

Solid/Liquid Extraction Unit – UOP4 MkII

Crystallisation is a valuable process in chemical engineering.

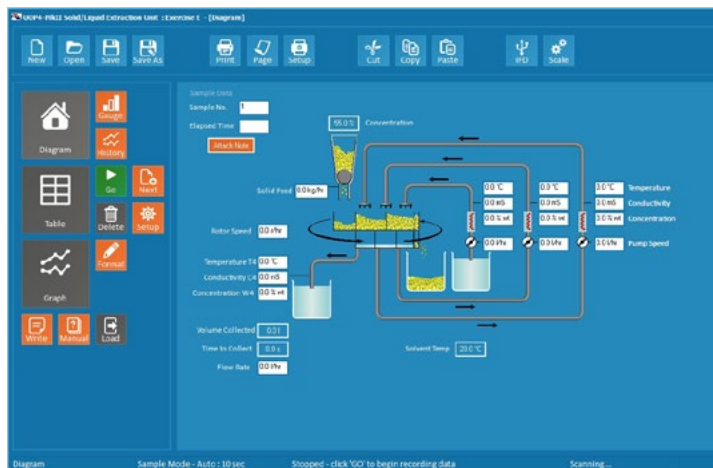
The UOP4-MkII is a laboratory-scale solid/liquid extractor system for teaching the fundamentals of this important unit operation to chemical-engineering students.

The equipment utilises a sophisticated, continuous feed, counter-current flow, multiple-stage, rotary extractor system of the type frequently seen in industrial applications. This gives the student an insight into the practical implementation of the operation, including process economics and control problems.

The effects of temperature, multiple stages, and throughput rate can all be investigated.

The extractor is computer compatible with optional educational software.

**CONTINUOUS SOLID/LIQUID EXTRACTION
MULTIPLE STAGE
INDUSTRIAL ROTARY CELL CONFIGURATION
COMPUTER COMPATIBLE**



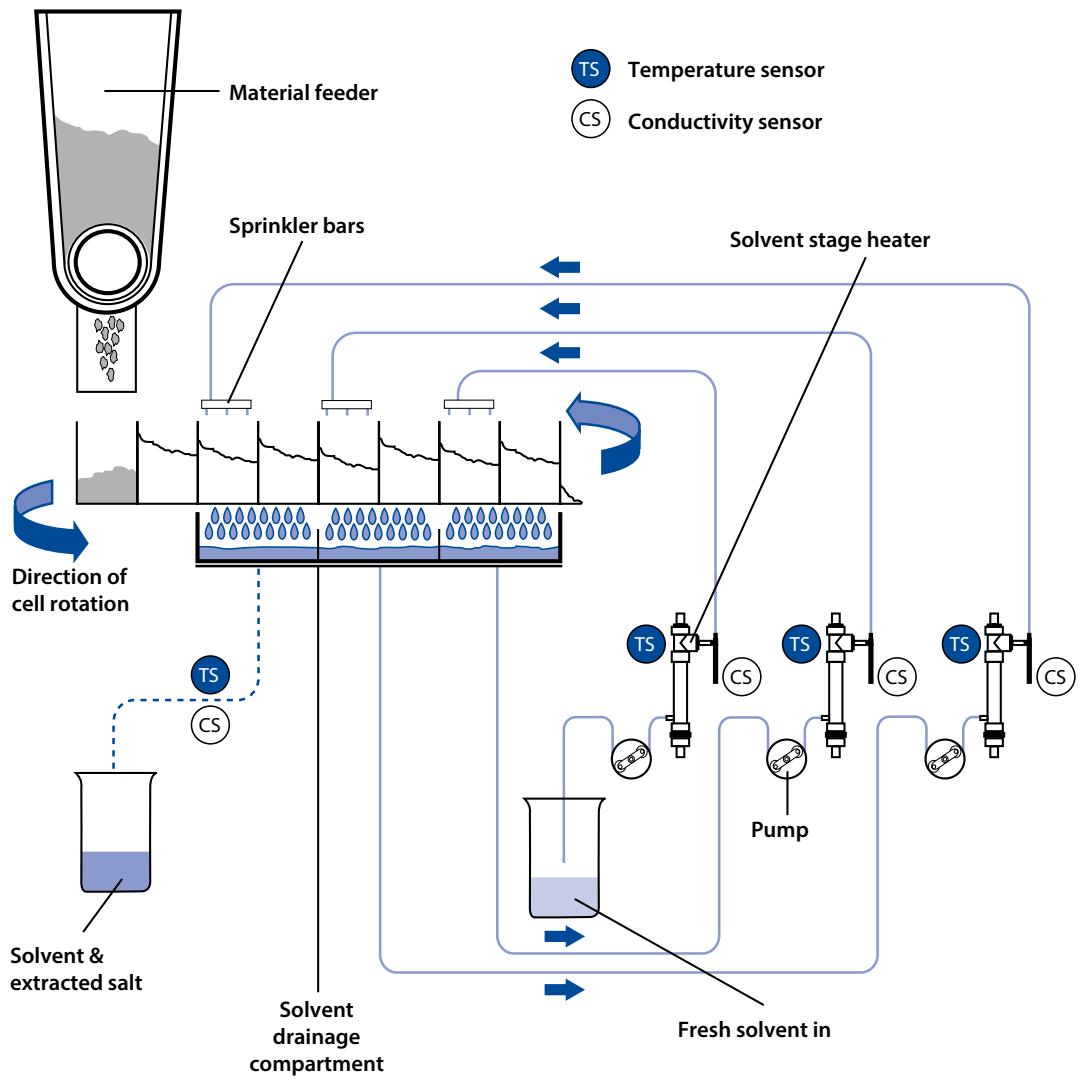
Experimental Capabilities

- Demonstration of the operation of a continuous multiple-stage process
- Closed-circuit percolation extraction (batch extraction)
- Open-loop percolation extraction (continuous operation)
- Investigation of continuous extraction in 1, 2 or 3 steps
- Investigation into effect of solvent temperatures
- Investigation into effect of solvent flow rates
- Investigation into effect of processing time
- Process economics
- Mass balances

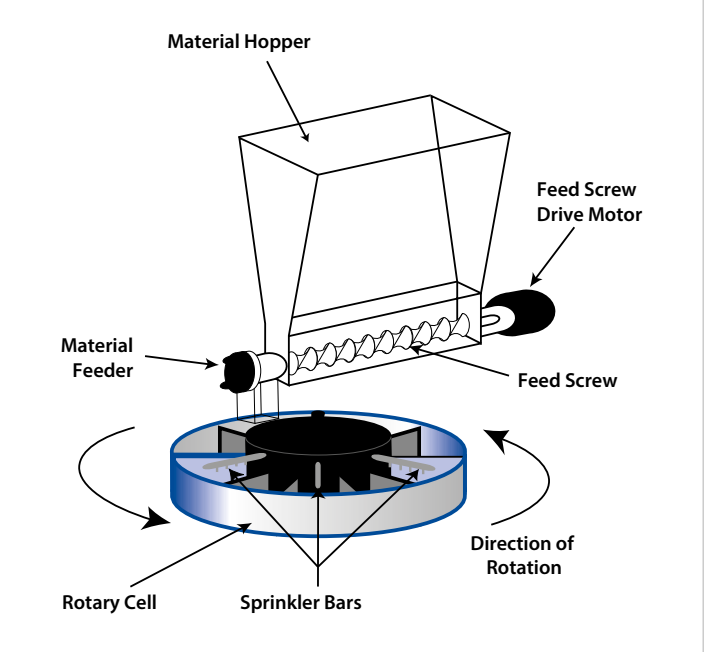
Features

- ▶ Self-contained floor standing unit with integral control and instrumentation console
- ▶ Three-stage continuous extraction process, can also be configured as one or two stages
- ▶ Independent vessel for closed-loop batch extraction
- ▶ Temperature control at each stage
- ▶ Individual control of solvent feed pumps at each stage, of cell rotation rate and of feed rate
- ▶ Probes at each stage allow full monitoring of the process
- ▶ With the data logger, the product concentrations can be directly displayed in real-time (for the recommended material)
- ▶ Optional data logging accessory with USB interface and educational software

UOP4-MKII Flow Chart



Detail of UOP4MKII showing the rotary extractor cell, feed hopper, feed screw and solvent sprinkler bars



Rotary extractor cell, feed hopper, feed screw and solvent sprinkler bars



Description

The heart of the solid/liquid extraction system is a continuously rotating extraction cell divided into compartments. The raw material is fed into these compartments from the input hopper using a screw feeder mechanism. The material is then passed under three solvent sprinkler bars, one for each stage of the process, and the dissolved product is captured in three drainage compartments. Pumps are provided. To pump the product from the drainage compartment of one stage to the sprinkler of the next stage. At the end of the process the spent carrier material is dropped into a collection vessel, assisted by water sprayed from above.

The system is configured as a continuous three-stage, counter-current flow process, but may also be configured as a one or two-stage process for teaching purposes.

Full temperature control is provided at each stage of the process using the three integrated PID controllers and related heating elements. Direct control is also provided over the product feed rate, the cell rotation speed and the interstage pump speeds.

In addition to the rotary cell, an independent vessel is provided which enables batch extractions to be performed.

The unit is fully instrumented with each stage of the process equipped with sensors, giving a temperature and a millivolt (mV) conductivity probe output. When using the standard water/potassium bicarbonate system, the sensor readings can be related to the percentage weight of potassium bicarbonate in the solution using experimental data.

All temperatures and voltage outputs from the conductivity sensors, together with the feed, extractor cell and individual pump rates can also be displayed directly on a computer using the optional data logging package. Using this package it is also possible to display and log the product concentration (when using the recommended material).

The equipment is designed to teach all relevant aspects of solid/liquid extraction in a simple and safe manner. It does not require the use of toxic, volatile or flammable solvents, as it is designed to use water or water-based solvents.

This ensures the process is fully visible to students, enabling them to observe and understand the details of the operation at every stage. There is no need for expensive solvent recovery equipment, such as a distillation column.

The solid carrier is a light porous material, a quantity of which is supplied with the equipment. It can be impregnated with a salt such as potassium bicarbonate or sodium bicarbonate, which is then extracted by the process. The use of a salt enables real-time monitoring of the process using the sensors and instrumentation. The carrier material is reusable.

Ordering codes

- ▶ UOP4MkII-A: 220-240V / 1ph / 50Hz, 13A
- ▶ UOP4MkII-B: 120V / 1ph / 60Hz, 20A
- ▶ UOP4MkII-G: 220V / 1ph / 60Hz, 13A

Overall dimensions

Length	0.77m
Width	0.56m
Height	1.52m
Packed and crated shipping specifications	
Volume	1.0m ³
Gross weight	100Kg

Requirements

Scale



- ▶ **Single phase mains electrical supply:**
 - UOP4MkII-A: 220-240V / 1ph / 50Hz, 13A
 - UOP4MkII-B: 120V / 1ph / 60Hz, 20A
 - UOP4MkII-G: 220V / 1ph / 60Hz, 13A
- ▶ **Cold water:** Typically 0.5 l/min

Optional accessories

- ▶ **Carrier material:** The UOP4MkII is supplied with 2kg of carrier material. Before use this material needs to be impregnated with potassium bicarbonate and dried. If an oven is not available the drying process may take up to three days. Approximately 1kg of material is required for a typical laboratory investigation. The material is reusable, but there is inevitably a slight loss of material during use. More material can be ordered, using order code UOP4MkII-CM (1kg bag).

Ordering specification

- ▶ A continuous three-stage solid/liquid extraction system using the rotary extraction cell design. The rotacell rotation speed is variable (0-4 revs/hour)
- ▶ Delivery of feed material is automated and feed rate is variable (0-3 l/hr)
- ▶ Operation modes are batch, or continuous with one, two or three stages. Independent temperature control is provided at each stage. Flow of all three solvent stages is variable (0-13.5 l/hr)
- ▶ Conductivity of the fluid stream is measured at the input, and at the output of each of the stages
- ▶ UOP4MkII is computer compatible using the data logging accessory, which includes a full educational software package. Details of theory and experimental exercises, operation of the equipment, automatic data logging and real-time graphical display of measured and calculated data is presented
- ▶ **Experimental capabilities include:**
 - Demonstration of continuous operation in 1, 2, or 3 stages
 - Investigation into the effect of solvent temperatures and flow rates of solvent and solids
 - Mass balancing
 - Process economics
- ▶ **UOP4MkII-DTA-ALITE** - Educational software and data logging accessory:
 - USB-based data logging system, including software and all cables required to connect to a PC. The software requires a PC, running Windows 7 above, with a spare USB port.

Technical specifications

Solvent temperatures:	Ambient to 50°C, individually controllable
Pump rate:	0-13.5 l/hr
Feed rate:	0-3 l/hr
Rotation speed:	1 rev/15min (4 revs/hr)
Cell compartment:	0.16 l capacity

Armfield standard warranty applies with this product

Knowledge base

- > 28 years' expertise in research & development technology
- > 50 years' providing engaging engineering teaching equipment

Benefit from our experience, just call or email to discuss your laboratory needs, latest project or application.

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Armfield products are distributed throughout the world. It is our policy in most countries to deal direct or through proven and accredited sales agents, who after suitable approval, may become exclusive representatives.

In exchange for this exclusivity they are required to offer a comprehensive service including the highest degree of after sales support.

Customer Demonstration

To arrange a demonstration please contact your local Armfield representative. Details can be found on our website here: www.armfield.co.uk, or contact Armfield HQ directly using the information below.

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