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Technical Teaching Equipment

Liquid-Liquid Extraction Unit

UELL

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Products
Products range
Units
11.-Chemical Engineering

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.

ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)

European Union Certificate
(total safety)

Certificates ISO 14000 and
ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate
(Worlddidac Member)

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 a 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 a 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.

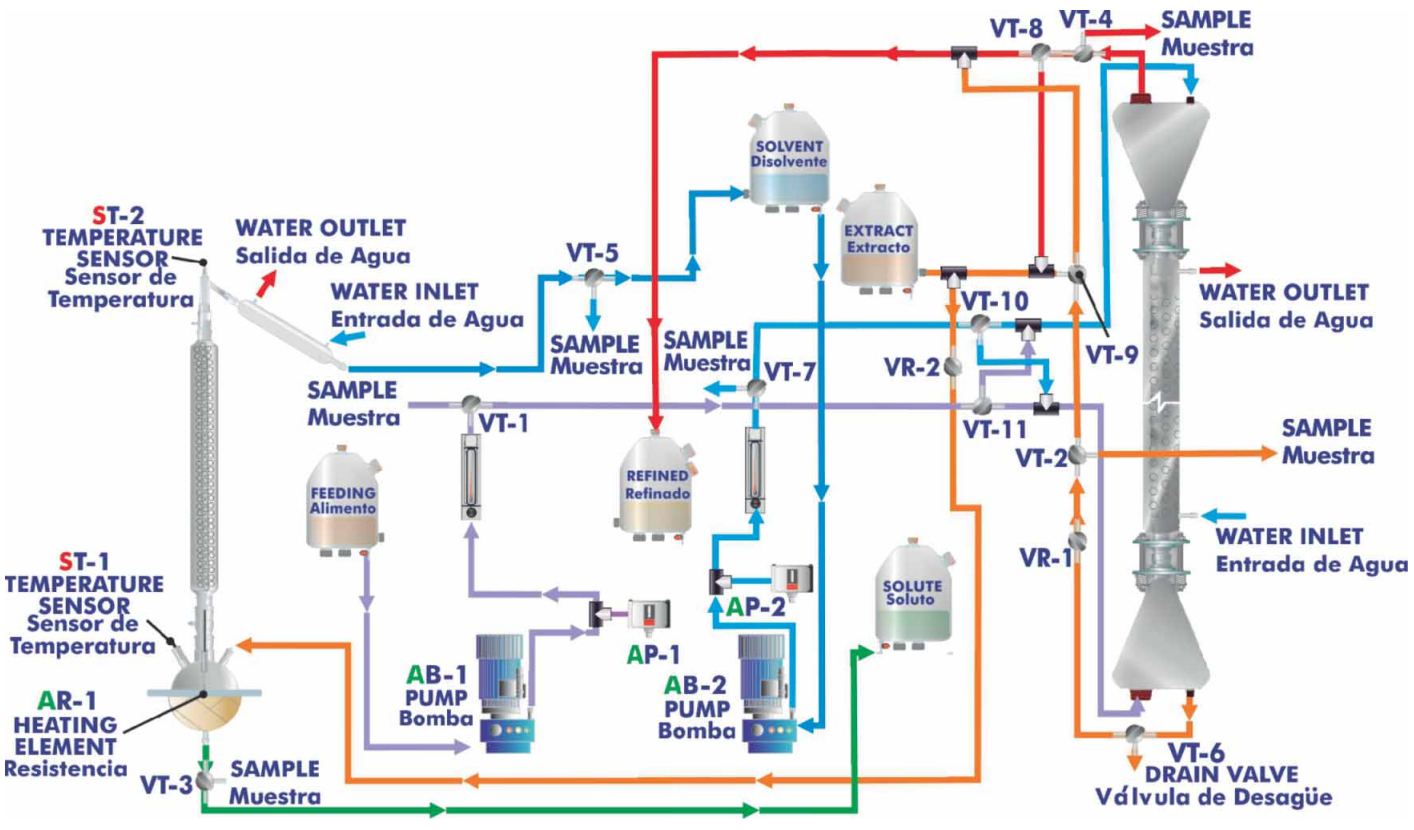
The supply circuits and product collection circuits include two pressure switches that switch off the pumps when the pressure is high, two sampling taps to collect samples, three-way directional valves to direct the different currents and a regulation valve to control the height of the interface.

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 closed 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. The boiler and the column head temperatures are indicated on two temperature sensors. 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 vapour phase is condensed in the coolant column and re-cycled to the solvent tank to recovery the dissolvent and to provide a closed circuit. Then, the solvent can be re-cycled continuously.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION



SPECIFICATIONS

This is a floor-standing unit and includes wheels for its mobility.

Anodized aluminum structure and panels in painted steel.

Main metallic elements in stainless steel.

Transparent elements for a better observation of the process.

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

Extraction process:

- Jacketed glass column packed with glass Raschig rings; length: 1200 mm and internal diameter: 50 mm.
- Two enlargement pieces at the ends, capacity: 2 l.

Distillation process:

- Boiler for the distillation, heated by an electric heating mantle; capacity: 5 l.
- Jacketed glass column packed with glass Raschig rings; length: 500 mm and internal diameter: 25 mm.
- A coolant column.

5 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 5 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 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:

- 2 switches for the diaphragm pumps (for the feed and for the solvent).
- 2 speed controls for the diaphragm pumps.
- 2 control panels for the diaphragm pumps.
- 1 switch for the electrical heating mantle.
- 2 displays for the temperature sensors.

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.

<u>OPTIONAL Distillation Column</u> (not included in the standard supply):

- 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, with ground, 220V./50Hz or 110V./60Hz.
- Water supply and drain.
- Air extraction system.

DIMENSIONS & WEIGHT

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.).

RECOMMENDED REAGENTS

- 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.

RECOMMENDED ACCESSORIES

-Refractometer.

-Pycnometer.

-Chronometer.

OPTIONAL COLUMN

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

AVAILABLE VERSIONS

Offered in this catalogue:

- UELL. Liquid-Liquid Extraction Unit.

Offered in other catalogue:

- UELLC. Computer Controlled Liquid-Liquid Extraction Unit.

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

edibon INTERNATIONAL
C/ Del Agua, 14. Polígono Industrial San José de Valderas.
28918 LEGANÉS. (Madrid). SPAIN.
Phone: 34-91-6199363 FAX: 34-91-6198647
E-mail: edibon@edibon.com WEB site: **www.edibon.com**

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