The recovery and processing of plant and organic basic substances for the pharmaceutical, chemical, food/non-food and cosmetics industry are subject to high quality demands.

SPX FLOW e&e Series extraction plants meet these demands with work based on many years of experience and innovative exchanges of views with customers and pharma experts. SPX FLOW e&e Series is among the leading brands in the field of extraction, evaporation, vacuum and freeze drying technology.

For these and other fields of application we offer excellent technical and economical customer-specific plants. Our engineers are at your disposal through the complete project life cycle, from planning through to the plant being set into operation.

**OUR SERVICES INCLUDE:**

- Project planning
- Plant design
- Basic and detail engineering
- Turnkey solutions
- Process automation
- Assembly
- Assembly supervision
- Commissioning
- Documentation
- Training
- After sales service

SPX FLOW e&e Series is a leading company in the field of extraction, evaporation, vacuum and freeze drying for the food, pharmaceutical, coffee and cosmetics industry.
Evaporation plants

SPX FLOW e&e Series offers complete production lines, from extraction plants for recovering basic extracts, to evaporation plants for concentrating these extracts and vacuum drying plants for the production of granulates or powder. Our evaporation plants are often integrated between the extraction and vacuum drying process, but they can also be operated as individual plants.

Depending on the product, various construction and operating methods can be used. Besides plate evaporation plants (advantages: little space requirements, easy to expand), SPX FLOW e&e Series also supplies tube bundle apparatuses as rising or falling film evaporators (advantages: suitable for the most delicate products as well as for multistage applications).

**APPLICATIONS**
- Pharmaceutical products
- Food/Instant products (coffee, tea, etc.)
- Dairy products
- Fruit juices
- Brewery products
- Organic products
- Inorganic products
- Waste water / solvent evaporation for environmental purposes
- Bioenergy
- Recycling of solvents

**EVAPORATION TECHNOLOGIES OFFER VARIOUS OPERATING METHODS**
- Rising film
- Falling film
- Forced circulation
- Natural circulation
ATEX, FOR THE EXTRACTION OF SMALL BATCHES OF RAW MATERIAL

The SPX FLOW e&e Series small scale extraction plant is designed to extract small batches of raw material using water or alcoholic solvents. The gasket material can also be adapted for other solvents (acetates, alkanes, etc.) on request.

The plant is equipped with 2 percolators, each 50 litre volume. Additionally, the plant features a condensation unit consisting of a condenser and a stainless steel vacuum pump, together with a solvent balance tank and a miscella outlet.

PROFIT FROM THE ADVANTAGES OF SPX FLOW e&e SERIES SMALL SCALE EXTRACTION PLANTS

- Determination of all process conditions which are necessary for the design and the purchase of a production plant, for example: yields, solvent requirements, temperatures, etc.
- CPP (Connect - Plug - Produce)
- Ideal for small scale productions
- Reduced project timescales with quick availability of the plant
- Can be used for commissioning and training of the operator personnel
- Consultancy by SPX FLOW e&e Series specialists available before, during and after the test runs
- Small footprint required for the installation of the plant
- The device can be rented for trials at your premises

SERVICE DATA OF THE SPX FLOW SMALL SCALE EXTRACTION PLANT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions Extractor Unit</td>
<td>2.100 x 1.300 x 2.100 mm (Length x Width x Height)</td>
</tr>
<tr>
<td>Dimensions Pump Unit</td>
<td>2.500 x 1.300 x 2.200 mm (Length x Width x Height)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 900 kg</td>
</tr>
<tr>
<td>Volume Extractor</td>
<td>2 x 50 litre</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>-1/3 bar</td>
</tr>
<tr>
<td>Design Temperature</td>
<td>Up to 150 °C</td>
</tr>
<tr>
<td>Volume Solvent Tank</td>
<td>300 litre</td>
</tr>
<tr>
<td>Installed Electrical Power</td>
<td>3.7 kW</td>
</tr>
<tr>
<td>Steam Requirement</td>
<td>Approx. 50 kg/h</td>
</tr>
<tr>
<td>Fresh Water Requirement</td>
<td>Approx. 2 m³/h from 15 - 35 °C</td>
</tr>
<tr>
<td>Equipment Protection Level</td>
<td>EEx E II T3</td>
</tr>
</tbody>
</table>
ATEX, FOR THE CONCENTRATION OF LIQUID EXTRACTS

The SPX FLOW e&e Series small scale evaporation plant is designed to concentrate small batches of extracts or other liquid products using water or alcoholic solvents. The concentration rate is limited to the viscosity of the concentrated liquid (up to approx. 500 cP). The plant consists of a plate evaporator with a downstream centrifugal separator. The evaporated vapours are condensed in a plate heat exchanger.

A vacuum pump is connected to the condenser, and the vacuum can be adjusted between 50 and 800 mbar. The evaporation temperature can be adjusted according to the product specific boiling curve through the applied vacuum, which also enables concentration of temperature sensitive extracts.

PROFIT FROM THE ADVANTAGES OF THE SPX FLOW e&e SERIES SMALL SCALE EVAPORATION PLANTS

- Determination of all process conditions which are necessary for the design and the purchase of a production plant, for example: product quality, evaporation behaviour, temperature sensitiveness, etc.
- CPP (Connect - Plug - Produce)
- Ideal for small scale productions
- Reduced project timescales with quick availability of the plant
- Can be used for commissioning and training of the operator personnel
- Consultancy by SPX FLOW e&e Series specialists available before, during and after the test runs
- Small footprint required for the installation of the plant
- The device can be rented for trials at your premises

SERVICE DATA OF THE SPX FLOW SMALL SCALE EVAPORATION PLANT

<table>
<thead>
<tr>
<th>DIMENSIONS EVAPORATION PLANT</th>
<th>3.600 X 1.350 X 2.000 MM (LENGTH X WIDTH X HEIGHT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
<td>APPROX. 900 KG</td>
</tr>
<tr>
<td>CAPACITY EVAPORATOR</td>
<td>APPROX. 50 L/H WATER EVAPORATION</td>
</tr>
<tr>
<td>VOLUME BALANCE TANK</td>
<td>APPROX. 100 LITRE</td>
</tr>
<tr>
<td>INSTALLED ELECTRICAL POWER</td>
<td>7.4 KW</td>
</tr>
<tr>
<td>STEAM REQUIREMENT</td>
<td>APPROX. 60 KG/H</td>
</tr>
<tr>
<td>FRESH WATER/COOLING WATER REQUIREMENT</td>
<td>APPROX. 2 M³/H FROM 15 - 35 °C</td>
</tr>
<tr>
<td>EQUIPMENT PROTECTION LEVEL</td>
<td>EEx E II T3</td>
</tr>
</tbody>
</table>
Rectification Plants

For the thermal separation of multicomponent mixtures.

There are many classical advantages of columns compared to connecting individual distillation units. These include the possibility for continuous operation, increased energy efficiency, technically safe design and operation and a reduced installation footprint. The careful selection of components also means that contact surfaces can be increased to improve plant efficiency. SPX FLOW e&e Series provides high performance, cost effective rectification plants to specific customer requirements.

EXAMPLES OF REALIZED DISTILLATION AND RECTIFICATION PLANTS

- Solvent recovery and concentration of water based solutions, e.g. Ethanol, Methanol, Ethyl acetate and many other organic solvents
- Aroma recovery for foods, e.g. fruit juices during juice concentration process
- Waste water treatment – stripping of organic components for reducing BOD and COD
- Intermediate step with liquid-liquid extraction plants
- Reactive rectification to convert chemical systems
NEW TECHNOLOGY FROM SPX FLOW

Dimethyl ether (DME) is an organic compound that exists as a non-toxic gas under atmospheric conditions. It is the simplest ether and can be derived from many sources. The new process from SPX FLOW uses DME to extract organic material and requires the use of only moderate pressures. DME, which is commonly used as an environmentally friendly propellant in aerosol canisters and is being increasingly used as an alternative fuel solution, is now approved for use with food substances and accepted as an extraction agent.

Traditionally carbon dioxide (CO₂) is used in applications using liquid gas extraction but this requires pressures of 150-500 bar. DME, however, liquefies at pressures above just five bar. This much lower pressure requirement and rating significantly reduces the cost of the equipment required as well as simplifying installation requirements.

The liquid gas extraction pilot plant process

The DME liquid gas is pumped from a storage tank through the extractor vessel which contains the solid raw material being used for the extract. The extracting agent can be fed through the extraction vessel from either the top or the bottom and the solvent circulated between tanks until the extraction is complete. The temperature control of the solvent is managed via heat exchangers.

When the extraction step is complete, the liquid solvent containing the extract is then routed to a separator where the expanded volume reduces the pressure and, because of its low boiling point (-28°C), the gas is flashed off. It leaves through the top of the separator to a condenser and is pumped as a liquid back to a second storage tank for recycling.

Besides DME, other solvents with similar boiling points may be used on the pilot plant, e.g. propane or butane.

Trials and driving efficiencies

SPX FLOW has extensive test facilities and has carried out pilot tests on this new extraction technology on herbals and other materials. The results have shown high yields with rapid extraction and the system does not need the high-pressure machinery required with the use of CO₂. Besides a high product quality, it offers the potential for significant cost savings in applications.

SPX FLOW continues to innovate and research to deliver technology which offers real savings and efficiency improvements to its customers. The new liquid gas extraction process is also available as a pilot plant for trials at customers’ sites.

Now accepted for use within the food industry and gas extraction installations, DME offers significant advantages in both its extraction and product characteristics. Its lower pressure requirements equates to significant reductions in equipment costs with a system design which still delivers the performance and efficiency expected from SPX FLOW extraction vessels. This new extraction process further demonstrates the continued, sustained drive for innovation at SPX FLOW.
Besides extraction and evaporation plants, SPX FLOW e&e Series designs, fabricates and supplies according to GMP, FDA and 3A standards:

- Vacuum belt drying plants (VBD)
- Vacuum drying cabinets (VDC)
- Vacuum freeze belt drying plants (VFBD)

**SPX FLOW e&e SERIES VACUUM BELT DRYING PLANTS**

SPX FLOW e&e Series vacuum belt drying plants are designed for the continuous charging of liquid or solid products with the dried granulate continuously discharged under clean room conditions (GMP). After the drying process, the products can be milled and customised as required. Vacuum belt drying can be regarded as one of the most economical and gentle drying methods as the use of a vacuum means very low water evaporation temperatures can be achieved. Aroma, colour and bulk density of the product can be specifically influenced by the process. SPX FLOW vacuum belt drying plants are widely used in the pharmaceutical, food and chemical industries.

**SPX FLOW e&e SERIES FREEZE DRYING TECHNOLOGY**

SPX FLOW e&e Series freeze drying plants mainly find their application in the coffee industry, but they can also be used for drying products for the food and pharmaceutical industry. Freeze drying may be considered a complex method, however it provides an extremely gentle and aroma-protective process. Special product characteristics can be maintained, such as colour and flavour of the dried products to ensure the highest quality results.

**ADVANTAGES OF SPX FLOW e&e SERIES DRYING PLANTS:**

- Short drying time
- Minimal loss of aroma
- Little loss of product
- No oxidation of product
- No mechanical stress
- Solvent recovery possible
- Low product temperatures
- Less energy consumption
- Completely closed system
- No pollution of environment
- Controllable Maillard reaction
- Instant properties of the dried product
Small scale vacuum belt dryer

The small scale vacuum belt dryer is a continuous dryer. Products can be introduced through a sluice in both liquid and solid form without interruption of or impact on the drying process. The drying process can be directly observed via two large sight glasses, enabling an exact adjustment of drying properties.

The special arrangement of the heating plates enables variation of the drying plate temperature of each heating zone for more complete control over the process.

Products can be fed by swivel arm, nozzle or vacuum sluice and parameters such as spread and product temperature adjusted to requirements. The vacuum can be generated via water ring pumps or dry compressing vacuum pumps, depending on the application and the process can achieve temperatures of -50 °C.

SPX FLOW e&e Series also offers the capability for characterising and developing drying product properties. Drying test runs can be carried out in order to determine important product properties such as water content, adsorption and desorption behaviour, relative product humidity and glass transition temperature.

**APPLICATIONS:**
- Plant extracts
- Fruit juice concentrates
- Food / Instant products
- Pharmaceutical products
- Coffee, tea, etc.
- Soluble dried malt extract
- Bakery products
- Meat extracts

<table>
<thead>
<tr>
<th>TYPE</th>
<th>VACUUM DRYING</th>
<th>VACUUM DRYING</th>
<th>LYOPHILISATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRYING TEMPERATURE</td>
<td>40 °C – 70 °C</td>
<td>10 °C – 40 °C</td>
<td>-2 °C – 40 °C</td>
</tr>
<tr>
<td>PRETREATMENT OF PRODUCTS</td>
<td>EXTRACTION, EVAPORATION</td>
<td>EXTRACTION, EVAPORATION, STERILISATION</td>
<td>EXTRACTION, EVAPORATION, FOAMING AND PREFREEZING UNIT FREEZING OF INSTANT PRODUCTS, MILLING OF INSTANT PRODUCTS</td>
</tr>
<tr>
<td>WATER EVAPORATION*</td>
<td>0,9 – 2,5 KG/M²/H</td>
<td>0,9 – 2,5 KG/M²/H</td>
<td>0,9 – 2,0 KG/M²/H</td>
</tr>
<tr>
<td>DRYING PRESSURE</td>
<td>70 – 300 MBAR</td>
<td>10 – 100 MBAR</td>
<td>0,1 – 6 MBAR</td>
</tr>
<tr>
<td>VACUUM DEVICES</td>
<td>CONDENSER AND WATER RING PUMP</td>
<td>CONDENSER AND WATER RING PUMP WITH GAS JET</td>
<td>ICE CONDENSER AND DRY COMPRESSING VACUUM PUMP WITH FC CONTROL</td>
</tr>
<tr>
<td>DRY PRODUCT HANDLING</td>
<td>DISCHARGING, PACKAGING IN BAGS</td>
<td>DISCHARGING, PACKAGING IN BAGS</td>
<td>DISCHARGING, PACKAGING IN BAGS</td>
</tr>
</tbody>
</table>

*Depending on the product properties.*
INSTANT COFFEE PROCESSING

The coffee extract quality is predominately determined by the coffee bean grade, blend, the roasting parameters used, the extraction technology and the extraction mode. SPX FLOW e&e Series offers individual process solutions designed to maximize the operational flexibility for end-product quality while meeting the desired production capacity.

In the extraction process soluble solids and aromas are efficiently extracted and the coffee aroma is carefully recovered to maximize the retention of the desired aromas. After the extraction process, the coffee extract is clarified to remove sediments and concentrated using an evaporator, which is operated under vacuum to concentrate the coffee extract at low temperature. The recovered aromas are mixed with the concentrated coffee extract to meet the desired taste profile. The standardised aroma-rich coffee extract can then either be bottled-off or spray / freeze dried.

ADVANTAGES OF SPX FLOW e&e SERIES INSTANT COFFEE PROCESSING TECHNOLOGY

Each SPX FLOW instant (soluble) coffee plant supplied is operator-friendly and specifically designed to meet the desired end-product capacity, quality and powder / granule morphology. The instant coffee capacity range offered by SPX FLOW is 50 – 1,500 kg/h.

SPECIAL FEATURES INCLUDE:

- Aroma stripping before extraction for premium aroma recovery
- Multiple extractor designs
  - A short and wide-body extractor for both finely and coarsely ground roasted coffee to obtain high production yields and premium coffee extract.
  - A conventional extractor for obtaining standard production yields and standard coffee extract quality.
- Different extraction modes depending on the desired coffee extract quality and optimum use of water and steam
- Second aroma recovery from the aroma-rich extract
- Off-flavour removal after hydrolysed extraction mode
- Extract clarification for sediment-free coffee extract
- Different evaporator designs (multi-effect Plate Heat Evaporators or multi-effect Falling-film Evaporators) with or without finisher
- Batch and continuous freeze drying systems, based on either a tray-system or belt-system
- Control of freeze dried end product properties, i.e. colour, bulk density, granule size and solubility
SPX FLOW Innovation Centre

**PROCESSES**
- Extraction
- Aroma rectification
- Concentration
- Drying

**PRODUCTS**
- Plant extracts
- Fruit juice concentrates
- Food/Instant products
- Pharmaceutical products
- Coffee, tea, etc.
- Soluble dried malt extract
- Bakery products
- Meat extracts

**PRODUCT SAMPLES**
For trials we need the following product quantities:
- Drying: approx. 10 - 20 kg of concentrate
- Extraction: 30 - 100 kg raw material, depending on the yield
- Evaporation: approx. 300 - 600 kg of liquid extract

**ADVANTAGES**
- Controlled testing conditions
- Short process times
- Continuous and batch processing
- Controlled adjustment of end-product properties including bulk density, colour and flavour
- Scale-up of results for commercial plants
- Product development resulting in representative product sample

**EQUIPMENT**
- Small scale extraction unit, 2 x 50 l
- Small scale evaporation unit, water evaporation rate: 50 kg/h
- Small scale vacuum belt and freeze dryer: 0,3 mbar – 100 mbar
- Rotary evaporator (laboratory scale), quick analysing of product concentration characteristics
- Pilot aroma rectification plant, aroma recovery of strip-condensates from extraction and evaporation processes
- Pilot liquid gas extraction plant