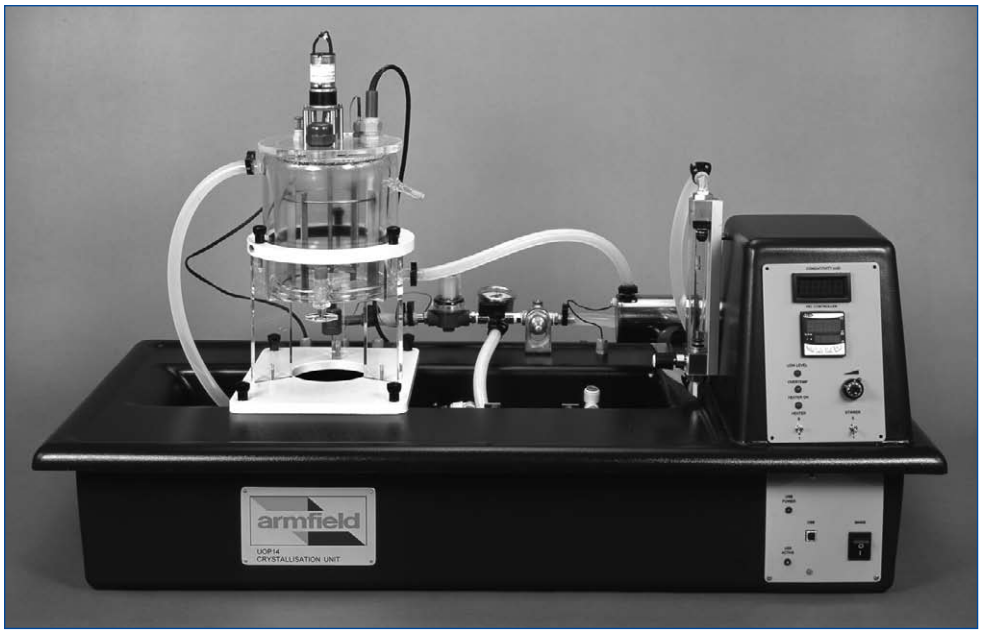
armfield

CRYSTALLISATION UNIT

UOP14
Issue 1



Crystallisation is a valuable process in chemical engineering where the separation of one or more of the components from a liquid mixture is required. The Armfield UOP14 demonstrates this process in the laboratory so that students may gain a thorough understanding of this industrial technique. The UOP14 system demonstrates an industrially important type of crystallisation, namely solution cooling crystallisation. Meaningful experiments may be conducted within a typical laboratory period and students benefit from visual observation of the process.

DEMONSTRATION CAPABILITIES

- ***Understanding the principles of crystallisation***
- ***Mass and energy balancing***
- ***Batch operation***
- ***Continuous operation (option)***
- ***Evaluation of crystallisation efficiency and crystallisation kinetics***
- ***Study of the effect of different parameters: agitation rate, cooling rate***
- ***Crystal size distribution***

Heat and Mass Transfer Unit Operations

UOP

DESCRIPTION

The UOP14 introduces students to the fundamentals of crystallisation. It is a bench-top unit with the see-through glass crystallisation reactor which allows visualisation of crystallisation phenomena. UOP14 utilizes the solution cooling method to study the crystalliser performance.

The equipment consists of a jacketed crystallisation vessel provided with temperature control and agitation.
The crystallisation reactor is thermally controlled by means of heated water circulating in the reactor jacket.
The water is heated by an in-line heater.
The temperature sensor within the reactor and the heater are linked to a 3 term PID controller which is programmed to maintain the desired set-point temperature.

The crystalliser vessel is filled with the hot solution to be crystallised. The solution is well mixed by means of a variable speed axial agitator. With decreasing temperature, the solution becomes supersaturated and finally crystallises.

At the end of the batch, a sample from the crystalliser is discharged and the crystalline product is filtered, washed, dried in the oven and sieved. The final sieving of the obtained crystals is carried out with the use of the set of test sieves with a range of mesh sizes. These sieves are provided with the UOP14. This fractionation can be used to evaluate crystal size distribution as well as crystal and nucleation growth rates.

A conductivity sensor is included which allows the progress of the crystallisation to be monitored on-line.

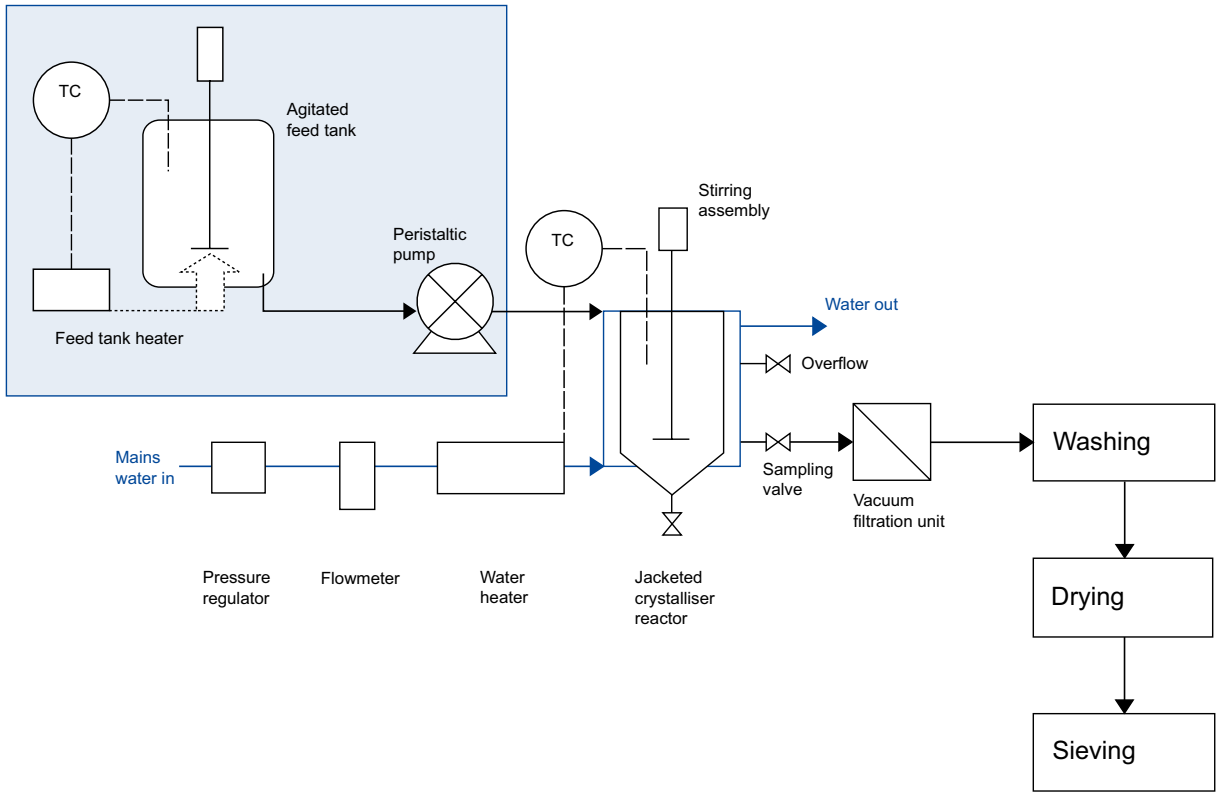


Fig.1 Schematic diagram of batch operation
Continuous feed unit accessory is highlighted.

Different cooling rates can be investigated by the application of different water flowrates. A valved flowmeter is provided to change the water flowrate quickly and easily. This allows the student to investigate different crystallisation conditions. Control of the equipment is straightforward. A panel displays the conductivity and temperature of the system with all controls (stirrer, heater, temperature controller).

The instruction manual included contains experiments, providing a thorough grounding in the operation of crystallisation systems in the context of unit operations for chemical engineering students.

The equipment is supplied complete with a USB computer interface and data logging software. The operational parameters are stored on a user supplied PC, via a USB interface. The associated software includes graph plotting, full instructions on setting up the equipment and performing the investigations, related theory and full help texts. Software requires a computer running Windows 98/2000/XP with a USB port.

ORDERING SPECIFICATION

- ***A bench top unit comprising a vacuum formed ABS plastic plinth with integral electrical console onto which is mounted the stirred glass crystallisation vessel, water heater, water flowmeter and heat exchanger.***
- ***A temperature sensor and 2kW water heater mounted in the mains water line and linked to a PID controller for accurate process temperature control.***
- ***A conductivity probe measuring solution conductivity.***
- ***A cooling action controlled indirectly by the valved flowmeter.***
- ***Protection devices for all electrical circuits.***
- ***Two displays: PID temperature control (reactor temperature), display for conductivity.***
- ***Sensor signals are routed to the USB interface for connection to a PC.***
- ***USB port for data logging by the supplied software.***
- ***Set of sieves for Crystal Size Distribution determination.***
- ***Comprehensive instruction manual with detailed laboratory teaching exercises.***

Optional – Continuous Feed Accessory UOP14-11

This bench-top item is designed to form a continuous crystallisation system together with the UOP14 unit. The module can be used for teaching continuous crystallisation and demonstrating its advantages over the batch process. A variable speed peristaltic feed pump controls the flow rate of the hot solution pumped from the feed tank to the reactor. The feed solution temperature is maintained by the controller linked to two heating elements.

The UOP14-11 is totally self-contained and can be added at any time to turn a standard batch crystalliser into a continuous system.

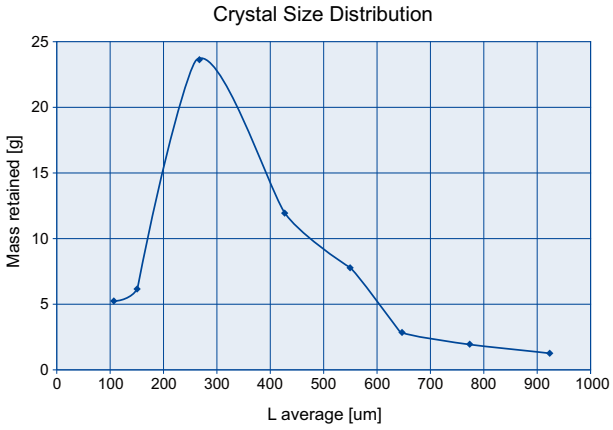


Fig.2 KCl Crystal size distribution.

OPTIONAL ACCESSORIES

UOP14-11: Crystallisation Feed Unit accessory is available for continuous experiment.

- ***A bench top unit comprising an ABS plastic plinth with integral electrical console onto which is mounted the stirred acrylic feed tank, with the heater and peristaltic pump.***
- ***A temperature sensor and 2.5kW heater mounted in the feed tank and linked to a PID controller for accurate solution temperature control.***
- ***A peristaltic pump, used to feed solution from the 20 litre feed tank to the reactor.***

ESSENTIAL ACCESSORIES

Software requires a computer running Windows 98, 2000 or XP with a USB port. (Computer not supplied by Armfield).

UOP14-12 Buchner vacuum filtration kit

Laboratory oven to dry the crystals sample

Laboratory balance

SERVICES REQUIRED

Electrical supply

UOP14-A:	***220-240V/1ph/50Hz at 13A***
UOP14-B:	***120V/1ph/60Hz at 20A***
UOP14-G:	***220-240V/1ph/60Hz at 13A***

Cold water supply at minimum:
3LPM at 3bar

OVERALL DIMENSIONS

UOP14:

Height:	*0.65m*
Length:	*1m*
Depth:	*0.5m*

UOP14-11:

Height:	*0.69m*
Length:	*1m*
Depth:	*0.5m*

SHIPPING SPECIFICATION

UOP14:

Volume:	*0.35m^3*
Gross weight:	*35kg max.*

UOP14-11:

Volume:	*0.35m^3*
Gross weight:	*35kg max.*

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