Liquid-Liquid Extraction Unit

UELL

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

VT-8 VT-4 SAMPLE Muestra

SOLVENT Disolvente

ST-2 TEMPERATURE SENSOR Sensor de Temperatura

WATER OUTLET Salida de Agua

VT-5

EXTRACT Extracto

WATER INLET Entrada de Agua

VT-10 VT-9 WATER OUTLET Salida de Agua

SAMPLE Muestra

SAMPLE Muestra

SAMPLE Muestra

VT-7

VT-1

VT-11

REFINED Refinado

VT-2 SAMPLE Muestra

FEEDING Alimento

VR-1 WATER INLET Entrada de Agua

ST-1 TEMPERATURE SENSOR Sensor de Temperatura

AP-2

SOLUTE Soluto

AP-1

AR-1 HEATING ELEMENT Resistencia

VT-3 SAMPLE Muestra

AB-1 PUMP Bomba

AB-2 PUMP Bomba

VT-6

DRAIN VALVE Válvula de Desagüe

VR-2

INTRODUCTION

Many processes in chemical engineering require the separation of one or more of the components of a liquid mixture by treating the mixture with an immiscible solvent in which these components are preferentially soluble.

The rate at which a soluble component is transferred from one solvent to another will be dependent, among other aspects, on the area of the interface between the two immiscible liquids. Therefore, it is very advantageous for this interface to be formed by droplets and films, the situation being analogous to that existing in packed distillation columns.

The Liquid-Liquid Extraction Unit, "UELL", allows to study the extraction of one or several components in a continuous way with a solvent. The contact takes place inside the vertically oriented packed column, in which the two phases circulate in countercurrent. The unit enables to recover the solvent in a distillation process.

GENERAL DESCRIPTION

The Liquid-Liquid Extraction Unit, "UELL", is a laboratory scale unit designed to study the separation of the components of liquid mixtures by contact of the mixture with an immiscible solvent in which these components are preferentially soluble.

The extraction process is carried out in the glass liquid/liquid extraction column, which is composed of a jacketed glass packed column with two enlarged end sections. The joints between the three sections of the column are sealed with PTFE gaskets. The column is filled with glass Raschig rings that are supported on a perforated PVC plate.

Feed for the column is stored in the feeding tank from where it is pumped by an adjustable speed diaphragm pump. It passes through a flowmeter and enters the base section of the column via an injector mounted on it. Refine (phase with low content of solute) leaves the top of the column through a pipe and is collected in a refined tank.

The solvent supply tank provides the feed for an adjustable speed diaphragm pump. The solvent is pumped and passes through a flowmeter, then enters the top of the column via an injector. Extract (phase with high content of solute) leaves the bottom of the column through a pipe and is collected in an extract tank. A drain valve is fitted in the extract line.

The supply circuits and product collection circuits include two pressure switches that switch off the pumps when the pressure is high, two sampling taps to collect samples, three-way directional valves to direct the different currents and a regulation valve to control the height of the interface.

The distillation process is carried out in the distillation column boiler. The distillation column is made up of a glass section and contains Raschig rings made of glass. It is mounted close to the extraction column and fitted at such a height that the solute may be drained into the solute tank.

Heating is done by means of a heating mantle in the base of the boiler and the boiler temperature is indicated on a temperature sensor. The boiler lid is perforated where the distillation column is fitted and a pipeline allows to drain the extract from the extract tank. The boiler-solute tank circuit includes a sampling tap to collect samples.

The dissolvent vapor phase is condensed in the coolant column and re-cycled to the solvent tank to recover the dissolvent and to provide a closed circuit. Then, the solvent can be re-cycled continuously.

Anodized aluminum frame and panels made of painted steel.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

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

Transparent elements for a better observation of the process.

Extraction process:

  Jacketed glass column packed with glass Raschig rings:

    Length: 1200 mm.

    Internal diameter: 50 mm.

  Two enlargement pieces at the ends, capacity: 2 l.

Distillation process:

  Boiler for the distillation, heated by an adjustable electric heating mantle, capacity: 5 l.

  Jacketed glass column packed with glass Raschig rings:

    Length: 500 mm.

    Internal diameter: 25 mm.

  Coolant column.

UELL detail

Five Pyrex storage tanks for the feed, refined, solvent, extract and solute, capacity (each one): 10 l. They include drain valves.

Supply circuits and product collection circuits to connect the different components of the unit. They include five sampling taps, distributed between all the circuits of the unit, to control the process in all the pipelines of fluid, three-way directional valves, drain valves and a regulating valve.

Two adjustable speed diaphragm pumps:

  Diaphragm pump with stainless steel head to pump the feed, max. flow: 47 l/h, max. pressure: 5 bar.

  Diaphragm pump with stainless steel head to pump the solvent, max. flow: 17 l/h, max. pressure: 5 bar.

Electrical heating mantle, power: 800 W.

Two "J type" temperature sensors to measure the temperature in the column head and the boiler temperature in the distillation process.

Two flowmeters to measure the feed and solvent flow:

  Flowmeter for acetic acid 4%, range: 0 – 48 l/h.

  Flowmeter for trichloromethane, range: 0 – 17 l/h.

The unit includes safety devices in the pumps to avoid shortcomings by overpressure. There are two pressure switches that switch off the pumps when the pressure is high.

Electronic console, including:

  Two switches for the diaphragm pumps (for the feed and for the solvent).

  Two speed controls for the diaphragm pumps.

  Two control panels for the diaphragm pumps.

  Switch for the electrical heating mantle.

  Display for the temperature sensors.

  Control display for the heating mantle (AR-1).

Cables and accessories, for normal operation.

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

Additional recommended element (Not included):

  - UELL-CP. Distillation column, 5 plates type.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Preparation of acid–base titration of the feed.

2.- Obtaining of the binodal curve.

3.- Study of theoretical and experimental mass balances.

4.- Calculation of the flooding velocity of the extraction column.

5.- Regulation of the height of the interface in the extraction column.

6.- Determination of the critical point existence.

7.- Study of the effect of the temperature in the liquid-liquid extraction process.

8.- Calculation of the mass transfer volumetric coefficient, referred to the continuous phase.

9.- Study of the efficiency of the extraction.

10.- Study of the batch operation regarding the solvent or the supply.

11.- Study of the extraction process for industrial processes.

12.- Calculation of the solvent recovery effectiveness.

13.- Study of the distillation process control.

14.- Repetition of the previous practical exercises for different compounds.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Water supply and drain.
- Air extraction system.

DIMENSIONS AND WEIGHTS

UELL:
- Dimensions: 1400 x 700 x 1950 mm approx.
  (55.11 x 27.55 x 76.77 inches approx.).
- Weight: 100 kg approx.
  (220 pounds approx.).

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- UELL-CP. Distillation column, 5 plates type.
- Refractometer.
- Pycnometer.
- Chronometer.

REQUIRED CONSUMABLES (Not included)

- Trichloromethane (solvent) / acetic acid / water.
- Trichloromethane (solvent) / ethanol / water.
- Leksol / Propionic acid / water.

* The unit is ready for working with a wide range of different chemical products, please ask us the most suitable ones.

SIMILAR UNITS AVAILABLE

Offered in this catalog:

- UELL. Liquid-Liquid Extraction Unit.

Offered in other catalog:

- UELLC. Computer Controlled Liquid-Liquid Extraction Unit.

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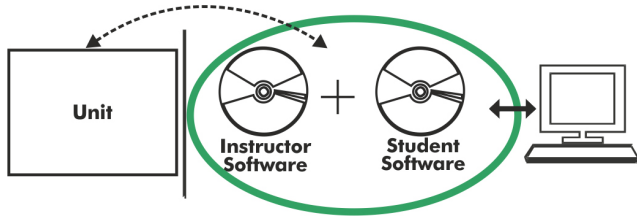
With no physical connection between unit and computer, **this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF)**. Both are interconnected so that the teacher knows at any moment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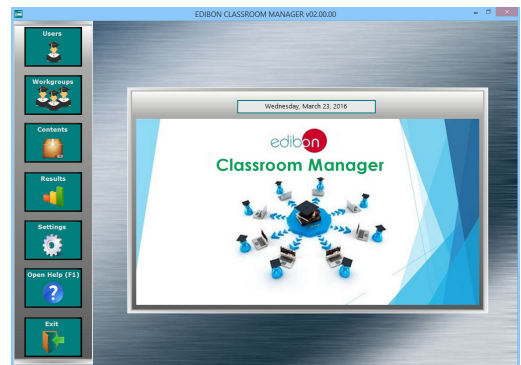
Instructor Software

- 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.
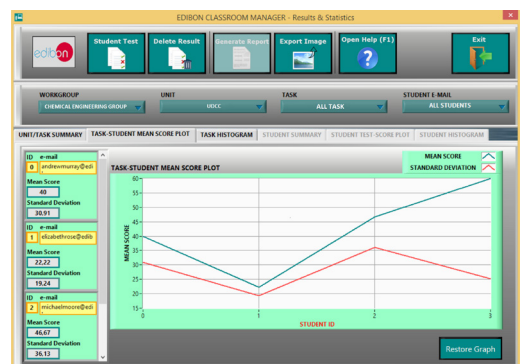- Report generation, User Progression Monitoring and Statistics.

ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen
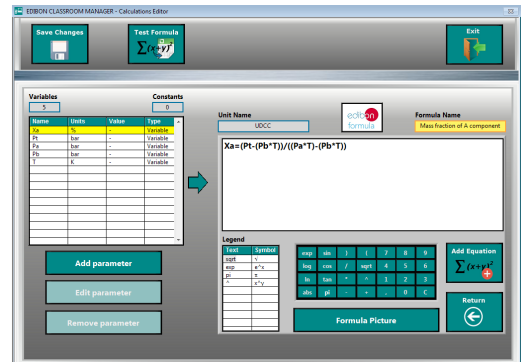
ECAL. EDIBON Calculations Program Package - Formula Editor Screen
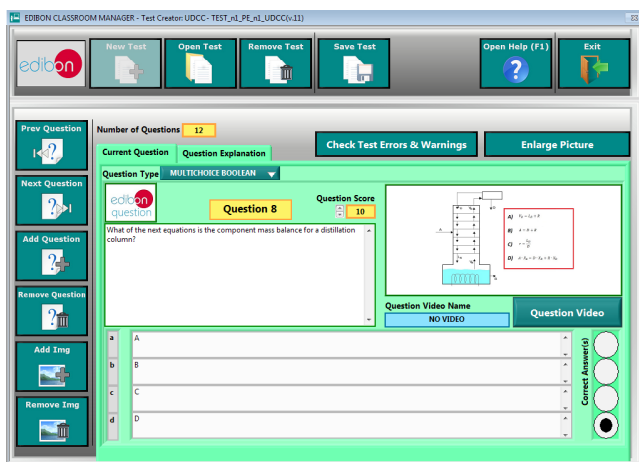
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

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

- 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.

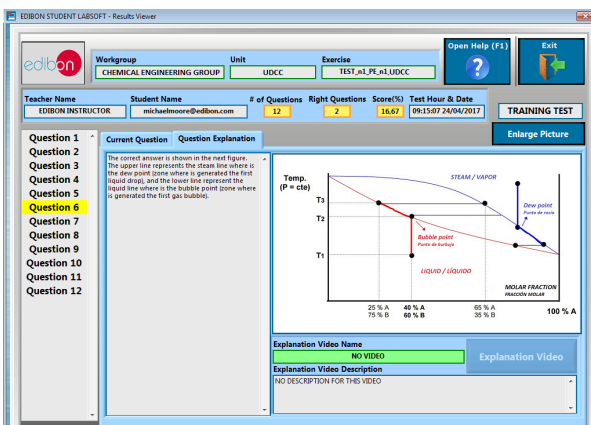- Multimedia-Supported auxiliary resources.

For more information see **ICAI** catalogue. Click on the following link:

www.edibon.com/en/interactive-computer-aided-instruction-software

ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen
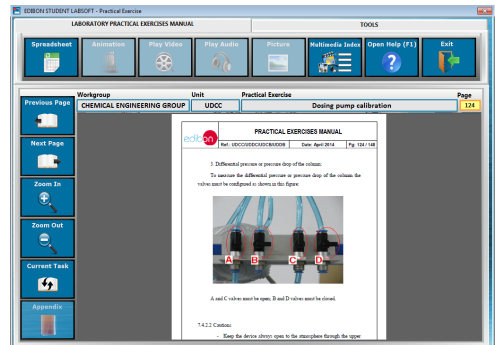
EPE. EDIBON Practical Exercise Program Package Main Screen

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.

REPRESENTATIVE:

C/ Julio Cervera, 10. Móstoles Tecnológico.
28935 MÓSTOLES. (Madrid). ESPAÑA - SPAIN.
Tel.: 34-91-6199363   Fax: 34-91-6198647
E-mail: edibon@edibon.com   Web: **www.edibon.com**

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