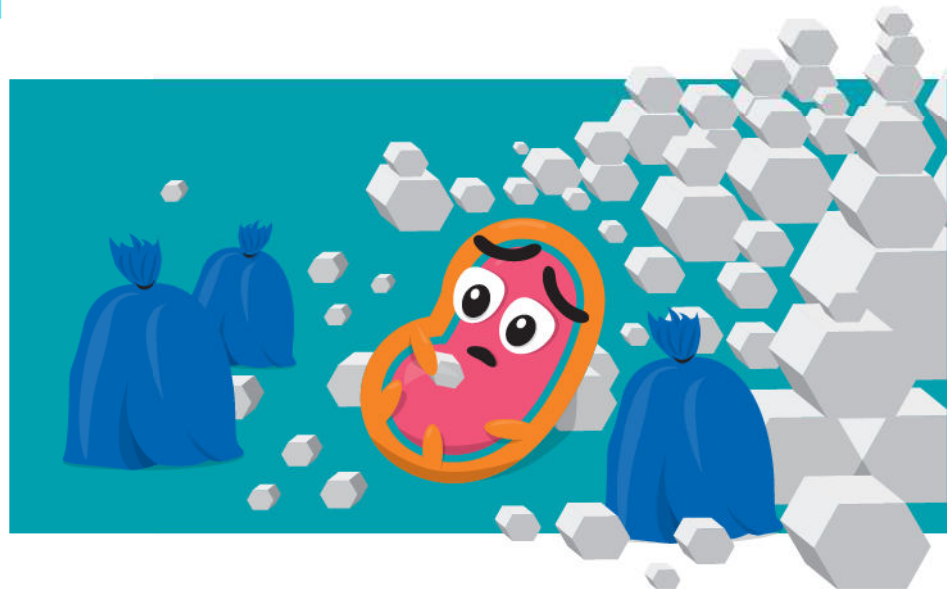
Our nutrition expert "Feedy" will explain the advantages of a fed-batch screening and present the solution for choosing an optimum strain.



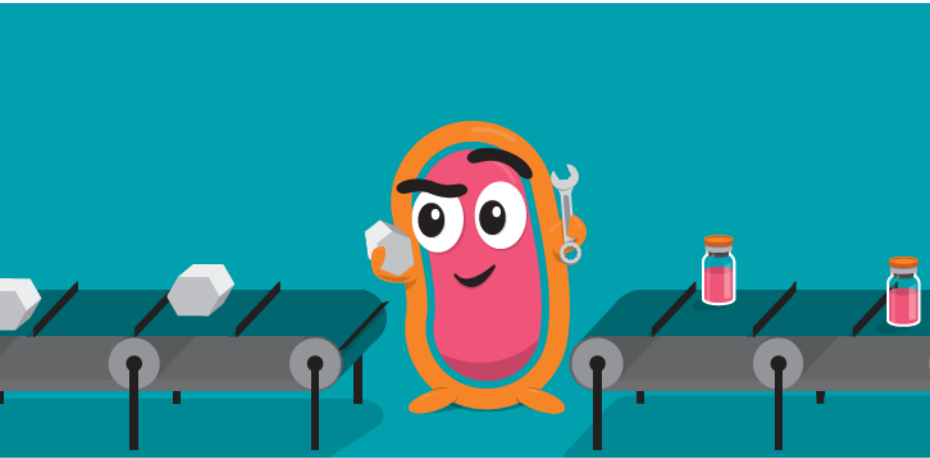
To demonstrate the differences between conventional batch screening and the cultivation conditions with Kuhner Feeding Technology, 'Feedy' is now going to dive deeply into the cultivation and analyze the various operating conditions.

## **Glucose excess** in conventional batch screening **makes cells sluggish**

In conventional batch screening, the complete amount of nutrients in the medium has been set from the very beginning. Due to the excess of nutrients at the beginning, the cells reproduce rapidly but often become sluggish. As a result, they partially also generate undesired by-products in addition to the target product. The process is inefficient.



## With the correct dosing of nutrients, cells become maximally efficient

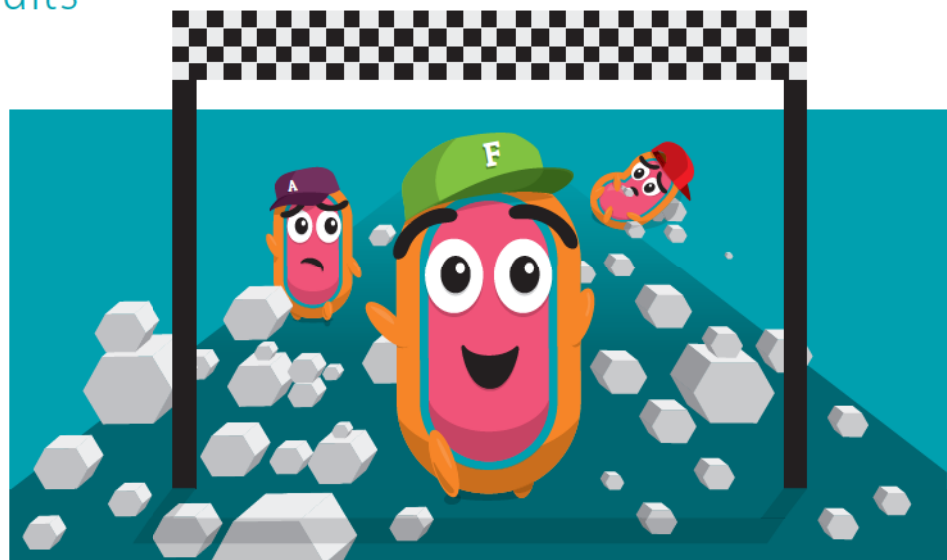


In the fed-batch process, the nutrients are continuously added to the medium.

Through the now existing nutrient limitation, the cells become especially active. This leads to optimum product yields. Fewer by-products are formed, and the danger of a pH-decrease and oxygen limitation is reduced.

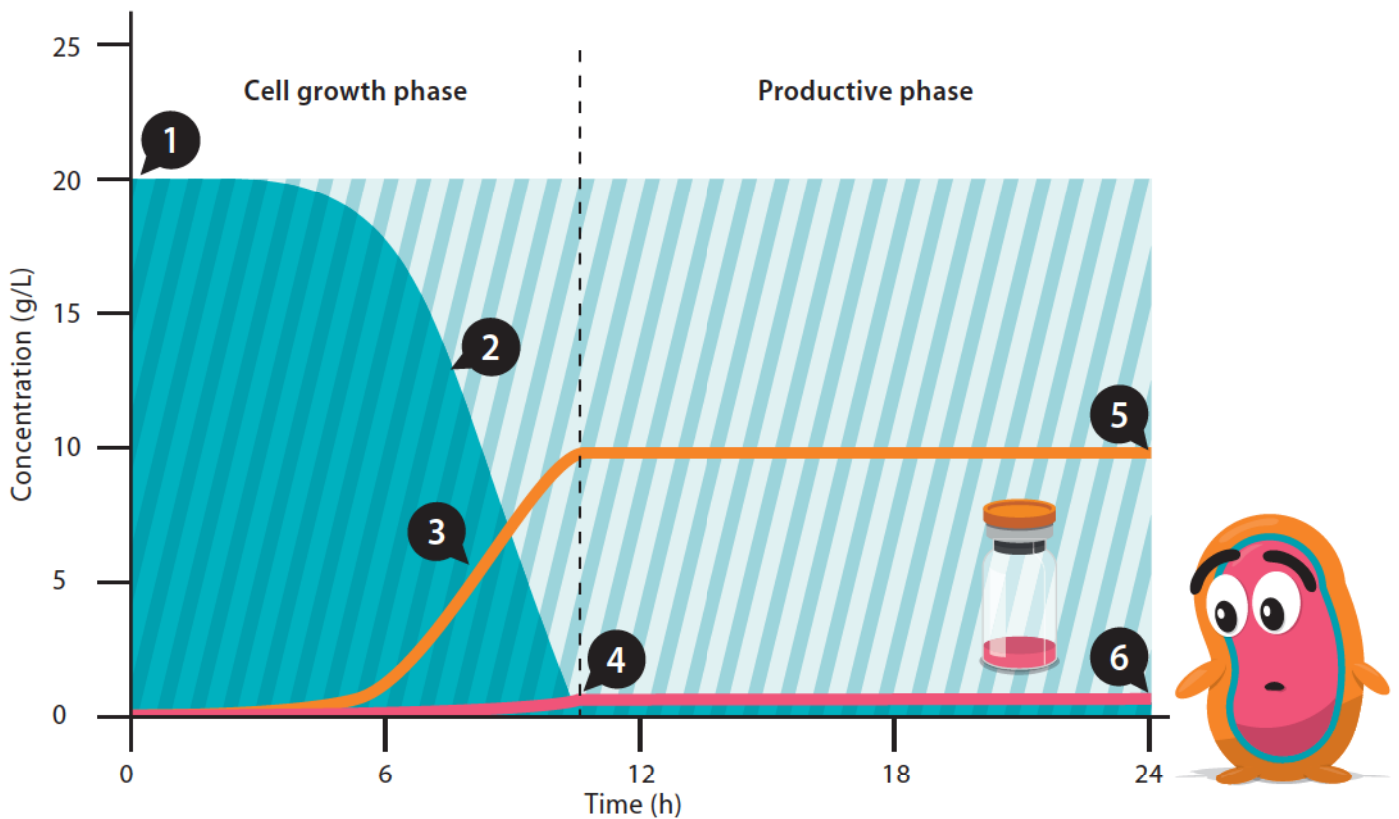
## The ambient conditions are crucial for optimal screening results

Using the Kuhner Feeding Technology, the screening conditions are more comparable to those on a production scale. Thus, an unfavorable strain selection is avoided already early on. Comparable and reproducible conditions in screening allow you to identify the optimum production strain already at an early time point. Consequently, this reduces costs as well as time-consuming process adaptations during later process development.





# Batch Cultivation

## of a catabolite-repressed strain



### Diagram legend:

 Glucose concentration in medium

 Biomass

### 1 Complete amount of glucose is present at the start

In conventional batch screening, the complete amount of glucose is added to the medium. The concentration of glucose in the solution decreases continuously.

### 2 Glucose excess

3 Through excessive glucose, the cells reproduce exponentially, without forming the desired product. During this time, product formation is repressed (catabolite-repressed). There is a high risk of oxygen limitation and of formation of undesired by-products.

### 4 Short productive phase

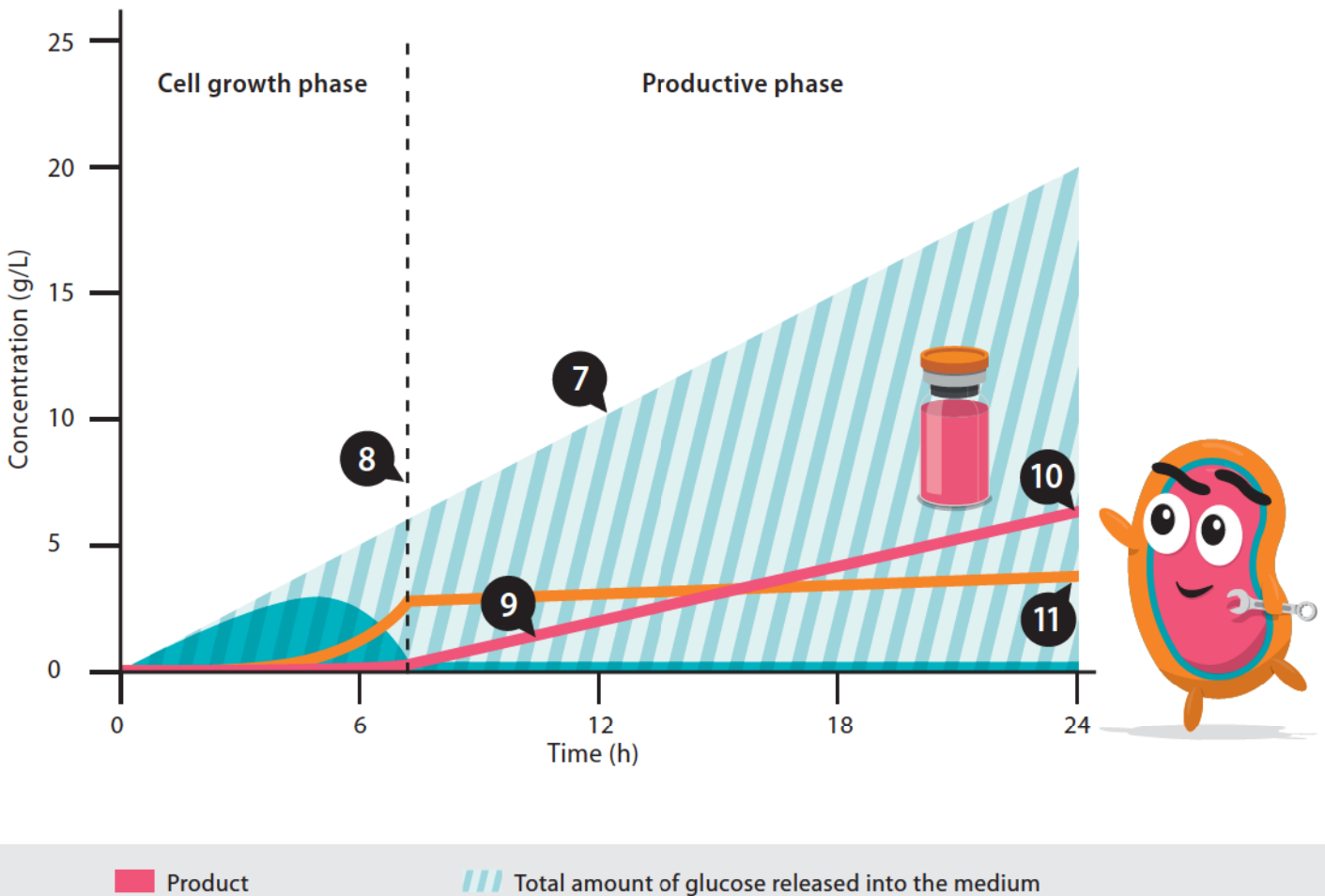
The formation of the target product starts only after the glucose is almost completely depleted. The catabolite repression is deregulated. But the remaining glucose concentration is so low that product formation is finished totally after a short time.

### 5 Much biomass, little yield

6 Mainly biomass has been formed at the end of batch cultivation, the product yield is low.

# Fed-Batch Cultivation

of a catabolite-repressed strain with the Kuhner Feeding Technology



## 7 Continuous supply of glucose

Already during screening, the Kuhner Feeding Technology continuously releases glucose into the medium. Thus, the conditions are more comparable to those of the later production process. This enables you to select the optimum strain.

## 8 The productive phase is reached faster

During the cell growth phase, the released glucose accumulates briefly in the medium. The cells grow exponentially and form biomass until all accumulated glucose is consumed. The subsequent productive phase is rapidly attained.

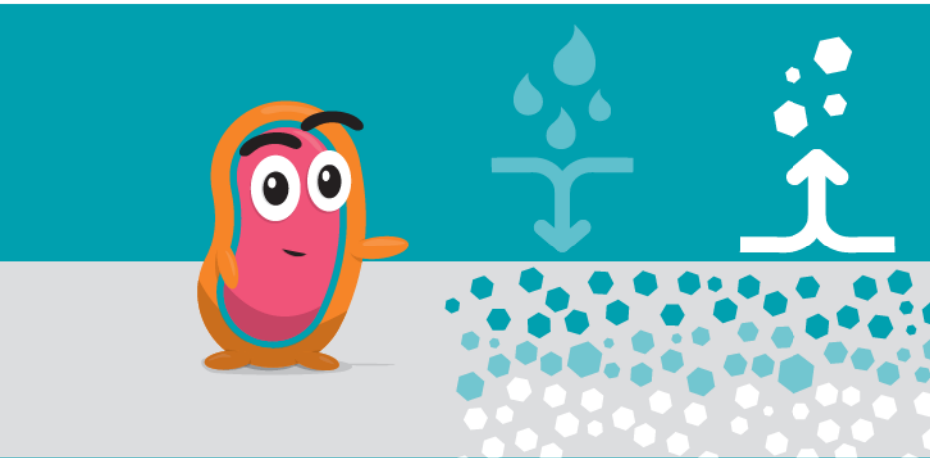
## 9 Continuous product formation

The glucose concentration in the medium is almost zero, because the released glucose is metabolized immediately. As a result, the cells are not catabolite-repressed, and the target product is continuously generated. The conversion of glucose into product is maximally efficient.

## 10 Optimum product yields

11 Through the long productive phase, considerably more target product is formed at lower biomass concentration. The product yield is high and comparable with that of the later production process.

Liquid penetrates slowly  
**into the silicone matrix...**



Our technology is based on a silicone polymer loaded with nutrients. Upon contact with liquid, the nutrients are continuously released into the medium. This allows a controlled feeding of the culture. The products of the Feeding Technology are supplied in a sterile packing and can be simply used with standard laboratory equipment.

...therefore, the **glucose is released evenly** into the solution.



# Advantages of the Feeding Technology at a glance



## High product yield

Continuous nutrient release to ensure optimum product formation.



## Selection of the best strain

Fast and reliable finding of the optimal production strain.



## Reduction in Costs

Low investment costs and avoidance of unforeseen development costs.

## Avoidance of negative process influences

Lower risk of an oxygen limitation and reduction of undesired by-products.

## Simple Scale-Up under process-realistic conditions

Time saving and cost reduction during bioprocess development through simple transferability of results.

## Various substrates and release rates

The Kuhner Feeding Technology allows the release of various nutrients at different release rates without using foreign enzymes.

## Comparable conditions between production and screening

Comparable cell metabolisms in screening and in production.

## Higher reproducibility of the screening

Adapting the preculture in the fed-batch increases the reproducibility of the main culture.

## Fast and easily integrated in the laboratory

Sterilely packaged and easily to handle, the technology is usable with standard laboratory equipment.

## Better Screening Results



# FeedPlates®

## Glucose Low, Standard and High release

Type	Article	Substrate	Release after 48 h*
96 well, round	SMFP01001	Glucose	5 mg
96 well, round	SMFP04001	Glucose	9 mg
96 well, round	SMFP08001	Glucose	10 mg
96 well, round	SMFP17001	Glucose	3 mg
96 well, square	SMFP01002	Glucose	6 mg
96 well, square	SMFP04002	Glucose	12 mg
96 well, square	SMFP08002	Glucose	14 mg
96 well, square	SMFP17002	Glucose	5 mg
48 well, round	SMFP08004	Glucose	23 mg
24 well, square	SMFP01003	Glucose	30 mg
24 well, square	SMFP04003	Glucose	48 mg
24 well, square	SMFP08003	Glucose	60 mg
24 well, square	SMFP17003	Glucose	18 mg

## Glucose High release plus

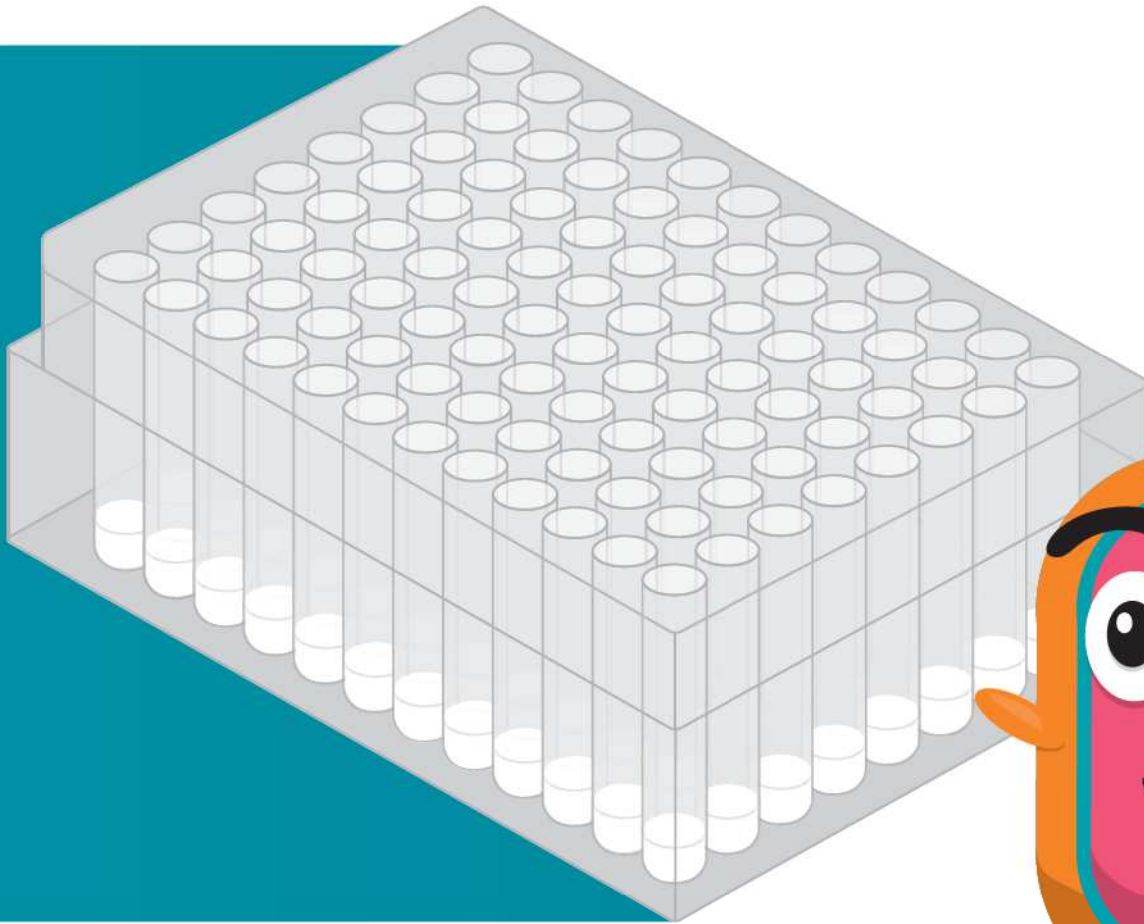
Type	Article	Substrate	Release after 48 h*
96 well, round	SMFP20701	Glucose	15 mg
96 well, round	SMFP20801	Glucose	19 mg
96 well, square	SMFP20702	Glucose	18 mg
96 well, square	SMFP20802	Glucose	24 mg
48 well, round	SMFP20704	Glucose	36 mg
48 well, round	SMFP20804	Glucose	46 mg
24 well, square	SMFP20703	Glucose	100 mg
24 well, square	SMFP20803	Glucose	125 mg

## Glycerin Low and High release

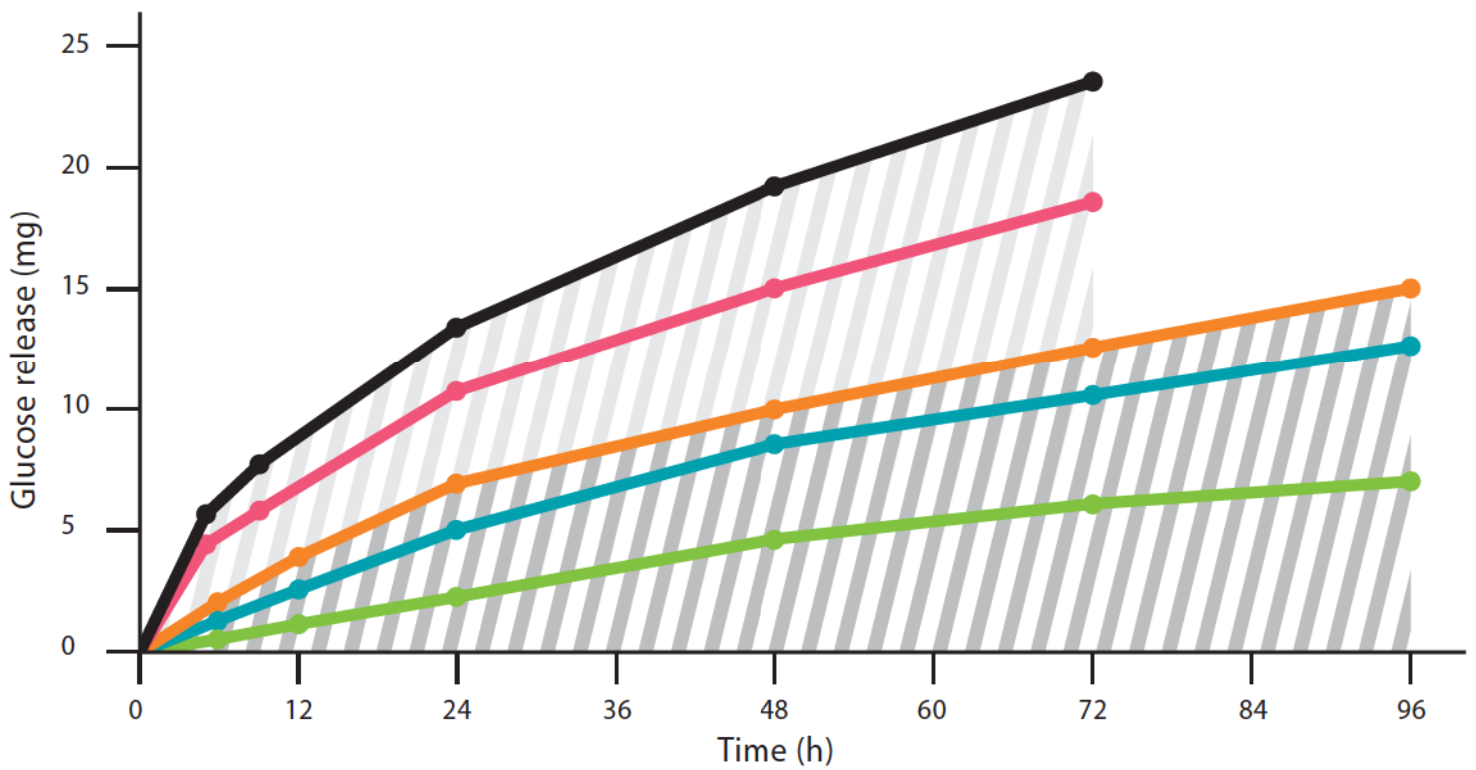
Type	Article	Substrate	Release after 48 h*
96 well, round	SMFP11001	Glycerin	3.5 mg
96 well, round	SMFP12001	Glycerin	6.5 mg
96 well, square	SMFP11002	Glycerin	5 mg
96 well, square	SMFP12002	Glycerin	10 mg
48 well, round	SMFP11004	Glycerin	10 mg
48 well, round	SMFP12004	Glycerin	19 mg
24 well, square	SMFP11003	Glycerin	27 mg
24 well, square	SMFP12003	Glycerin	33 mg

\* Release determined at 37 °C in 10 mM PBS Puffer, pH 7.4





## Release of various 96-well FeedPlates®



### Article numbers

● SMFP20801 ● SMFP20701 ● SMFP08001 ● SMFP04001 ● SMFP01001

### Processes

/// High release plus /// Low, Standard and High release

# FeedBeads®

Simple use of Fed-Batch  
in Shake Flasks

Package size: 25 Beads/Package



## Glucose

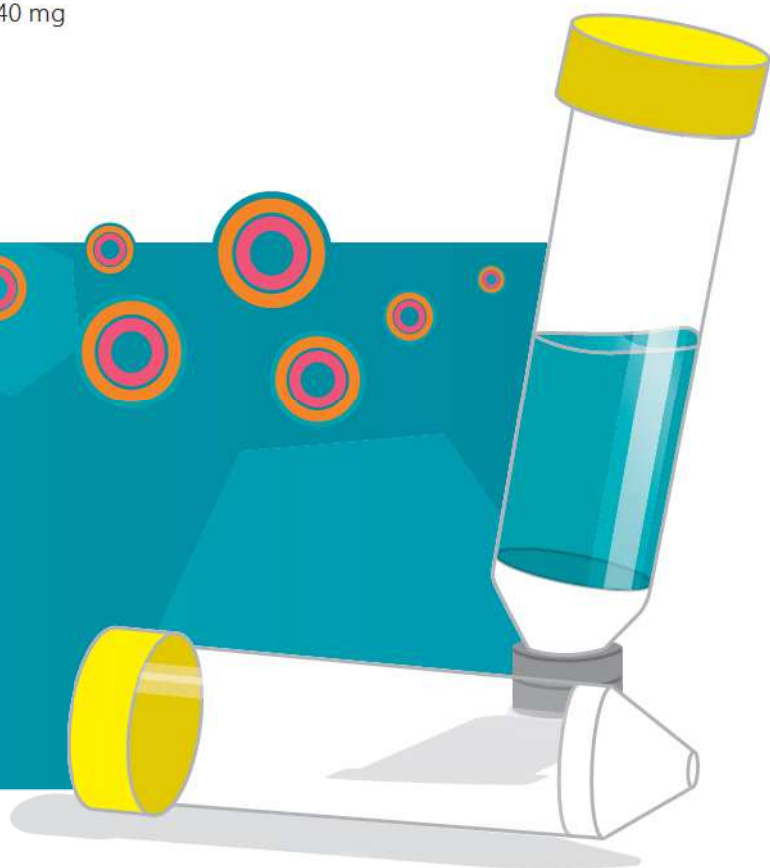
Type	Article	Substrate	Release after 48 h*
Ø 12 mm, h=3 mm	SMFB01001	Glucose	32 mg
Ø 12 mm, h=3 mm	SMFB02001	Glucose	40 mg
Ø 12 mm, h=3 mm	SMFB08001	Glucose	75 mg

## Glycerin

Type	Article	Substrate	Release after 48 h*
Ø 12 mm, h=3 mm	SMFB11001	Glycerin	15 mg
Ø 12 mm, h=3 mm	SMFB12001	Glycerin	40 mg

# FeedTubes®

Individual charging of standard  
TPP cultivation test tubes with  
various releases and substrates.



\* Release determined at 37 °C in  
10 mM PBS Puffer, pH 7.4

# Put together your own **free Feeding Test Kit** and **convince yourself**



## Customized for you!

We know how individual your specifications may be. That is why, we compile the contents of our Test Kits to fit your requirements. We will meet your needs with one of our Feeding products or a combination of several ones. Therefore, please feel free to contact us and inform us of your specifications.

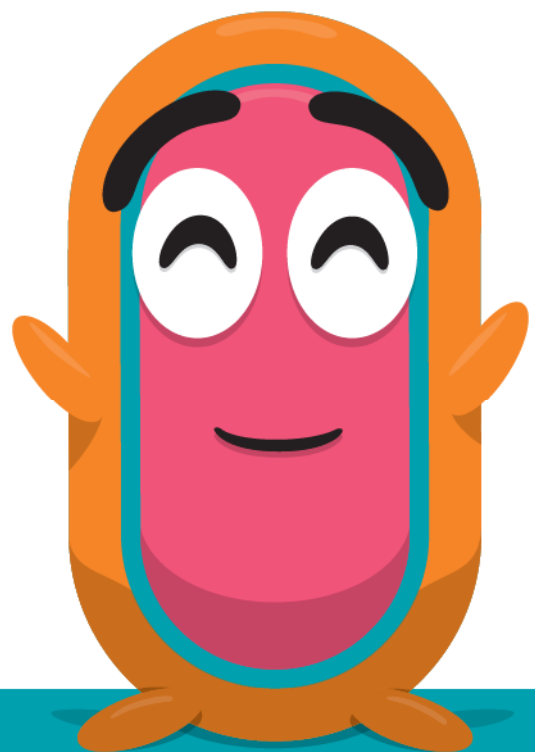


Request your customized Test Kit directly by e-mail: [deoffice@kuhner.com](mailto:deoffice@kuhner.com)  
or by telephone: **+49 (0) 2407 55 48 822**

# Kuhner shaker

## Feeding Technology

Nice to  
**feed you**



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