

# Advanced Biofuel Development

## with DASGIP Parallel Bioreactor Systems

### Biofuel Development

Biofuels is one of the most exciting areas of today's biotech research aiming at biotechnical methods of fuel production being competitive with conventional procedures in the near future.

DASGIP has geared its line of parallel bioreactor systems towards the needs for biofuel development providing monitoring and control of pH and redox potential, gas supply of non-common gasses such as methane and temperature control up to 95°C.

### Anaerobic Conditions

If anaerobic conditions are required gas tight vessels are essential for biofuel development. DASGIP vessels can be equipped either with a silicone or with a fluorine caoutchouc (FPM80) seal. Both materials were tested by optical method using a resazurin solution.

In tests lasting several days, anaerobic conditions could be maintained. After initially sparging with nitrogen, any gas supply was cut off but overhead agitation was started to prove the lip seal assembly. Both seal types proved to sustain anaerobic conditions for several days, with the FPM80 showing a slightly better performance.

### Temperature

For the pre-treatment of a raw carbon source (e.g. cellulose), high temperatures may be required. The DASGIP temperature control modules in combination with the DASGIP Bioblock, an integrated agitation and temperature regulation unit, are available at an extended temperature range from below ambient up to 95 °C.



8-fold DASGIP Parallel Bioreactor System

### pH and Redox Control

In anaerobic metabolism of microorganisms a negative redox potential is essential for specific enzyme activities. As even small changes in pH can influence the redox potential, both parameters have to be monitored and controlled closely.

DASGIP PH4RD4 (PH8RD8) modules can measure redox potential and pH simultaneously and individually in four (eight) reactors. Addition of reducing agents, base or acid with the DASGIP multi pump modules allows adjustment and regulation of pH and redox values. By being able to control these conditions researchers can find optimum process parameters.

Users can combine these features with further options such as off-gas analysis, optical density monitoring and level/anti foam control.

All modules are suitable for working volumes from 150 mL up to pilot scale.

Application Biofuels

Quality System certified by DQS ■ DIN EN ISO 9001 ■ Reg.-No. 63431

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### Gassing

DASGIP has extended its line of gassing systems: With the MX4/1, one bioreactor is supplied with a mix of up to four mass flow controlled input gasses. The MF4 combines four mass flow controllers in one module. It allows gassing not only of common gasses such as oxygen or carbon dioxide but also of methane, carbon monoxide or other non-common gasses. Separate gas leads ensure safe gassing even of gases which would normally react with each other with one module.

Four optional pressure sensors at the outputs provide safe operation of glass vessels and single-use plastic containers with both gassing modules. Both versions are designed to serve working volumes from bench top up to pilot scale, providing flow rates of up to 30 sL/min per output.

### Automation

Some biofuel processes involve a multi step procedure. For example, single unit sugars have to be extracted by pre-treatment from a raw carbon source (e.g. cellulose). By then feeding the glucose or other sugar solution to the micro organism culture conversion to alcohol (e.g. ethanol) is induced.

The DASGIP system supports the automation of these process steps. Due to its modular design and its powerful process control features the DASGIP System is able to bring this multi step process into one automated workflow. Four or eight different vessels dedicated to different phases of the process, definition of different sets of set-points for the different steps of the process are possible. A change from one set of set-points to the next one can be induced by the triggered parameter control features of the software.



DASGIP Gassing Station for supply of unconventional gasses

In this way, an automated process could look like a) hydrolysis in one vessel, b) automated transfer of the liquid to another vessel, where e.g. enzymes are added, c) transfer of the broth into vessel three for the seed stage and d) finally addition of the grown cells and the single sugar to start alcohol production in a fourth reactor.

Last but not least, the whole process is documented by comprehensive data and event logging.

### Benefits

With the DASGIP Parallel Bioreactor System for Biofuel Development users benefit from a solution dedicated to their application field: Anaerobic conditions are maintained, specific temperature and gassing demands are met, crucial parameters are monitored closely, and automation of multi processes is supported.

Scientists can compare the performance of several different microorganisms under the same conditions (screening), or the same microorganism can be compared under different conditions (optimization). The high information density and parallel operation of up to 16 vessels (in different sizes) optimize pre-treatment and accelerate the selection of strains and of the best process parameters.