



Liquid Injection System (LIS)

Automated Feeding of Liquids in Shake Flasks

aquila**biolabs**

LIS is the first easy-to-use technology allowing for automated feeding of liquids into microbial shake flask cultures.

The Technology



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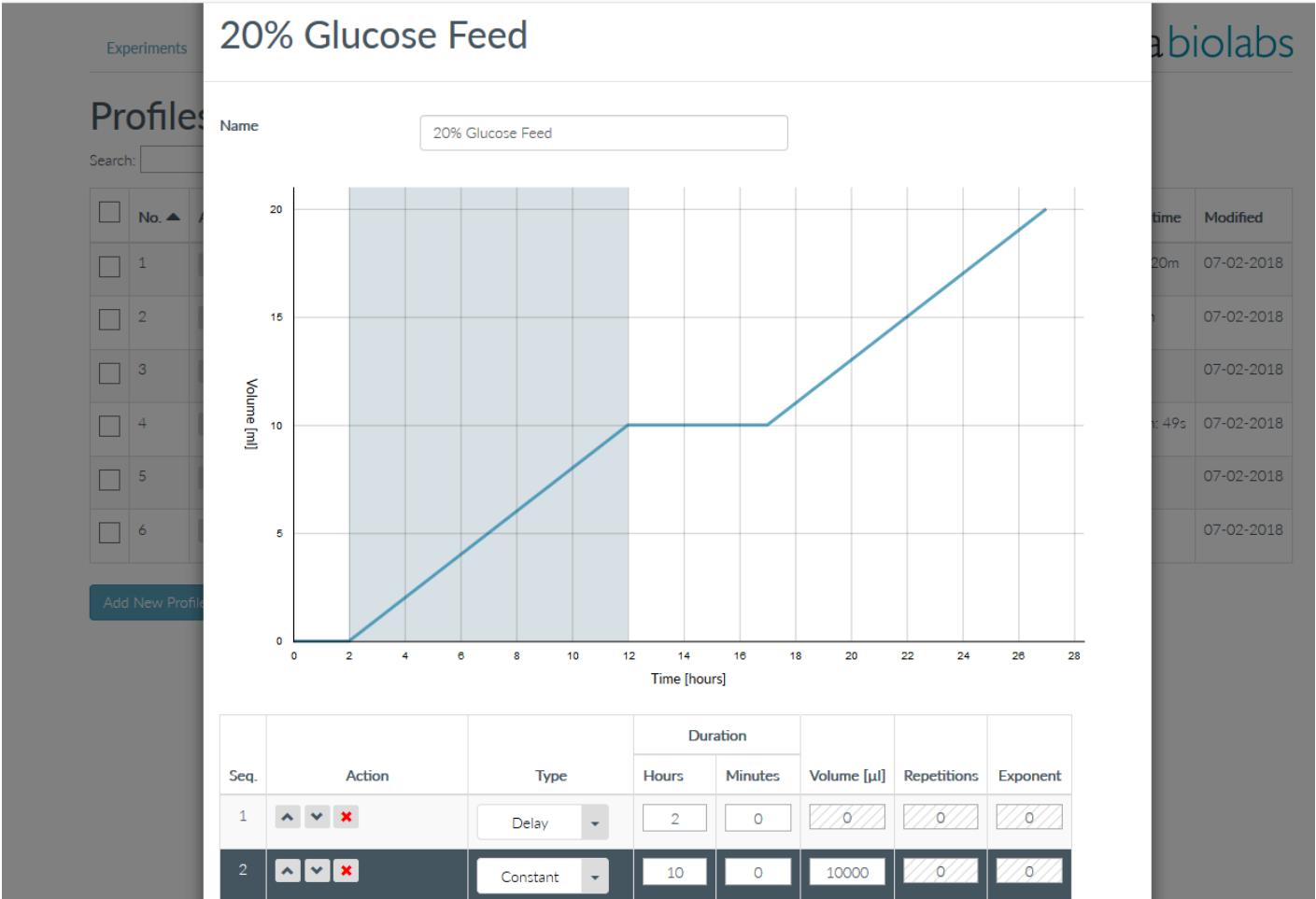
The LIS Drive and the the LIS Cartridge are the two key components of the LIS technology.

LIS Components (1/3): LIS Drive and LIS Cartridge



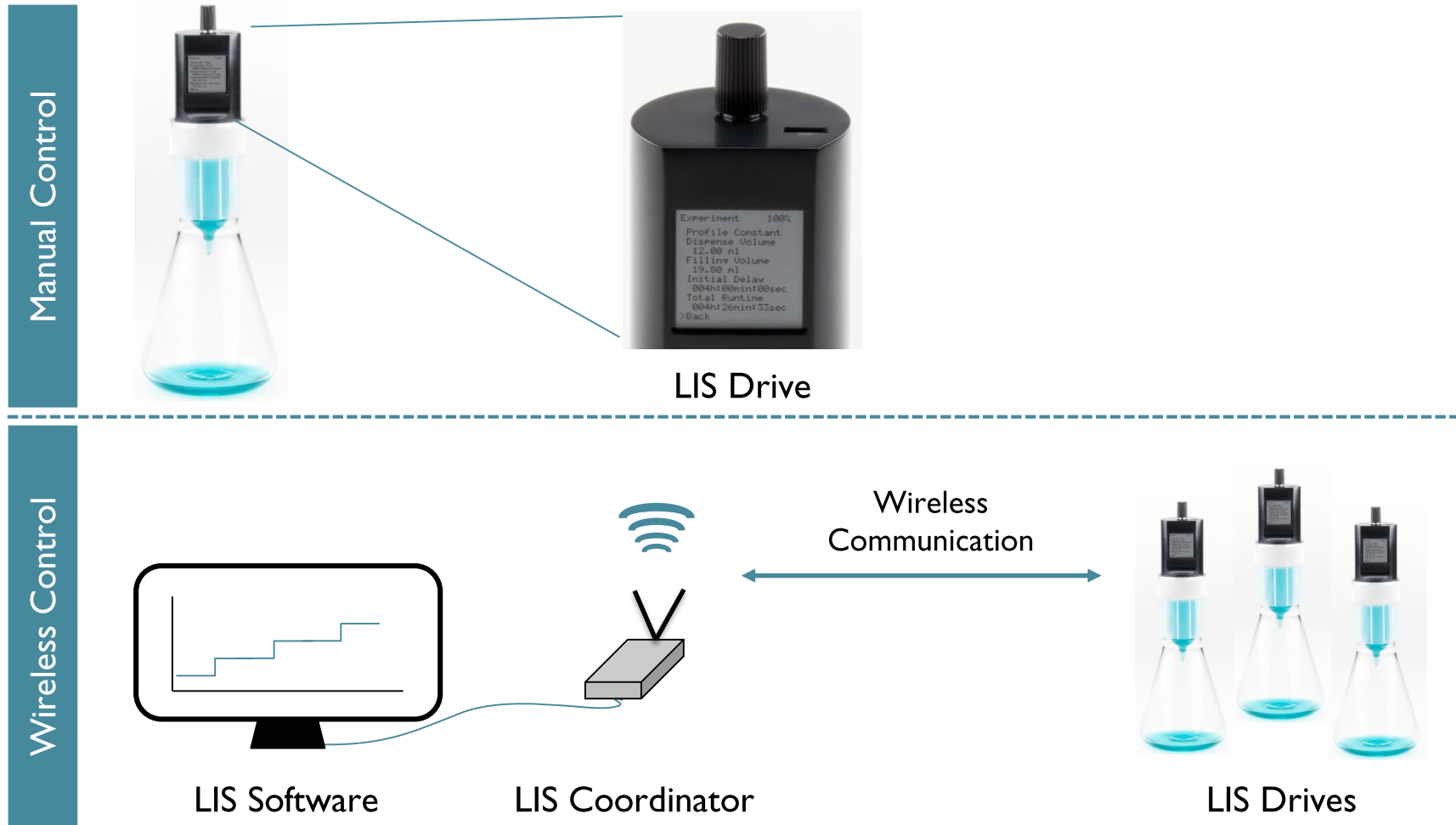
The LIS Drive and the the LIS Cartridge are the two key components of the LIS technology.

LIS Components (2/3): LIS Software



You can either set-up your LIS experiments manually on the drive, or wirelessly by using the LIS Software.

Control Options: Manual vs. Wireless



Optionally, customers can use LIS flasks to meet the increased oxygen demand of their microbial cultures when performing feeding experiments with LIS.

LIS Components (3/3): LIS Flasks



What are LIS Flasks?

During Fed-Batch experiments with LIS, many microbial bioprocesses show an increased demand for oxygen. LIS shake flasks have additional necks allowing you to meet the increased oxygen demand of your cultures.

Specifications

- For microbial cultures
- Standard 38mm top neck for mounting of LIS
- 1 additional side neck for maximal oxygen intake
- 250, 500, 1000 and 2000ml shake flasks (with and without baffles)
- Autoclavable glass flasks

Benefits

Use your standard seal (e.g. cotton plug), while applying the LIS technology and avoid an oxygen limitation for your culture.

LIS compatible with cell cultures (e.g. CHO cells) currently under development.

LIS flasks can be used with all commonly used shake flask seals to generate good oxygen transfer rates.

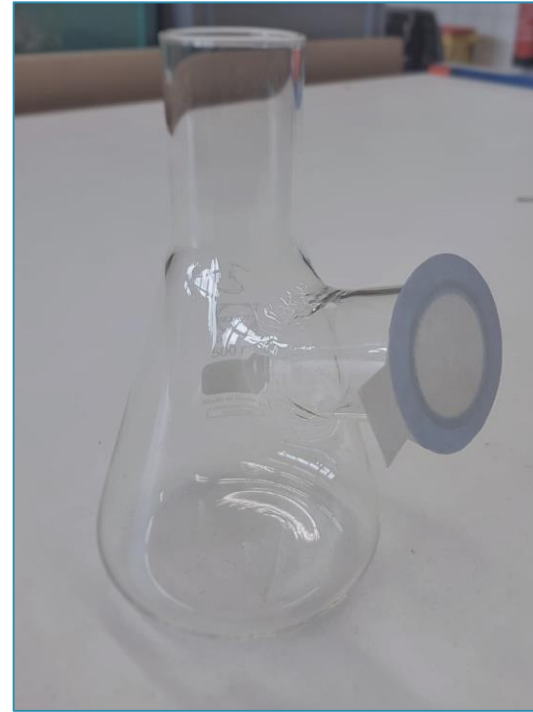
Examples of LIS Flask Side Neck Sealing Options



Cotton plug



Aluminium cap



AirOtop seal



Silicone sponge closures

LIS and its key components as well as accessories are priced competitively at attractive market entry prices.

List Prices

Component	Importance	Key Facts	Price
LIS Drive	Mandatory	<ul style="list-style-type: none">– Programmable miniature pump– Plug and Play	<ul style="list-style-type: none">– 699 EUR
LIS Cartridge	Mandatory	<ul style="list-style-type: none">– Box of 50 cartridges including accessories– Single Use	<ul style="list-style-type: none">– 429 EUR / Box– ~ 8,6 EUR / Experiment
LIS Software (including LIS coordinator)	Optional	<ul style="list-style-type: none">– Software for wireless control of LIS Drives– Incl. Feeding Profile Generator– Unlimited End-User-Licenses	<ul style="list-style-type: none">– 999 EUR
LIS Flask	Optional	<ul style="list-style-type: none">– Special Glass Flask for increased oxygen intake	<ul style="list-style-type: none">– 89 EUR (250ml)– 99 EUR (500ml)– 129 EUR (1000ml)– 169 EUR (2000ml)

All prices are net prices excluding VAT or costs for shipment.

LIS is compatible with a broad range of different chemicals, routinely used for feeding experiments.

Compatible Substances

Substance	Comment
Sugar solutions (e.g. 50% glucose)	
Viscous solutions (e.g. 75% glycerol)	
Aqueous solutions (e.g. IPTG, acids, bases, buffers)	
Alcohols (e.g. 50% ethanol, 75% methanol)	Accuracy varies with temperature, concentration and type of alcohol
Antifoam	Accuracy can vary for different types of antifoam
Organic solvents (e.g. DMSO)	
Fats (e.g. olive oil)	
Phages	
Cell suspensions	

LIS is compatible with all common laboratory shakers and shaking conditions.

Compatible Maximal Shaking Conditions

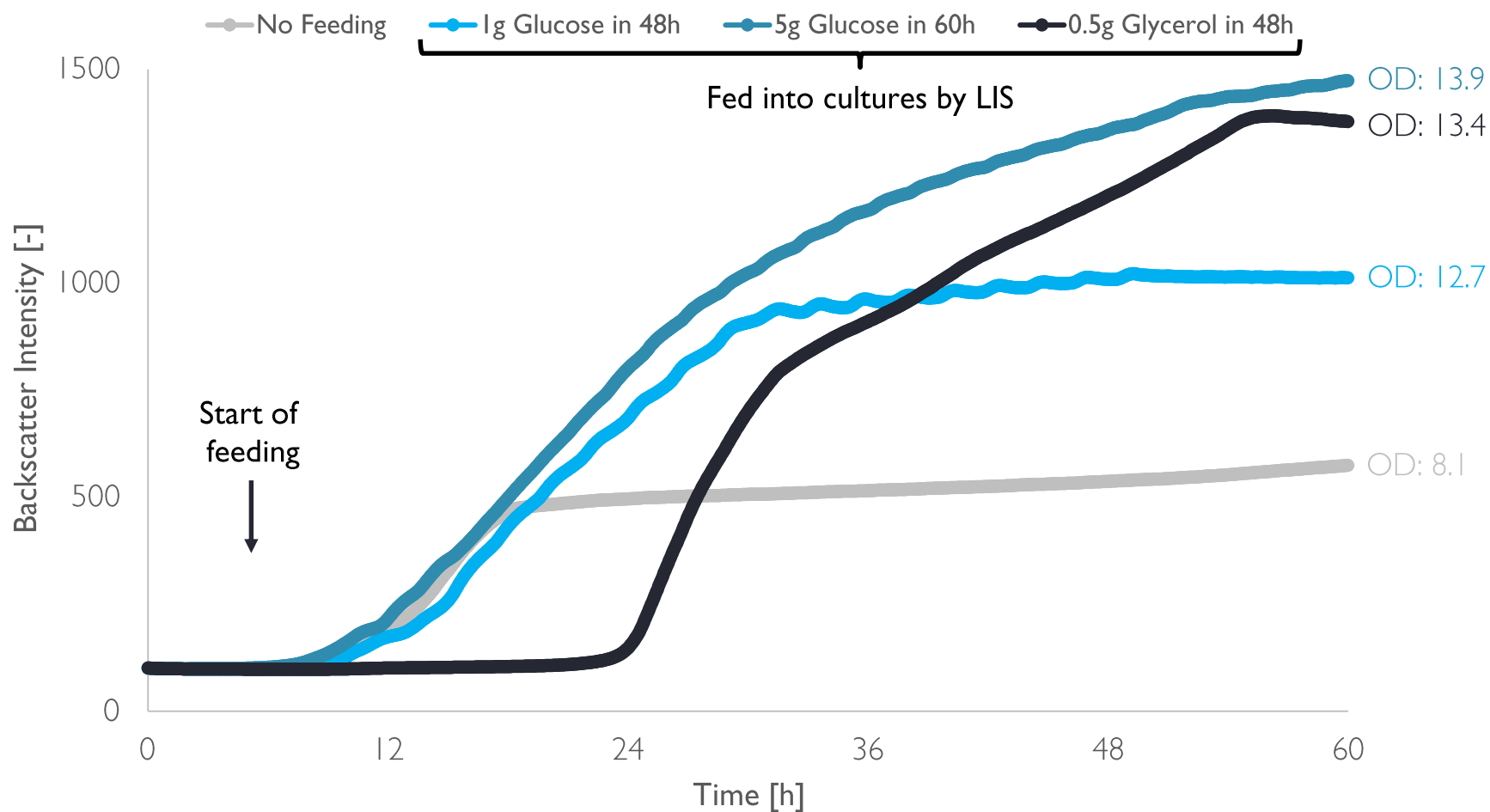
Shaking diameter	Flasks fixed on tray with ...	Setup	Shake flask size (total volume)				
			100 ml	250 ml	500 ml	1000 ml	2000 ml
25 mm	Clamps	Shake flask only Shake flask + “new” CGQ sensor Shake flask + “old” CGQ sensor	250 250 250	300 300 300	250 300 300	250 300 300	250 250 250
	Sticky stuff	Without CGQ sensor	200	200	200	250	250
50mm	Clamps	Shake flask only Shake flask + “new” CGQ sensor Shake flask + “old” CGQ sensor	250 200 250	250 250 250	225 225 225	225 225 225	200 200 200
	Sticky stuff	Without CGQ sensor	200	200	250	250	250

Tests were performed with a flask filling volume of 10% and 20 mL filling volume of the LIS cartridge

All data is shown in rounds per minute (rpm)

LIS is the first technology allowing for fed-batch experiments in shake flask cultures.

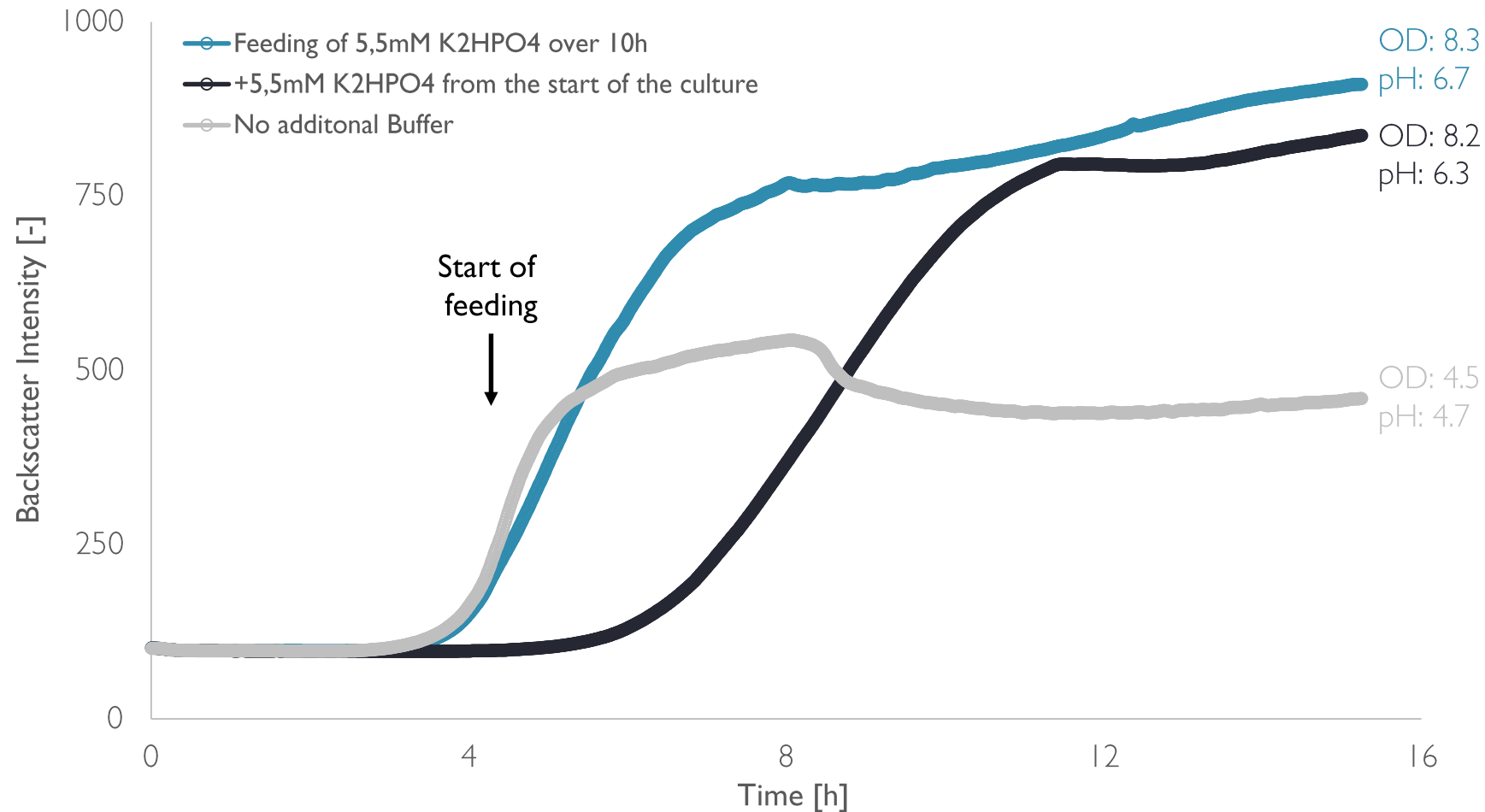
Exemplary Use Case (1/3): Fed-Batch



Saccharomyces cerevisiae, 25 ml YPD Medium, 250 ml Shake Flasks, 30 °C, 250 rpm

LIS can be used to control pH drifts of *Escherichia coli* shake flask cultures by automatically feeding buffer to the culture.

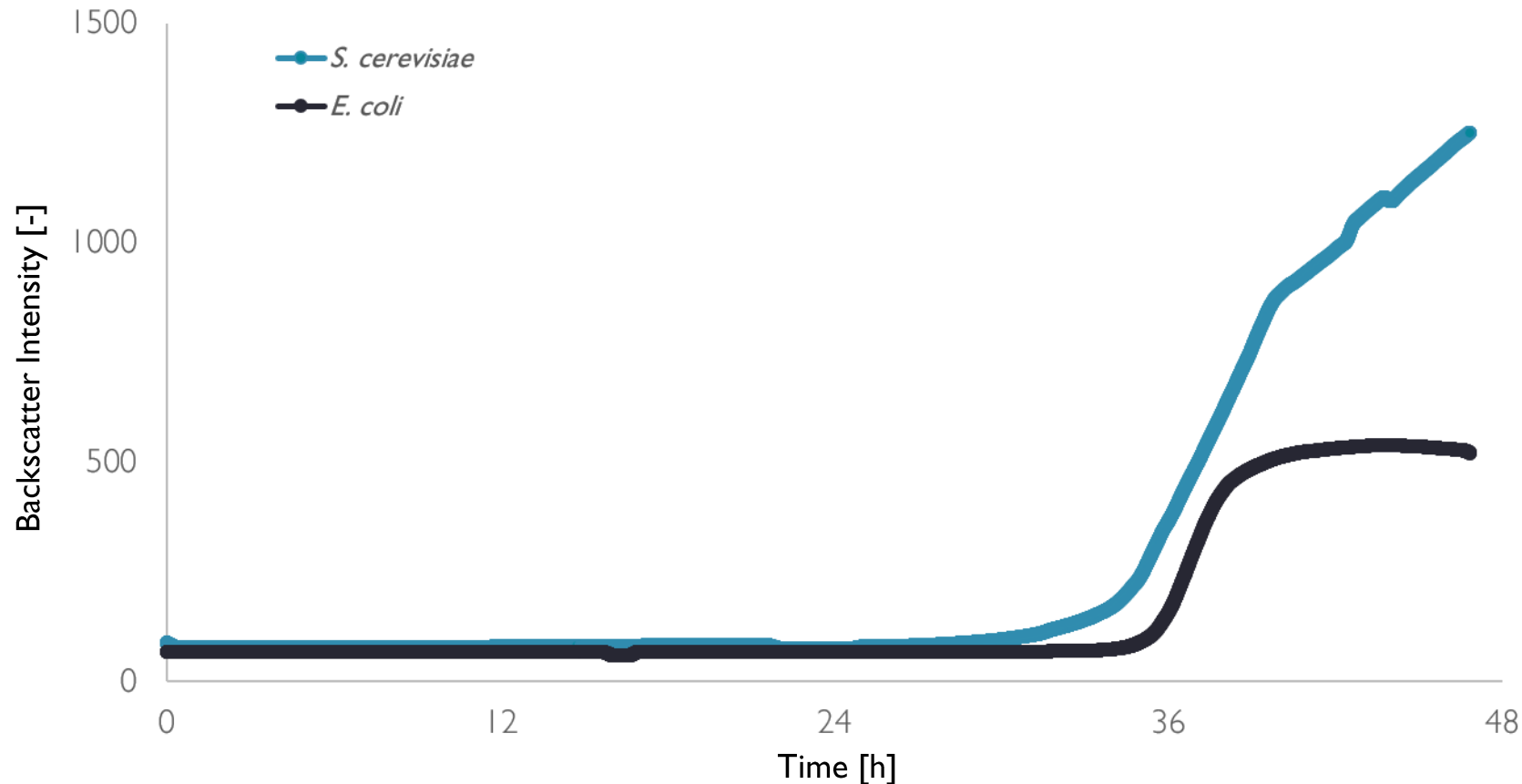
Exemplary Use Case (2/3): pH Regulation



Escherichia coli, 25 ml LB Medium + 2 % Glucose, 250 ml Shake Flask, 37°C, 250 rpm

LIS can be used to time your precultures perfectly for the next experiment.

Exemplary Use Case (3/3): Preculture Inoculation



The first LIS cartridge was filled with an *E. coli* culture (LB medium + Kanamycin, OD600 = 0.1). 1 ml of this culture was dispensed into a 250 ml shake flask filled with 25 ml LB + Kanamycin using a single shot after an initial delay of 32 h. The second cartridge was filled with a *S. cerevisiae* culture (YPD medium + 0.5 M NaCl, OD600 = 0.1). 1 ml of that culture was fed into a 250 ml shake flask filled with 25 ml YPD medium + 0.5 M NaCl using the same feeding profile.