

BioProcessDB Basic Edition

Fermentation Management System

BioProcessDB is a database solution for the management of complete fermentation processes.

All important process data can be entered or automatically calculated. The recorded shaking flask experiments/batches can be linked to family trees. Extensive searching possibilities are available.

The software can be connected with the SCADA software MFCS/win and expand its data management capabilities significantly. Parallel connections to multiple MFCS servers are possible.

ProBioData BioProcessDB works as a client server system and uses Microsoft SQL Server as the underlying platform.

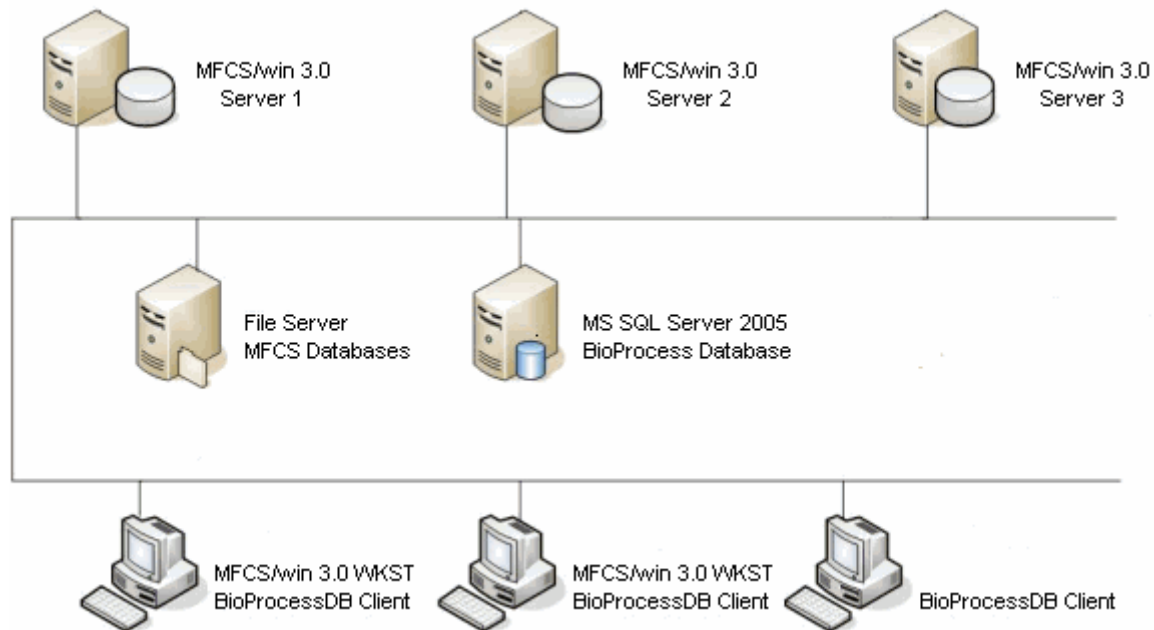


Fig. 1 BioProcessDB in the company network

Directories

The database contains the following directories:

- MFCS Servers
- Fermentors
- Laboratories
- Recipes
- Components
- Component Charges
- Manufacturers
- Media
- Media Preparations
- Organisms
- Strains
- Products
- Profiles
- Shaking Flask Experiments
- Batch Stages
- Batches

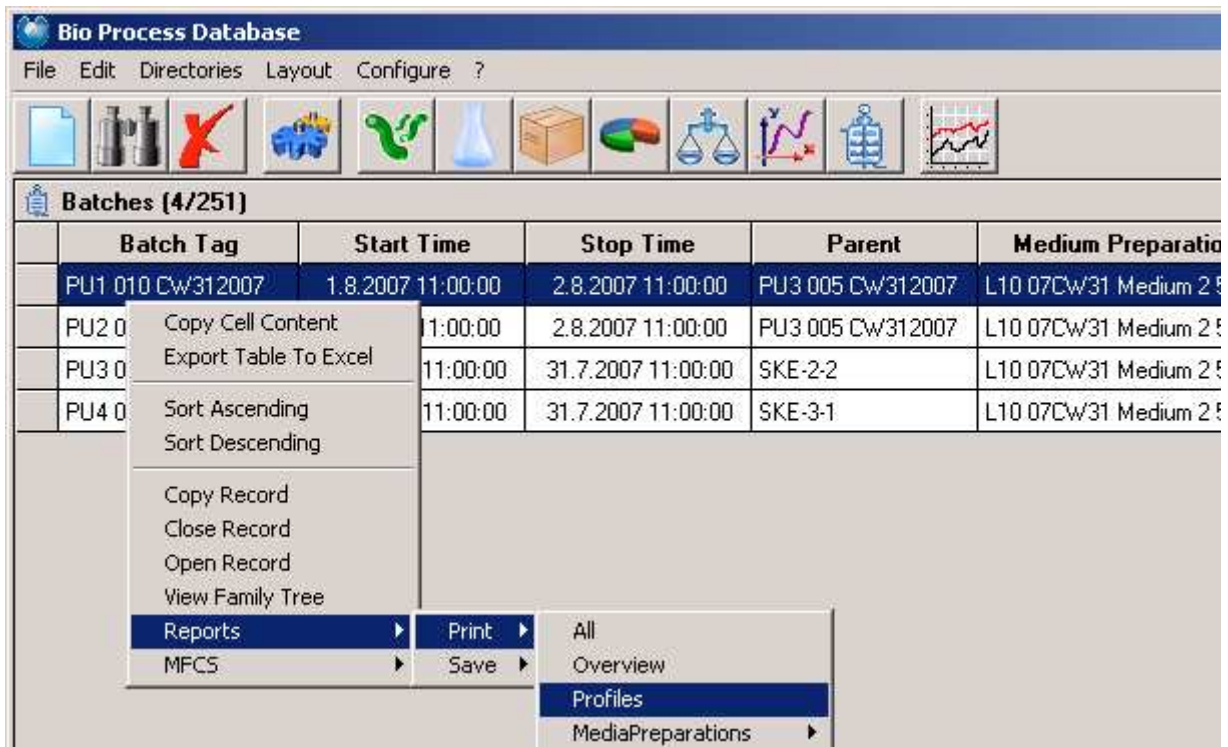


Fig. 2 Directory window

Each user can save his personal layout settings for the directory window to see relevant informations at once.

If a user selects a record from the directory window the record details are displayed in a formula. Data sub categories for the record are available through several tabs. Excerpts from the default formulas for some directories are shown below.

The screenshot displays a web-based interface for a bio-process database. The main window title is "View PU1 001 CW052007 - Bio Process Database". At the top, there is a navigation bar with several tabs: Administration (selected), Controller Setpoints, Profiles, Sample Data, Unique Values, Summary, MB Analysis, Attachments, and Cu. Below the tabs, the interface is organized into several sections:

- Batch Tag:** A text input field containing "PU1 001 CW052007" and an "Edit" button.
- Stage:** A dropdown menu.
- Previous Batch:** An empty text input field.
- Shaking Flask Culture:** A dropdown menu with "SKE-1-1" selected.
- Strain:** A text input field containing "Corynebacterium glutamicum K1".
- Fermentation Goal:** A section containing:
 - Fermentation Goal:** A dropdown menu.
 - MFCs Description:** A text input field.
 - Comment:** A large text area.
- Culture Conditions:** A section containing:
 - Recipe:** A dropdown menu.
 - Medium Preparation:** A text input field containing "L10 07CW05 Medium 1 30 l".
 - Inoculum:** A text input field with a unit selector "l".
 - Run Time:** A text input field with a unit selector "h".
 - Start Batch Volume:** A text input field with a unit selector "l".
- MFCs Settings:** A section containing:
 - MFCs Server:** A dropdown menu with "Server 1" selected.
 - Fermentor:** A dropdown menu with "PU1" selected.
 - Week:** A dropdown menu with "5 29.01.2007 - 04.02.2007" selected and a year selector "2007".
 - Start Time:** A date-time selector with "15.01.2007 08:00:00" selected.

Fig. 3 Batch formula with main tab

New Shaking Flask Experiment - Bio Process Database

Administration | Sample Data | Attachments | Custom Fields

Experiment

Experiment Goal

Parent Experiment Stage

Week 2007 Sample Storage Temperature °C

Shaking Flask
 Shaking Flask Start Time 08.02.2007 12:07:28 Stop Time 08.02.2007 12:07:28

Culture Conditions
 Medium Preparation Inoculum

Fig. 4 Shaking flask experiment formula

New Strain - Bio Process Database

Administration | Elements | Attachments | Custom Fields

Strain Tag

Organism

ParentStrain

Vector

Resistance

Fig. 5 Strain formula

View Medium 1 - Bio Process Database

Administration Attachments Custom Fields

Medium Tag: Medium 1 Medium Type: A

Components

Component	Concentration	in	
Glucosemonohydrat	20	g/l	
(NH4)2SO4	3	g/l	
H3PO4	1,5	g/l	
MgSO4	0,5	g/l	
KCl	1	g/l	
FeSO4	0,01	g/l	

Fig. 6 Medium formula

New GMH-1 - Bio Process Database

Administration Attachments Custom Fields

ComponentCharge: GMH-1

Concentration: 20 % of Component: Glucosemonohydrat

Storage

Fig. 7 Component charge formula

Composition

Component	Concentration	in	Charge	CF	in	Initial Weight	in	SDC
Glucosemonohydrat	20	g/l			%		g	
(NH4)2SO4	3	g/l	GMH-1		%		g	
H3PO4	1,5	g/l	GMH-2		%		g	
MgSO4	0,5	g/l	GMH-3		%		g	
KCl	1	g/l			%		g	
FeSO4	0,01	g/l			%		g	
			Water				g	
			Mass Before Sterilisation				g	

Fig. 8 Component table for medium preparation

If the default fields are not sufficient for your work, you can add customer specific fields using the “Custom Fields”-feature. If you need a more sophisticated customization, we can offer you the redesign of the existing default tabs or the development of completely new tabs.

Of course we can also implement import-/export solutions for existing data collections may be stored in Excel*.

You can easy generate a new record similar to an existing record. Select the existing record, choose “Copy Record”, make the necessary changes and save it as a new record.

The BioProcessDB includes already some default control and calculation possibilities for the entered data. Examples:

A doublet control prevents the user from inserting the same medium compound several times.

For the saved media a medium preparation can be calculated with input options for mass, seperate sterilisations and charges.

Basic calculations for the analysis of your fermentations like eg. productivity and yield coefficients.

Product Titer [g/l]	Total Product [g]	Qp [g/l/h]	Qs [g/l/h]	Yps
0,5	4,97	0,02	0,84	0,02

Fig. 9 Excerpt from the summary tab

The batch family tree shows ancestry and descendants of a selected batch.

Family Tree for PU3 003 CW052007 - Bio Process Database			
	-1	0	+1
☐	SKE-1-3	PU3 003 CW052007	PU1 008 CW072007 PU2 009 CW072007 PU1 010 CW082007 PU2 011 CW082007

Fig. 10 Family tree

An implementation of customer specific calculation and analysis functions can be ordered.

Searching

All data fields and tables shown in a record formula can be used as search criteria. This offers extensive searching possibilities. If nevertheless a deeper data digging is required, the powerful “more”-feature is available.

Fig. 11 Batch formula search mode with a search for batches with the selected medium preparation

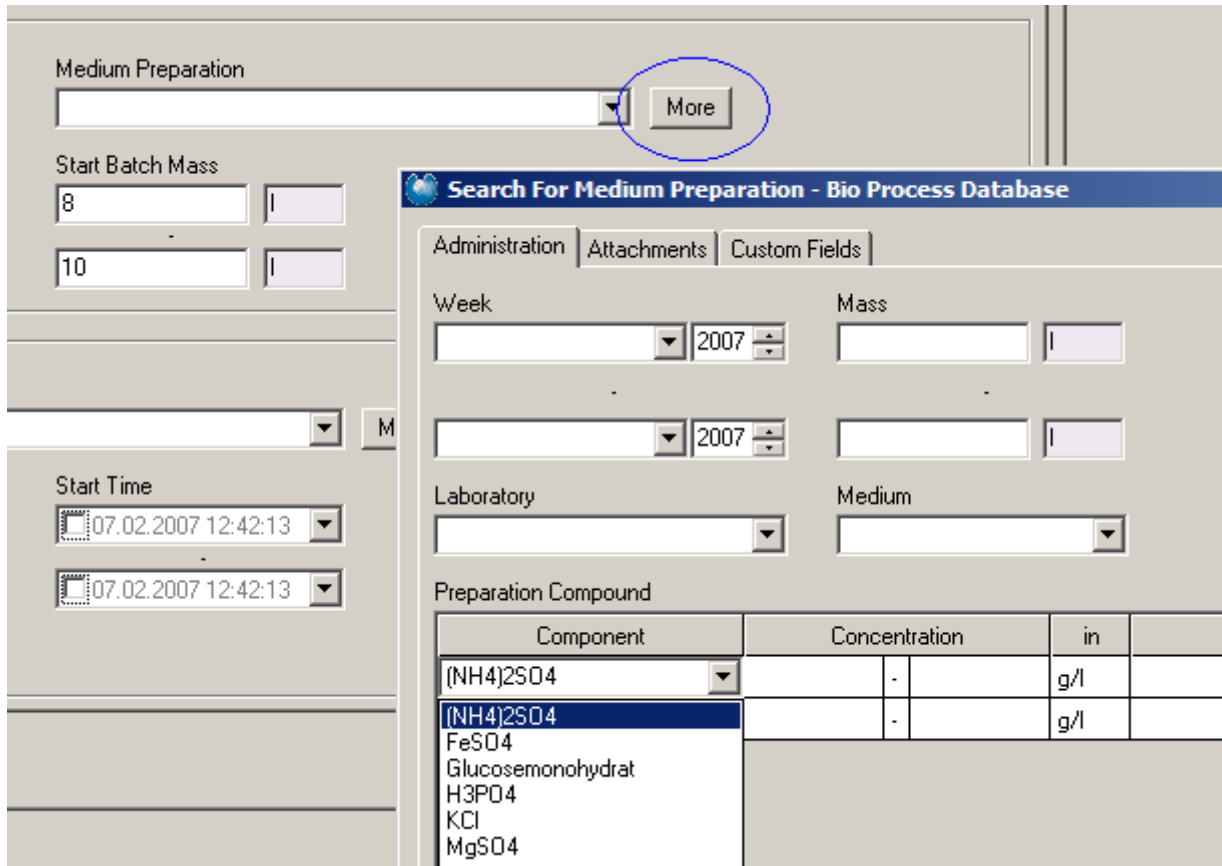


Fig. 12 The advanced search finds all batches with a medium preparation which meets certain conditions

Reports

The database provides the printing of some default reports which can also be exported to an Excel or Adobe Acrobat* file. Customer specific reports can be designed by ProBioData on demand.

PU2 011 CW082007							Glutaminsäure			Corynebacterium			
Stage:		Vorfermentation 2			Date:		15.01.2007	In. (I):			Remarks:		
Prob Nr	Time [h]	F-Time	Temp [°C]	pH	pO2 [%]	Flow [l/min]	Stirr [1/min]	Base [ml]	Acid [ml]	Press [mbar]	Feed [g/h]	OD 660	Sub [g/l]

Fig. 13 Report example – fermentation protocol

Interaction with MFCS/win

BioProcessDB offers possibilities for an integrated data management for all MFCS servers installed in your company.

Below are some examples for the MFCS/win integration.

The screenshot shows the 'Bio Process Database' application window. The title bar reads 'Bio Process Database'. Below the title bar is a menu bar with 'File', 'Edit', 'Directories', 'Layout', and 'Configure ?'. A toolbar contains various icons representing different biological and process-related functions. Below the toolbar, a tabbed interface shows 'MFCS Servers (2/2)'. A table lists the configuration for two MFCS servers.

MFCS Server Tag	NodeID	Computer Name	Path
Server 1	1	PBD1	\\PBD1\MFCS_WIN\
Server 2	2	PBD6	\\PBD6\MFCS_WIN\

Fig. 14 MFCS server directory

The screenshot shows the 'View PU3 003 CW052007 - Bio Process Database' window. The title bar reads 'View PU3 003 CW052007 - Bio Process Database'. Below the title bar is a menu bar with 'Administration', 'Controller Setpoints', 'Profiles', 'Sample Data', 'Unique Values', 'Summary', 'MB Analysis', 'Attachments', and 'Cu'. A table displays controller setpoints for different phases.

Phase	Age	in	pH	in	PO2	in	STIRR	Ctrl_M
Growth	0	h	7	pH	30	%Sat		
Production	24	h	8	pH	30	%Sat		

Fig. 15 Enter controller setpoints for the PU controllers imported from the MFCS

The screenshot shows the 'View PU3 003 CW052007 - Bio Process Database' window. The title bar reads 'View PU3 003 CW052007 - Bio Process Database'. Below the title bar is a menu bar with 'Administration', 'Controller Setpoints', 'Profiles', 'Sample Data', 'Unique Values', 'Summary', 'MB Analysis', 'Attachments', and 'Cu'. A table displays sample data for a batch formula.

Probe Time	BIOM	Unit	Substrate	Unit	Product	Unit
06.02.2007 11:44:48	0,5	g/l	10	g/l	0	g/l
06.02.2007 11:45:24	1	g/l	9	g/l	0,1	g/l
06.02.2007 11:46:00	2	g/l	7	g/l	0,2	g/l
06.02.2007 11:46:36	4	g/l	3	g/l	0,3	g/l
06.02.2007 11:47:12	5	g/l	0	g/l	0,5	g/l

Fig. 16 Sample values imported from MFCS/win are shown in the batch formula

Technical Issues

BioProcessDB is designed as client server solution based on Microsoft SQL Server* 2005 and therefore suited for multiuser scenarios.

Tested for Windows XP SP3.

Feature List

- Administration of media, strains, shaking flasks, fermentations and others
- Extensive possibilities for searching and filtering
- Integrated standard calculations
- Fast generating of similar records with the "Copy Record"-function
- Generating of family trees
- Ideal MFCS/win extension for data management capabilities
- Report and export functions e.g. to Excel, PDF
- Hyperlinks to customer documents and external resources
- User specific adjustment of data layout
- Customers can define specific data fields
- High level customization on demand through ProBioData
- Ready for networks and multiuser scenarios
- User management
- Audit trail
- Batch definition module to define MFCS batches via BioProcessDB
- Data can be exported from BioProcessDB or other sources like Excel sheets to the MFCS/win SDM. Please ask for customized solutions.
- Export of all measured MFCS values into an Excel crosstable for plotting or statistic evaluations
- If you want to connect another SCADA system than MFCS/win to the BioProcessDB, please contact us.
- Plotting. More information below.

Plotting

The BioProcessDB plot module allows you to plot nearly as much batches as you want in one chart. You can combine batches from different servers and different variables for one plot. It is possible to assign the batch runtime to the x-axis for a time series chart or any MFCS variable to plot one variable against another.

The plot can be zoomed, printed or exported as a picture to a png file. The module provides the generation of plots for certain time periods or for the last x minutes of a running batch. Plot configurations can be saved as templates for reusing.

An additional feature is to import the complete MFCS access database of a batch into a newly generated SQL Server database to improve the speed of the plot generation.

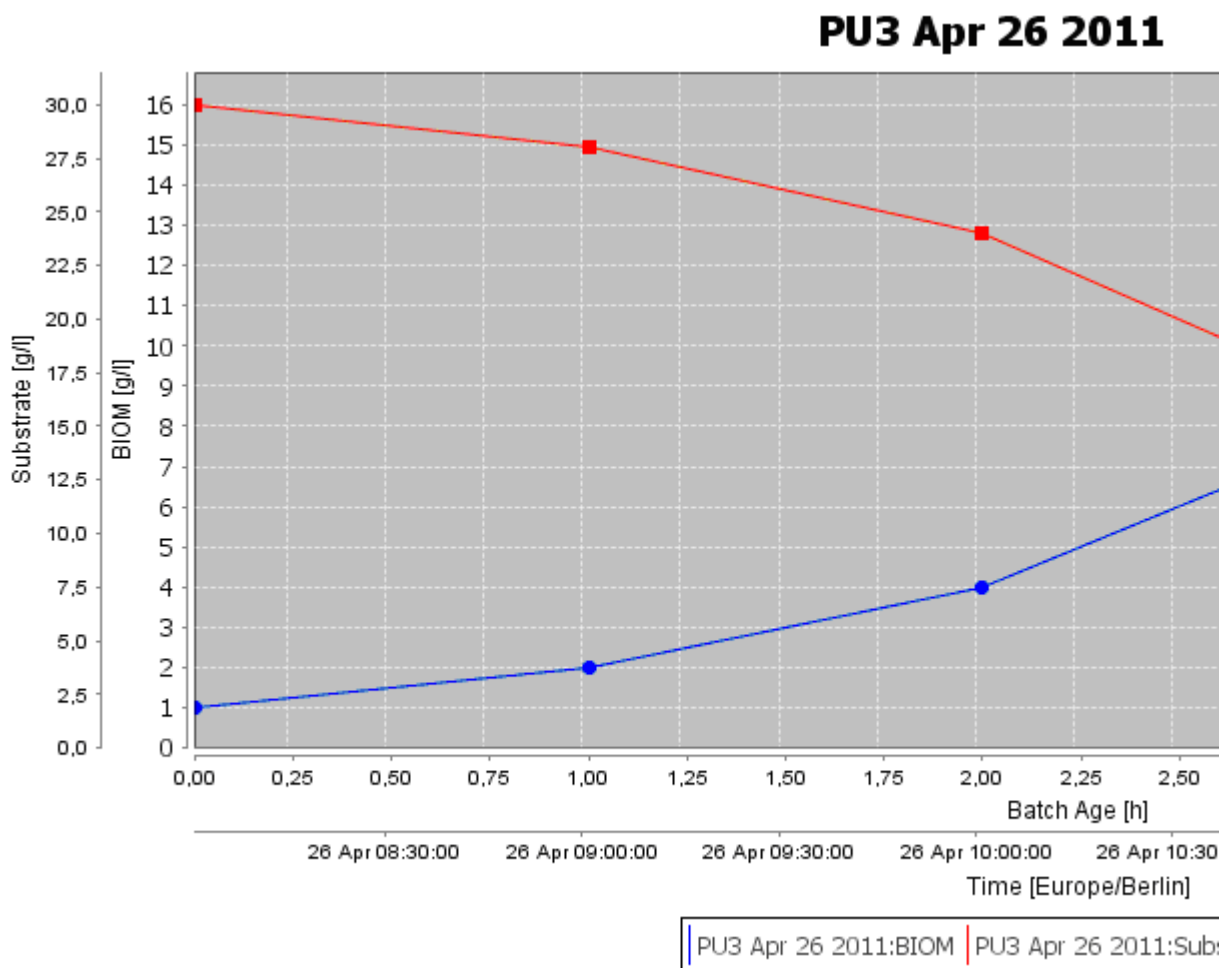


Fig. 19 Plotting some offline data

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* Glossary

Adobe Acrobat is a product of Adobe Corporation
Excel and SQL Server are products of Microsoft Corporation
MFCS/win is a product of Sartorius-BBI-Systems GmbH