

## Product datasheet (en)

Version: 1702\_14.04.2014

Photo:

Name:

leXsolar-BioFuel Large



Item number:

1702

Youtube link:

Area of application:

Chemistry  
Technology Training

Dimensions (cm x cm x cm):

42x35x15

Weight (kg):

4,00

User group:

Highschool / Secondary School

Key facts:

Production of biofuel displayed in experiments for students  
Covers bioethanol and biodiesel production  
Interdisciplinary experiments for chemistry, physics and biology  
Includes an Ethanol-fuel cell for the generation of electrical energy out of biofuel

## List of components:

1 x 1100-23 Potentiometer module  
1 x 1100-27 Motor module without gear  
1 x 1700-01 leXsolar ethanol fuel cell module  
1 x 1702-01 Plug with hose  
1 x 1702-02 Yeast  
1 x 1702-03 Box 1702  
4 x L2-02-016 Bump transparent 5,0 mm height X 11,1mm diameter  
1 x L2-02-017 Yellow propeller  
1 x L2-06-016 Laboratory thermometer  
1 x L2-06-070 Distilling head, 2 cores 75°, NS 19/26  
1 x L2-06-071 Condenser  
1 x L2-06-072 Alcoholmeter  
1 x L2-06-075 Erlenmeyer flask 1000 ml  
1 x L2-06-076 Airlock  
1 x L2-06-077 Rubber stopper  
1 x L2-06-079 Areometer  
1 x L2-06-082 Beaker 250 ml  
3 x L2-06-083 Test tubes  
1 x L2-06-084 Grip stopper  
3 x L2-06-085 Pasteur pipette  
1 x L2-06-086 Measuring cylinder 100ml  
1 x L2-06-087 Syringe 2ml  
1 x L2-06-110 Silicone ring  
1 x L3-01-013 Lid for tray  
1 x L3-01-078 Padding "BioFuel-Large"  
1 x L3-03-016 leXsolar-CD  
1 x L3-03-142 Einräumplan 1702 BioFuel Large

## Extras needed:

1 x 1700-02 Chain clamp  
1 x L2-06-118 Stand base plate  
1 x L2-06-114 Bunsen burner  
1 x L2-06-116 Universal stand clamp  
1 x L2-06-119 Stand rod 60cm, M10  
2 x L2-06-120 Double clamp  
1 x 9100-03 AV-Module  
2 x L2-06-012 Test lead black 25 cm  
2 x L2-06-013 Test lead red 25 cm

## Extras available:

No extras available.

## Description:

The entire process of producing biofuels can be demonstrated with leXsolar-BioFuel Large. It starts with the biological step of alcoholic fermentation. Afterwards the produced mash will be distilled with the help of the leXsolar-condenser, which was developed just for this experiment. The last step demonstrates the conversion of the produced biofuel into usable energy, such as electrical energy, using the provided Ethanol-fuel cell. leXsolar-BioFuel Large does not only cover the topic of the production of bioethanol, but also the production of biodiesel through transesterification of fats.

#### Experiments:

##### Part 1: Biodiesel production

Transesterification from fat to Biodiesel (FAME)  
Determination of fat parameters  
Extraction of fats from foods and oil plants

##### Part 2: Alcohol fermentation

Production of a mash/ alcoholic fermentation  
Fermentation of different sugar types  
(including catalytic splitting of starch)  
Proof of fermentation gases

##### Part 3: Distillation and production of Bioethano

Distillation of mash  
Characteristics of the produced Ethano

##### Part 4: Ethanol fuels

Introduction Ethanol fuel cell  
I-V curve of Ethanol fuel cells  
Dependency of Ethanol fuel cells on concentration and temperature  
Energy balance of the whole process

#### Specifications of components:

##### 1100-23 Potentiometer module:

Plug-in module with adjustable resistance  
Resistance continuously adjustable: 0 - 1.1 kOhm  
Maximum current: 1A  
Module contains two potentiometers connected in series (1 x 100 Ohm and 1 x 1 kOhm)  
Allows an exact adjustment of the resistance while having a large resistance range  
Layout: plug-in module with 4mm jacks  
Grid-dimension of the jacks: 70mm  
Module size: 85mmx85mm

##### 1100-27 Motor module without gear:

Plug-in module with DC-motor  
Initial current: 20 mA  
Initial voltage: 0.35 V  
Equipped with automatic fuse protecting from overvoltage

Layout: plug-in module with 4 mm jacks  
Grid-dimension of the jacks: 70 mm  
Module size: 85 mm x 85 mm

1700-01 leXsolar ethanol fuel cell module:  
Ethanol fuel cell for conversion of chemical energy into electrical energy  
Stack of two fuel cells with separately contactable single fuel cells  
For ethanol solution with concentration up to 20%  
Recommended ethanol concentration for continuous operation 10%  
Open circuit voltage  $V_{oc} = 1$  V (double cell)  
Maximum short circuit current  $I_{sc} = 40$  mA  
Maximum peak power  $P = 10$  mW  
Approx. continuous power  $P = 2$  mW (at least 2 min.)

1702-01 Plug with hose:  
Stopper (PE) for Erlenmeyer flask L2-06-075 pierced with PE-tube  
Joint: ST/NS 29/32  
To be used for detection of carbon dioxide

1702-02 Yeast:  
Yeast for producing ethanol solutions up to 18% in 48 hours  
contains nutrient salt

L2-02-016 Bumpon transparent 5,0 mm height X 11,1mm diameter:

L2-02-017 Yellow propeller:

L2-06-016 Laboratory thermometer:  
Alcohol laboratory thermometer with red liquid. White occupied capillaries, amber stain graduation, Length according to ISO 305 mm, 6mm  $\varnothing$ , with suspension eye, packed in a protective plastic holder, measurement range:  $-10..+ 110^{\circ}\text{C}$ , graduation:  $1^{\circ}\text{C}$

L2-06-070 Distilling head, 2 cores  $75^{\circ}$ , NS 19/26:  
Fractionating column with 2 joints NS 29/32 and GL14 fitting for thermometer L2-06-016

L2-06-071 Condenser:  
Condenser for distillation of ethanol  
Joint: NS 29/32 for Erlenmeyer flask L2-06-075  
No need for cooling water circuit  
Distillation of approx. 750ml with one cooling water charge possible

L2-06-072 Alcoholmeter:  
Alcoholometer for measuring the concentration of ethanol solutions  
For concentration of 30 - 90 vol.%

L2-06-075 Erlenmeyer flask 1000 ml:  
Erlenmeyer flask 1000 ml with joint NS 29/32  
Borosilicate glass

L2-06-076 Airlock:  
Airlock for fermentation

Together with stopper L2-06-077 to be used with erlenmeyer flask L2-06-075

L2-06-077 Rubber stopper:

Rubber stopper for NS 29/32 with hole for air lock L2-06-076

L2-06-079 Areometer:

Areometer for measuring the sugar content of water sugar solutions

Density range 0 ... 300 g/L

L2-06-082 Beaker 250 ml:

Borosilicate beaker 250ml

L2-06-083 Test tubes:

Test tubes 160x60

L2-06-084 Grip stopper:

Grip stopper for test tube L2-06-083

L2-06-085 Pasteuer pipette:

Plastics pasteuer pipette

L2-06-086 Measuring cylinder 100ml:

Measuring cylinder 100 ml (PE)

L2-06-087 Syringe 2ml:

L2-06-110 Silicone ring:

L3-01-013 Lid for tray:

L3-01-078 Padding "BioFuel-Large":

L3-03-016 leXsolar-CD:

The leXsolar-CD covers all student and teacher manuals's as pdf- and word-file. If you need manual's as printed version, you can order them separately.

Specifications extras needed:

1700-02:

9100-03:

The IV-Module is able to measure current and voltage and therefore replaces conventional multimeters completely. With touch buttons three measurement modes can be selected: current, voltage and combined current- /voltage-measurement.

leXsolar AV-Module is intuitive and easy to use but yet allows precice and professional

measurements. A high resolution graphics display shows the measurement values as well as visualizes the measurement modes.

Technical specifications:

Voltage measurement:

- Range: 0...12 V
- Accuracy: 1mV
- Overvoltage protection >12V

Current measurement

- Range: 0...2 A
- Accuracy: 0.1 mA (0...199mA) and 1mA (200mA...1A)
- Automatic fuse protection >2A (reactivation with touch button)
- Internal resistance <0.5 Ohm (0...200mA); <0.2 Ohm (200mA...2A)

Electrical connection:

- compatibel to leXsolar-basic unit
- 4mm-banana plugs

Display: Graphics display resolution 192x192

Power supply: 2 x AA battery or rechargeable

Interfaces:

- Display to read the measurement values
- leXsolar USB-Connect\* for direct PC-connection
- leXsolar Wireless-Connect\* for wireless data acquisition

\*available 2015

Specifications extras available:

L3-03-096:

Every leXsolar-training kit comes with the leXsolar-CD. There you can find all the students and teacher manuals as pdf and as word file. Of course you can order them as printed version as well.

L3-03-103:

Every leXsolar-training kit comes with the leXsolar-CD. There you can find all the students and teacher manuals as pdf and as word file. Of course you can order them as printed version as well.