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Technical Teaching Equipment

Catalytic Reactors

QRCB

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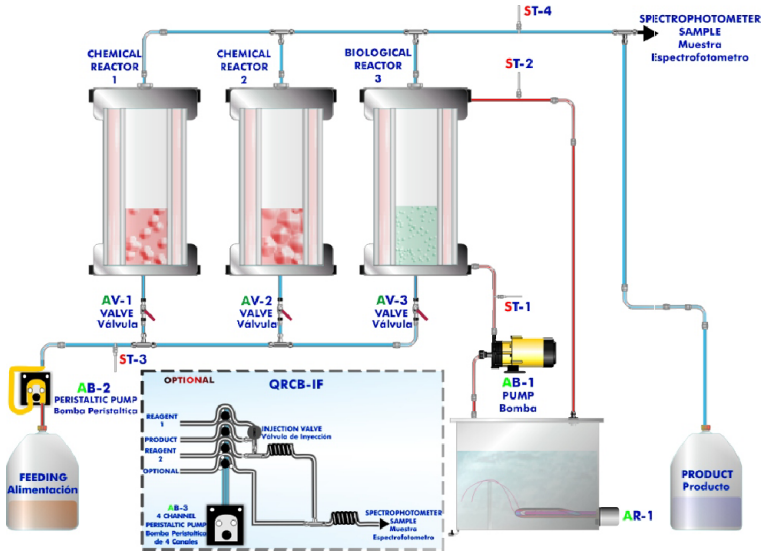
Products
Products range
Units
11.-Chemical Engineering

Electronic Console

Optional accesory:
QRCB-IF. Flow Injection Analysis (FIA) unit

PROCESS DIAGRAM AND ELEMENTS ALLOCATION



Note:
ST= Temperature sensor
AR= Heating resistance

DESCRIPTION

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.

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

QRCB unit has been designed to perform the inversion reaction of saccharose, separating its components: glucose and fructose. In order to execute this process, the unit consists of tree fixed-bed reactors that contain different types of catalysts:

Two packed bed reactors for chemical catalysis, composed by acid ion exchange resins.

A biological reactor. (Recommend use with an immobilized enzyme).

A peristaltic pump with variable speed feeds the reactors' active part with the product. The catalytic process takes place in a continuous way in the fixed bed of the reactors. The reactors' temperature is controlled by an external bath of water that makes it possible to observe the chemical reaction's thermal influence for each setting option.

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

As an optional supply, there is the possibility of acquiring the QRCB-IF unit. It is a Flow Injection Analysis (FIA) unit which is used to determine, in an automatic way, the solution glucose concentration resulting from the carried out experiments.

SPECIFICATIONS

Bench-top unit.

Anodized aluminium structure and panels in painted steel (epoxy paint).

Main metallic elements in stainless steel.

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

2 glass flacks of 2 litres of capacity, for the initial solution and the final product.

Reactors:

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

Thermostatic bath, with heating resistance of 600W.

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

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

4 Temperature sensors, "J" type.

Spectrophotometer, for the final product analysis and absorbance measures:

- Wavelength range: 325-1000 nm.
- Band width: 5 nm.
- Electrical supply: 230V-50Hz.

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).

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.

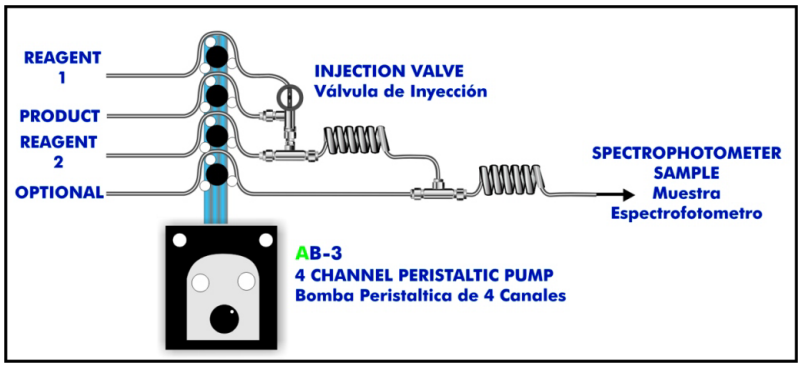
OPTIONAL ACCESSORY

- 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.

6 ports injection valve.

Coil reactor.

Continuous measuring cell for spectrophotometer.

Dimensions: 500 x 500 x 350 mm. approx.

Weight: 15 Kg. approx.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

1.- Study of the principles of packed bed catalytic reactors.

2.- Checking the influence on different variables (feed flow, temperature of reaction, reagents concentration) on the obtained final product.

3.- Studies of steady and unsteady state catalysis.

4.- Flow characterisation in a packed bed.

5.- Effect of the variation in the particle´s size in the effectiveness of a fixed-bed reactor.

6.- Mass balancing.

7.- Determination of steady state and unsteady state kinetics of a packed bed catalytic reactor.

8.- Effect of flow rate, temperature and feed concentration on steady state conversion.

9.- Performance comparison of a chemical catalyst (ionic exchange resins) with a biological catalyst (immobilized enzyme).

10.- Comparison of chemical and biological (enzymic) catalysis.

11.- Spectrophotometer calibration.

12.- Using the spectrophotometer and product analysis.

13.- Study of the FIA Flow Injection Analysis technique and principles (with QRCB-IF accessory).

14.- Examination of the reproducibility and sensitivity of the FIA analysis method as a function of the flow rate and sample concentration (with QRCB-IF accessory).

REQUIRED SERVICES

-Electrical supply: single-phase, 220 V./50Hz. or 110V./60Hz.
-Water to fill the thermostatic bath.

DIMENSIONS & WEIGHTS

QRCB:

Unit:	-Dimensions: 650 x 700 x 800 mm. approx.
	-Weight: 50 Kg. approx.
Spectrophotometer:	-Dimensions: 470 x 380 x 140 mm. approx.
	-Weight: 10 Kg. approx.
Electronic Console:	-Dimensions: 430 x 330 x 310 mm. approx.
	-Weight: 10 Kg. approx.

OPTIONAL ACCESSORY

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

AVAILABLE VERSIONS

Offered in this catalogue:

-QRCB. **Catalytic Reactors.**

Offered in other catalogue:

-QRCC. Computer Controlled **Catalytic Reactors.**

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

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