edibon

Engineering and Technical Teaching Equipment

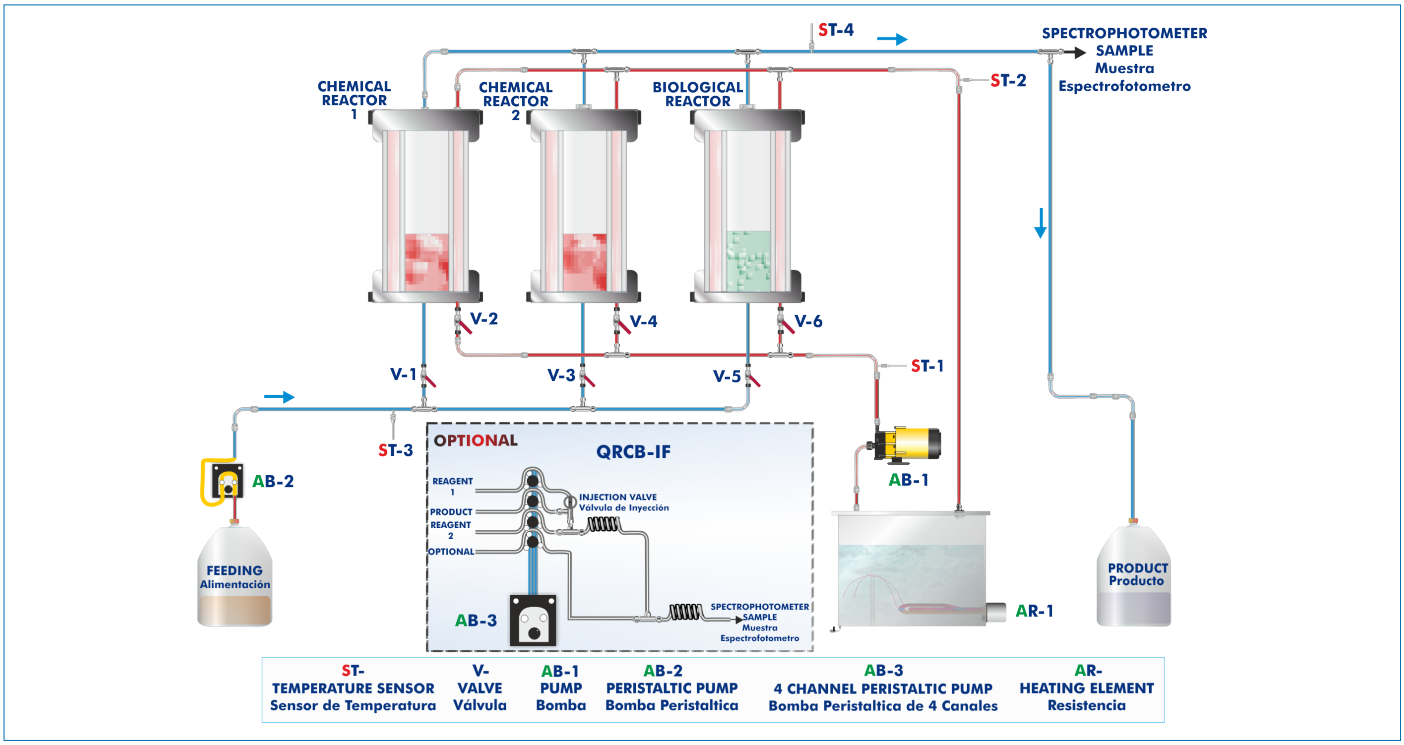
Catalytic Reactors

QRCB

www.edibon.com
PRODUCTS
11.-CHEMICAL ENGINEERING

Electronic console

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate (total safety)

Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)

"Worlddidac Quality Charter" and Platinum Member of Worlddidac

INTRODUCTION

In a chemical reaction, the process of catalysis is the increase or decrease in the speed of the chemical reaction (reaction kinetics) caused by what we call a catalyst.

Nowadays, research and development of catalysts are extremely important in the chemical industry. It is thought that approximately 90 % of industry-made chemical products involve some catalytic process in their processing.

One of the main characteristics of catalysts is that they are not consumed by the chemical reaction, although they may suffer some deterioration. This deterioration is due to the loss of their catalytic features. Besides, the student must understand the immobilization of catalysts in the reactors, a fact that prevents them from being dragged by the final product.

GENERAL DESCRIPTION

The Catalytic Reactors, "QRCB" is an unit designed to perform the saccharose hydrolysis reaction in a continuous way by using catalytic fixed-bed reactors.

Saccharose hydrolysis is the industrial process to obtain glucose and frustose from saccharose. It is a reversible chemical reaction.

The "QRCB" unit is composed of three fixed-bed reactors. Two of them are fixed-bed reactors for chemical catalysis with the same chemical catalyst, called ionic exchange resin but with different grain size. The third reactor is a fixed-bed reactor for biological (enzymic) catalysis, with an immobilized enzyme. To start the hydrolysis process our product (saccharose) has to pass through this enzyme.

Saccharose hydrolysis is favoured with temperatures around 50 °C – 60 °C. For that end, the reactors have a jacket through which hot water will flow. The water temperature is controlled through the potentiometer of the thermostatic bath.

Feeding saccharose to our reactors is done through a peristaltic pump which allows the regulation of speed by using a potentiometer.

The resulting solution is pumped to the final-product flask. From this point on it will be analysed with a spectrophotometer.

As an optional supply, there is the possibility of acquiring the additional recommended element Flow Injection Analysis (FIA) Unit, "QRCB-IF". This unit is a Flow Injection Analysis system, which is used to measure the conversion degree of the reaction of the saccharose hydrolysis in a continuous way.

SPECIFICATIONS

Bench-top unit.

Anodized aluminum frame and panels made of painted steel.

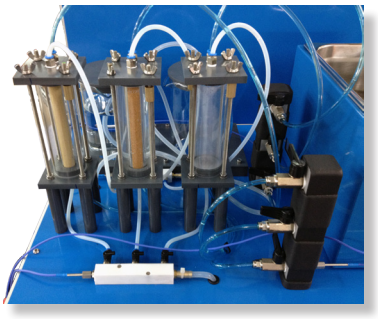
Main metallic elements made of stainless steel.

Diagram in the front panel with distribution of the elements similar to the real one.

Two glass flacks of for the initial solution and the final product, capacity: 2 l.

Reactors:

- Two fixed-bed reactors for chemical catalysis, composed by acid ion exchange resins.
- Fixed-bed reactor for biological (enzymic) catalysis. (Recommended use with an immobilized enzyme).
- Reactors diameter: 50 mm.
- Reactors height: 160 mm.
- Material: glass, with a methacrylate cover for protection.



QRCB detail

Thermostatic bath, with heating resistance of 600 W.

Heated water supply to the reactors jackets that allows the automatic control of reaction temperature to a set point value.

Peristaltic pump, with speed regulation, that allows to regulate the feed flow, range: 0 – 32 ml/min.

Four temperature sensors, “J“ type, placed at key points of the system.

Spectrophotometer, for the final product analysis and absorbance measures:

- Wavelength range: 325 – 1000 nm.
- Band width: 5 nm.

All electrical circuits are protected by adequate protection devices.

Electronic console:

- Metallic box.
- Connections for the temperature sensors.
- Digital display for the temperature sensors.
- Selector for the temperature sensors.
- Heating resistance controller.
- Digital display for feeding flow.
- Pump switch.
- Pump regulator (potentiometer).
- Main switch.

Cables and Accessories, for normal operation.

Manuals:

This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

Additional recommended elements (Not included):

-QRCB-IF. Flow Injection Analysis (FIA) Unit.

Additional recommended elements (Not included)

QRCB-IF. Flow Injection Analysis (FIA) Unit

This unit is a Flow Injection Analysis system, which we will use to measure the conversion degree of the reaction of the saccharose hydrolysis in a continuous way.

This unit provides an easy method for measuring the saccharose concentration of the final product in continuous way without the need of the measuring it manually. The unit can also be useful for the teaching of the FIA technique and the demonstration of the advantages of this measuring method in continuous processes.

It consists of a peristaltic pump with four channels that is used to impulse the right quantities of the final product together with reagents that colour it. Then the solution are put through coil reactor in order to complete the mixture. The last stage of the QRCB-IF unit involves passing the reaction through the spectrophotometer measuring cell.

Specifications:

- Four channels peristaltic pump, 0.01-35 ml/min. For each channel.
- Six ports injection valve.
- Coil reactor.
- Continuous measuring cell for spectrophotometer.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Study of the principles of catalytic fixed-bed reactors.
2.- Effect of the variation in the particle´s size in the effectiveness of a fixed-bed reactor.
3.- Comparison of chemical and biological (enzymic) catalysis.
4.- Checking the influence on different variables (feed flow, temperature of reaction, reagents concentration) on the obtained final product.
5.- Spectrophotometer calibration.
6.- Using the spectrophotometer and product analysis.
7.- Study of the "FIA" Flow Injection Analysis technique and principles (the additional recommended element QRCB-IF is required).
8.- Examination of the reproducibility and sensitivity of the "FIA" analysis method as a function of the flow rate and sample concentration (the additional recommended element QRCB-IF is required).

Additional practical possibilities:

9.- Studies of steady and unsteady state catalysis.
10.-Flow characterisation in a fixed-bed.
11.-Mass balances.
12.-Determination of steady state and unsteady state kinetics of a catalytic fixed-bed reactor.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.

DIMENSIONS AND WEIGHTS

QRCB:
Unit :
-Dimensions: 650 x 700 x 800 mm approx.
(25.59 x 27.55 x 31.49 inches approx.)
-Weight: 50 Kg approx.
(110.23 pounds approx.)
Spectrophotometer:
-Dimensions: 470 x 380 x 140 mm approx.
(18.50 x 14.96 x 5.51 inches approx.)
-Weight: 10 Kg approx.
(22 pounds approx.)
QRCB-IF:
-Dimensions: 500 x 500 x 350 mm approx.
(19.68 x 19.68 x 13.77 inches approx.)
-Weight: 15 Kg approx.
(33 pound approx.)
Electronic console:
-Dimensions: 490 x 330 x 310 mm approx.
(19.29 x 12.99 x 12.20 inches approx.)
-Weight: 10 Kg approx.
(22 pounds approx.)

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

-QRCB-IF. Flow Injection Analysis (FIA) Unit

SIMILAR UNITS AVAILABLE

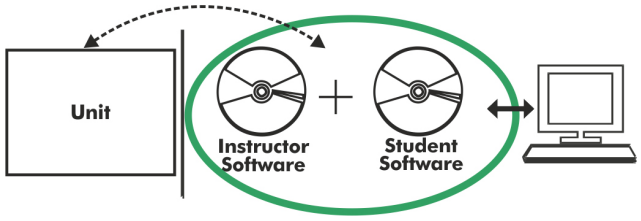
Offered in this catalog:

-QRCB. Catalytic Reactors.

Offered in other catalog:

-QRCC. Computer Controlled Catalytic Reactors.

QRCB/ICAI. Interactive Computer Aided Instruction Software:



With no physical connection between unit and computer, **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF)**. Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

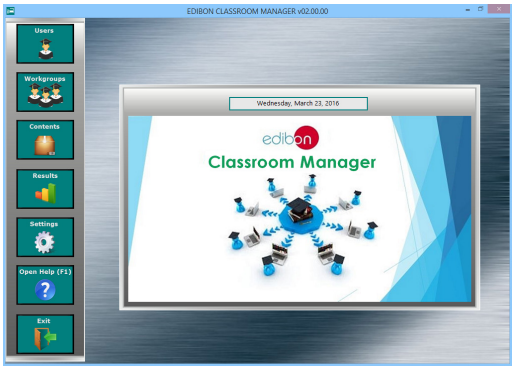
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

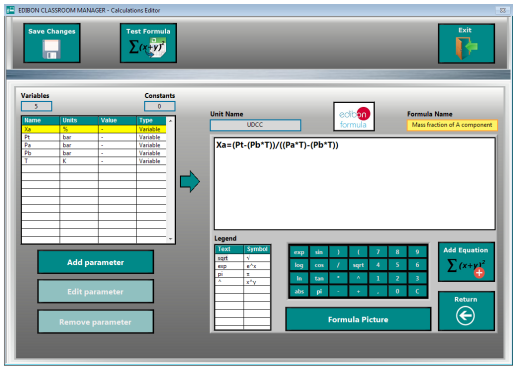
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

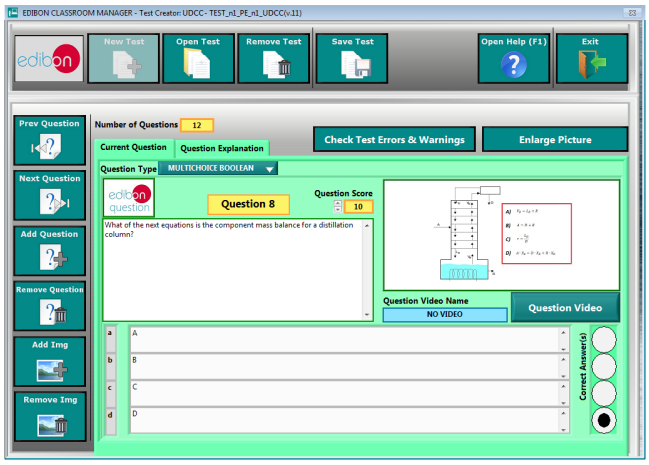
- **User Data Base Management.**
- **Administration and assignment of Workgroup, Task and Training sessions.**
- **Creation and Integration of Practical Exercises and Multimedia Resources.**
- **Custom Design of Evaluation Methods.**
- **Creation and assignment of Formulas & Equations.**
- **Equation System Solver Engine.**
- **Updatable Contents.**
- **Report generation, User Progression Monitoring and Statistics.**



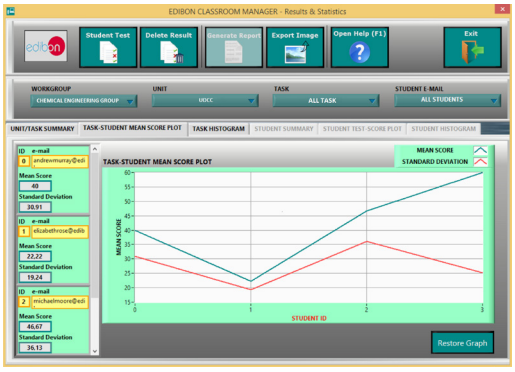
ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional

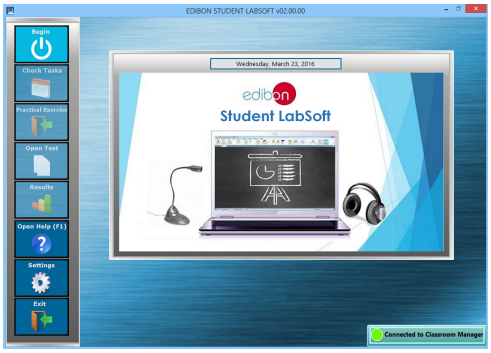
Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

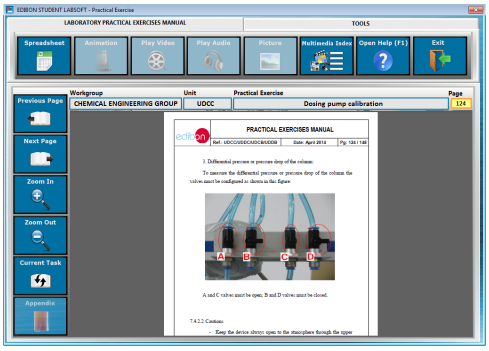
ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- **Student Log-In & Self-Registration.**
- **Existing Tasks checking & Monitoring.**
- **Default contents & scheduled tasks available to be used from the first session.**
- **Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- **Evaluation Methods to prove your knowledge and progression.**
- **Test self-correction.**
- **Calculations computing and plotting.**
- **Equation System Solver Engine.**
- **User Monitoring Learning & Printable Reports.**
- **Multimedia-Supported auxiliary resources.**

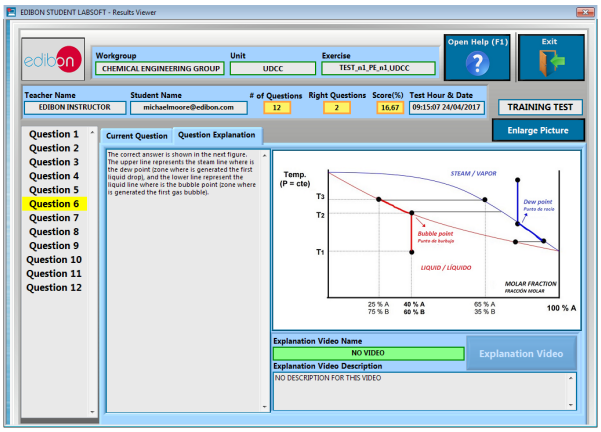


ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen

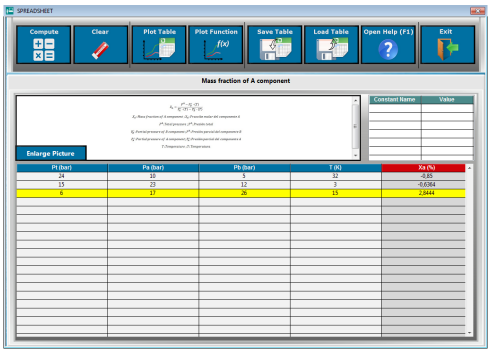


EPE. EDIBON Practical Exercise Program Package Main Screen

For more information see **ICAI** catalogue. Click on the following link:
www.edibon.com/en/files/expansion/ICAI/catalog



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

INTERNATIONAL

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REPRESENTATIVE: