



**your partner
in process engineering**



50 YEARS OF EXPERIENCE

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VUOS partners can benefit from a profound expertise in organic chemistry, which has been built in 50 years of VUOS history. During that time our chemists have developed unique know-how in R&D, fine chemicals production, toxicology and engineering. So VUOS can offer the whole sequence of relevant services – from literature search, research, laboratory testing, process development, pilot plant production to plant scaling up and toxicology testing. Combination of these abilities allows VUOS to satisfy fully needs of its partners, especially from pharmaceutical, electronical and chemical industries.

VUOS has been working continually on improving quality of its services and products. An overall high quality standard was confirmed by ISO 9001:2001 certification audits. Our analytical and toxicology department works under GLP conditions, our chemicals production complies with GMP like or GMP.

Process Engineering department of VUOS

is intended on the development and execution of technology processes and equipment manufacture; these are used in the chemical, pharmaceutical and food industries or environmental systems.



VUOS 50 YEARS OF EXPERIENCE



- 1941 Foundation of Research Laboratories
- 1951 Research Laboratories as an independent state company
- 1952 New name – VUOS
- 1992–6 PRIVATISATION of state company VUOS
- 1997 VUOS acquired Research and Development Department of Synthesia
- 1998 New Owner – Aliachem a.s. – part of Unipetrol group



The department mentioned takes part in research, design and erection of industrial units. It is engaged to solve some serious problems of ecology, development and manufacture of special technological equipment as well. There are available research and testing laboratories, pilot-plants and workshops. Engineering calculations, design or project activities use up-to-date SW technics. Wide basis of physical and toxicology properties of substances are available, as well as instrumental analysis laboratory. Department operates under the quality control system ČSN ISO 9001:2001.

The nature of activities

- The department takes advantage of long years experience and expert knowledge in the field of chemical processes and special technology as well.
- Professional structure of Department and good experimental basis makes it possible for optimum solving technology problems.
- Design and process equipment are at contemporary level, distinguished by good operation safety, ecology and economy standpoints.
- The customers orders are solved from the problem study, basic/detail engineering, design up to complete delivery of the units.
- The department activities are effective especially in the ranges of middle investment projects.



Technological development

- Research and study
- Lab/pilot-plant development and testing
- Simulation calculations
- Design of processes
- Evaluation of alternative proceedings and project risks (troubleshooting)

Engineering

- Material and energy balances
- Calculations and design of equipment
- Treatment of gas and liquid wastes
- Detection and improvement of the technology faults (trouble-shooting)

Project data and information

- Process sketches and flow-sheets
- Specification of raw-and auxiliary materials
- Design of process control
- Quantity and composition of waste materials
- Processes and equipment for the treatment of all types of wastes
- Detail specification of the production equipments
- Dimensional sketches of equipments
- Economical evaluation of investment homecoming

Project documentation

- Technology part of project
- Project documentation in all the steps

Manufacture, assembly, running-in

- Machinery
- Special apparatus manufacture
- Assembly
- Operation and safety manual
- Complex test-runs
- Personnel training
- Services and consulting

Expert knowledge, know-how and unit operations

- a) Fluid flow
- b) Heat and mass transfer
- c) Separation processes
- d) Reaction techniques
- e) Enviromental technology
- f) General technology

General technologies

Mass and heat transfer
Separation processes

The Process Eng. Dpt. is intended on the up-to-date systems SW and HW, applied for design and calculations. The programmes are able to solve the material and energy balances, even if for the sophisticated technology points, modelling all the important heat transfer operations, separation processes, chemical reactions, fluid flow and liquids pumping. Simulation of equipment or units gives usually better results in comparison with expensive modelling experimentation.

Unit operations

<i>Liquid flow</i>	<ul style="list-style-type: none"> - pipes, fittings, orifices, pumps - vacuum systems (water ring pumps, ejectors)
<i>Mass transfer</i>	<p>Distillation</p> <ul style="list-style-type: none"> - batch, continuous, atmospheric, vacuum , multicomponent, extractive distillation, reactive distillation - flow-film evaporators - plates (sieves, bubble caps, valves) and packing (poured packing, structured packings) comparison <p>Absorption</p> <ul style="list-style-type: none"> - dissolving, absorption connected with chemical reaction - absorption with absorbent circulation - absorption columns (poured packing columns, TCA washers, Venturi scrubber) <p>Stripping</p> <ul style="list-style-type: none"> - Air/Steam VOC stripping - stripping columns <p>Extraction</p> <ul style="list-style-type: none"> - batch/continuous liquid-liquid extraction - extraction columns with vibrating plates <p>Drying</p> <ul style="list-style-type: none"> - whirl, spray, jet, spin-flash and fluid bed dryers <p>Dust separation</p> <ul style="list-style-type: none"> - cyclone and hydrocyclone - demisters - solid settlers, sedimentation tanks <p>Agitation</p> <ul style="list-style-type: none"> - agitators, stirrers – propeller, turbine, paddle, anchor - static mixers
<i>Heat transfer</i>	<p>Heat exchangers design</p> <ul style="list-style-type: none"> - tube, tube-in-tube, plate, spiral, spray coolers and condensers, cooling towers <p>Boilers, heaters</p> <ul style="list-style-type: none"> - jacketed vessels, thermosyphons, falling film boilers <p>Condensers, steam generators</p> <ul style="list-style-type: none"> - direct/undirect
<i>Reaction techniques</i>	<ul style="list-style-type: none"> - reversible , irreversible, parallel, consecutive reaction - kinetic equations
<i>Energy auditing</i>	<ul style="list-style-type: none"> - analysis of heat consumption - handling with condensate - distribution of steam and technological water - heat savings - thermal losses in buildings - insulation

Software applied

ChemCAD® + moduls CCTherm, CCBatch, BatchCAD, CCRreact /simulation – balance, unit operations / Visimix® /agitation/ VesselPak® /heat exchange – agitated vessels/



Distillation is one of the unit operations with long tradition at VUOS. The Department of Process Engineering is experienced in the practical application of distillation for different production purposes:

- atmospheric and vacuum distillation
- batch or continuous distillation
- multicomponent distillation
- azeotropic distillation
- distillation of heat unstable compounds

Rectification columns

The department is noted for its deep knowledge in the field of vacuum and multicomponent rectification requiring high number of theoretical plates (e.g. rectification of aromatic compounds, separation of isomers). Solving the technology problems comprises optimum type of column packing (structured packing, poured packing, plates). The project contains design of flux distributors, collectors and other components of distillation column (internals).



Nitrotoluene isomers distillation

Accessories for rectification columns

Rectification columns for individual cases are supplied by special heat exchangers. Different evaporators are recommended, e.g. tubular (falling film, termosyphone) or boilers. For the vapour condensation there are available tubular, helical or plate exchangers. The task is to secure an efficient, safe and cost-effective processing.

Laboratory and pilot plant testing

For the laboratory tests there are ready glass made apparatus – units and components, suitable for any modelling of distillation process. There are devices for vapour pressure of pure compounds and phase balance measuring. Wide offer of pilot size rectification columns for testing are available.



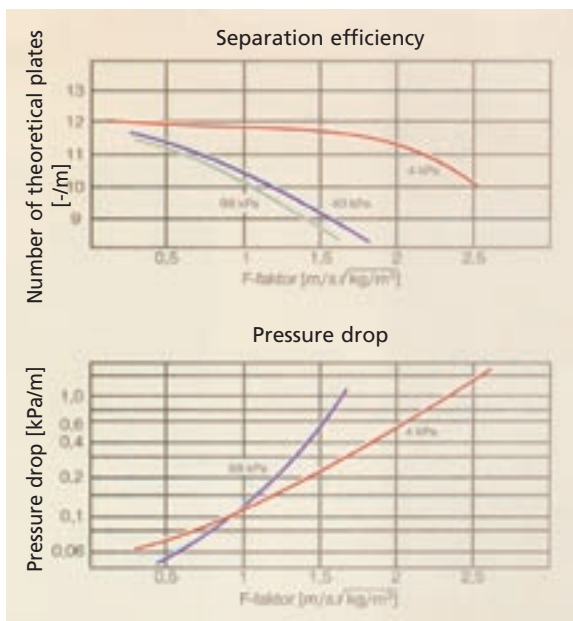
Isocyanate distillation

The test rectification columns:

Item	Vessel		Column			Operation pressure	Max. temperature	
	material	volume (m ³)	diameter (m)	packing	No. of TP			material
	–	m ³	mm	–	–	–	kPa	°C
1	stainless steel	0,5	300	stuctured packing	20	stainless steel	0,4	220
2	glass-lined steel	2,0	300	stuctured packing	80	stainless steel	1,0	150
3	glass-lined steel	0,4	200	stuctured packing	20	graphite /glass	0,15	150
4	glass-lined steel	3,3	300	stuctured packing	35	graphite /glass	0,15	150
5	glass-lined steel	1,6	300	poured packing	7	ceramics /glass	0,1	150
6	glass-lined steel	1,2	300	stuctured packing	25	ceramics /glass	0,15	150
7	glass-lined steel	1,0	200	stuctured packing	20	stainless steel	101	150
8	glass-lined steel	5,0	300	poured packing	5	ceramics	101	150

Manufacture of structured packing NT-700

Special structured column packing, one of the best products, is manufactured from stainless steel wire mesh. It has been developed for the separation of heat sensitive compounds with very closed boiling points. The outstanding features of this packing, i.e. high number of theoretical plates and very low pressure drop, designates that for special vacuum distillation processes.



VUOS provides equipment delivery for the treatment of waste air from volatile organic compounds (VOC); stationary or mobile units are used.

Process description

The process is based on physical adsorption of solvents in a porous microstructure of granulated charcoal. The compounds adsorbed remain unchanged and can be recycled again to the production process after regeneration of charcoal.

Regeneration of charge is based on solvents desorption by overheated steam. The solvents layer is separated from steam condensate and in top of it can be treated by distillation. The kind of charcoal applied depends on gas impurities.

VUOS provides the deliveries of big stationary units as well as mobile adsorption equipment for smaller sources of pollutions.

Process advantages

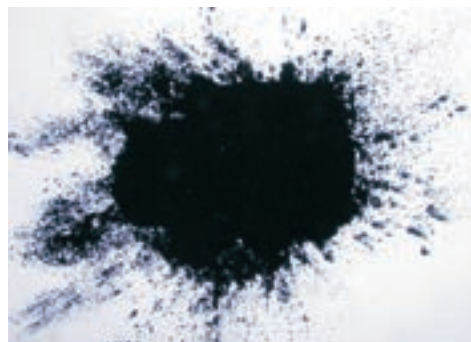
- High flexibility securing good purification possibility of polluted air in the ranges of solvent concentration from 2 to 50 g/Nm³ and quantity from 100 up to 10000 Nm³/ h.
- High efficiency in the ranges from 96 to 99,5 %.
- Solvent recycling enables the cost savings
- Simple design gives trouble-free operation and long service life.
- Low investment and production costs in comparison with other processes (combustion).



Adsorption of o-dichlorbenzene

Process application examples

- Solvent vapours from the production of chemical, pharmaceutical and food industry products, plastics, films, textiles.
- Vapours of solvents and diluents from paint shops and printing plants.
- Vapours of chlorinated hydrocarbons from degreasing baths.



VUOS provides delivery of equipment for waste gases treatment by solvent absorption (washing) or by chemisorption.

Process description

The solvent absorption process is based on selective absorption of compounds from the gas flow by washing liquid. Absorption proceeds in apparatus giving high inter-phase surface.

Absorption columns with static packing (poured and structured packing) or with moving built-in baffles (turbulent contacting absorbers) are widespread. Venturi scrubber, shower or other types of washing system can be used as well.

Washing liquids used pertain first of all to the group of polyglycoethers, esters of phtalic acid and silicon oil. The solvents are regenerated via respective compound desorption by heating of saturated absorbent using inert gas or vacuum.

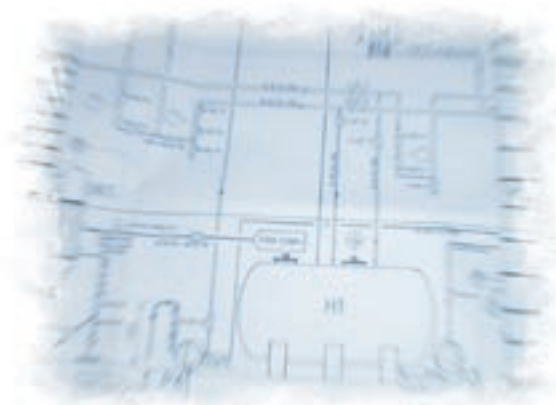
Number of reports on VUOS products have to do with absorption connected to chemical reaction, e.g. treatment of acidic waste gases.

Process advantages

- Mentioned process is very useful for the treatment of gases containig high and variable concentration or for treating of different gases mixtures.
- The gas may hold some solid particles, mist and aerosols.
- The risk of pyrolysis, hydrolysis, polymerization and selfburning in apparatus is excluded.
- Possibility of separated compound regeneration.
- Process is continuous, equipment requires small built-up area.

Process application, examples

- Treatment of waste gases containing cetones (MEC, MIBC cyclohexanone), chloroderivatives of hydrocarbons (methylchloride), heavy hydrocarbons (oil, naphthalene, styrene).
- Drying of gases (natural gas, chlorine).
- Oils separation from rolling mills exhaust.



Absorption of ethanol

VUOS provides delivery of equipment for waste water stripping of VOC by compressed air or steam.

Process description

The process is based on countercurrent operation, where VOC dissolved in water are separated by air or by steam using stripping column. The phase relation between liquid and steam is dependent on Henry's Law.

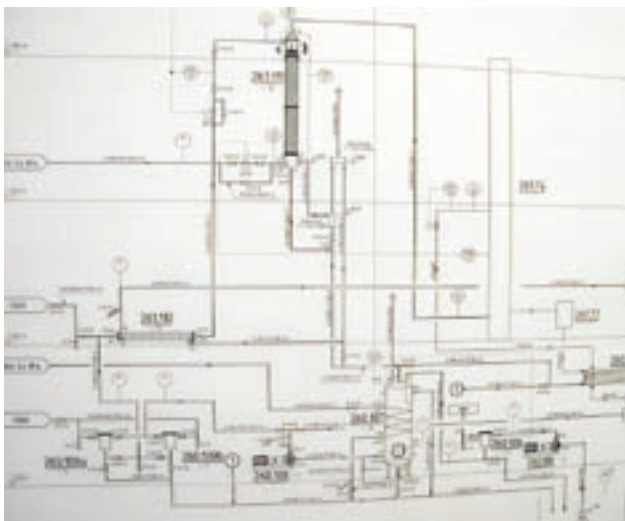
The exhaust air from stripping operation is purified by adsorption or by VOC combustion. In the case of steam stripping the organic compounds are separated from water phase afterwards. Steam operations use atmospheric or low pressure (vacuum) usually. Compressed air is applied for stripping of volatile organic solvents, steam on the contrary for stripping compounds with higher boiling points (up to 200 °C) and for treatment of waste water with high content of organic impurities. Steam stripping operates with better efficiency in comparison to air, because the final treatment of exhaust air is necessary, but air stripping is of lower investment costs. Pilot plant testing for engineering study and design is recommended.

Process advantages

- Low investment costs as well as low production costs, when the heat regeneration is applied.
- Reliable and trouble-free operation, easy control and maintenance.
- High efficiency and capacity of unit, VOC concentration in waste water is decreaseable to less than 5 ppb.
- Capacity of equipment is from 100 to 10000 l/h of waste water.
- Process is continuous, equipment takes low built-up area.

Process application, examples

- Decontamination of ground water.
- Treatment of industrial waste water.

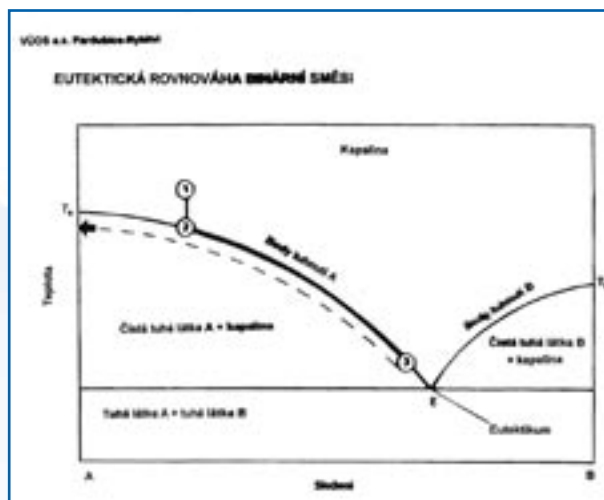


Stripping of o-dichlorbenzene from waste water

VUOS provides development, process testing, as well as delivery of equipment for organic compounds purification by melt crystallization.

Process description

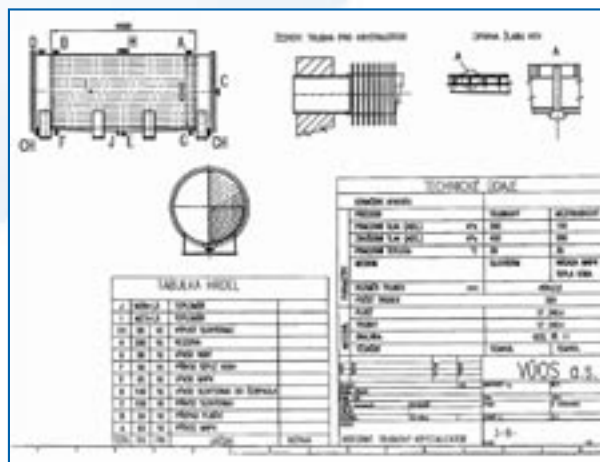
The process principle is based on controlled static melt crystallization and fractional sweating out. Operation requires separation of impurities from the treated compound in the state of low melting eutectic mixture (more than 80 % of organic substances). The main apparatus presents crystallizer with internal heat exchanger for uniform temperature control in the whole volume of crystallizer. The operation itself proceeds in the two steps: controlled crystallization with nucleation and crystal growth, and controlled melting-sweating out with the separation of eutectic impurities, return fraction and the final product.



Crystallization from melt is combined with distillation usually. Design of the equipment results from laboratory and pilot-plant testing. Laboratory and pilot plant crystallizers are available for test runs.

Process advantages

- Final products of very high purity.
- Lower energy consumption and low heat strain in comparison with distillation.
- Environment-friendly operation (solventless technology of crystallization).
- Possibility for the plant automation, high reliability, trouble-free operation.



Process application

- Purification of different organic compounds with melting points in the ranges from 20 up to 120 °C.
- Purification of substituted derivatives of benzene and naftalene.

VUOS secures respective engineering and design activities in the field of process equipment and liquids mixing.

VUOS has available the up-to-date software products (Visimix, Vesselpack), testing apparatus and models, expert knowledge and experience for engineering calculations, analysis, scaling up, development and manufacture of equipment for liquid agitation (stirring). Very useful are the possibilities of laboratory and pilot-plant test runs (homogenization, measuring of power input) in connection with long years experienced personnel.



Sphaere of activity and examples of applicaion

- Mixing of newtonian and nonnewtonian liquids in vesels.
- Dissolution of solid compouds in liquids.
- Dispergation of gases in liquids.
- Agitation in homogeneous or heterogeneous reactions.
- Heat exchange in agitated vessels with different geometry and/or internal heating/cooling (jacket, coils).
- Design and manufacture of static mixer.
- Design and manufacture of laboratory and pilot plant agitators (anchor, paddle, propeller, turbine).

FILTRATION AND CENTRIFUGING

The products of chemical technology are usually powdered, crystalline or pasty substances. Different filtration and sedimentation techniques are used for solid particles separation from solvents, alkalies, acids or water suspensions. VUOS is an proprietor of well arranged laboratory and testing room. VUOS offers filtration and centrifuge testing in the laboratory and pilot-plant units. VUOS supplies technological equipment for the cake and clarifying filtration, filter or sedimentation centrifuging.

Experimental units of laboratory size and pilot-plant equipment are available:

- vacuum and pressure Nutch-filters
- filter press, model
- membrane chamber filterpress, model
- sedimentation centrifuge
- try centrifuge
- sedimentation decanter
- rake-out filtering centrifuge



VUOS performs the development and equipment delivery for the treatment of liquid wastes by pressure oxidation techniques.

Process description

Technics of pressure oxidation is specified for the decomposition of very stable organic matters, which are not suitable for biological decomposition. The principle of pressure oxidation is based on catalytic oxidation of organic compounds by oxygen at elevated temperature (180 to 220 °C) and pressure (1,8 to 2,2 MPa). There are used bubbling columns with injection of gaseous oxygen into waste water. Oxidation proceeds usually in acidic area (pH 1 to 3) and it is catalysed by Fe^{2+} ions. Organic compounds are decomposed and give rise to carbon dioxide, water and simple organic fragments, which can be treated by biological process.

The efficiency of pressure oxidation depending to the reaction conditions (temperature, pressure, time) and structure of organic compound, is varying in the ranges from 60 up to 95 %. Recommended maximum chemical contamination of waste water, expressed in values of chemical oxygen demand (COD) is found in ranges 5000 to 60 000 mg/l O_2 . Oxidation is an exothermic reaction; the process is autothermic over 20 000 mg/l O_2 .



Laboratory autoclave

Process advantages

- Process is effective for elimination of very stable organic impurities.
- Process is free from other chemicals, impurities are not transferred to other phases.
- Low energy consumption in the case of autothermic processing.
- Process is continuous, equipment does not need large built-up area, it is of high reliability and easy operation.
- Operation capacity is in the ranges from 10 to 5 000 l/h of waste water.



Pilot column

Process application

- Treatment of waste water from organic dyestuffs production, semiproducts and organic specialities.
- Treatment of liquid wastes containing organic halogenized substances (AOX).
- Purification of waste settlings from flocculation and precipitation of impurities.
- Destruction of waste organic liquids from VOC waste water stripping.

Process description

Biological waste water treatment is in fact nothing more than simulation and acceleration of proceedings in the nature. The main advantages are its simplicity and relatively low cost. Biological treatment of waste water in the principle is an aerobic biochemical process with the reproduction of heterotrophic bacteria as well as other microorganisms, thus the organic compounds are decomposed to obtain energy for their vital functions and for the structure of their own organisms.

Treating of chemical waste water and town sewage water together is usual. One of the reasons is the reality, that sewage waters contain more nitrogen and phosphorus than some of industrial waste water. Dilution of industrial waste water by sewage water decreases concentration of toxic compounds and final biological treatment is then easier. In any case, the industrial waste water would be examined to secure trouble-free operation of the commercial unit.



VUOS offers

VUOS offers testing of biodegradability of toxic compounds in the waste water using their own model equipment for biological treatment. The model itself simulates in principle the procedure from biological treatment plant. The model unit of 40 l volume consists from the two steps, each one in two stages, e.g. one oxic section and one settling vessel at least. Continuous pumping of town and industrial water, recycling and internal circulation, aeration by compressed air, mixing respective anoxic sections by spiral agitators; all items are comprised.

The model unit for experimental treatment enables processing about 50 l of town sewage water with 15 l of industrial water daily in any ratios. Testing results are evaluated by actual standard methods, i.e. sludge index, COD, BOD and others, including microscopic analysis of activated sludge.



The pilot model of biological waste water treatment

VUOS provides testing and equipment deliveries for drying of organic and inorganic substances.

VUOS has available some special laboratories and test – rooms; they are fit by different types of experimental dryers. Solutions and suspensions, pastes, powdered and crystalline compounds, granulates, as well as dangerous heat unstable and sensitive substances could be tested in the experimental units. Drying tests for customers are executed. Drying equipment is available as follows.



Fluid dryers

Spray dryer

Drying of suspensions and solutions:

- type Anhydro, capacity 5 kg/h at temp. diff. 100 °C
- type Niro, capacity 20 kg/h at temp. diff. 100 °C
- type Strojtech, capacity 20 kg/h at temp. diff. 100 °C

The practical drying process is executed in drying chamber. The solution or suspension is transported by means of feeding pump over the spraying atomizer disc, where by centrifugal forces come on drops distribution into the stream of hot air. The air overheated by natural gas or by electricity is led to the drying chamber countercurrently to the stream of particles. Dried product with the waste air is transported to the cyclone, where dry compound is separated. Wet air is sucked off by air fan.

Spin flash dryers

Spin flash dryers are used for drying of paste or crystalline substances from water media.

- type VS 80, chamber dia. 0,08 m for 50 m³/h of air
- type VS 220, chamber dia. 0,22 m for 300 m³/h of air
- type VS 440, chamber dia. 0,40 m for 2000 m³/h of air
- type VS 660, chamber dia. 0,66 m for 6000 m³/h of air
- type VS 800, chamber dia. 0,80 m for 10000 m³/h of air

Wet material is fed by automatic screw feeder in dependance on the drying air outlet temperature. Drying air is heated to the required temperature by gas burner or by electricity. The air is sucked to the lower section by air fan. Hot air and intensive contact with the compound, when mechanically stirred, improves the drying process.

Dried product and evaporated moisture with air is led from the drying chamber through classifier to the separating unit, where the solid product is collected and wet air is sucked off.



Injectors

Vacuum dryer with horizontal paddles (venuleth)

Recommended for drying of paste and crystalline compounds from solvents:

- type Venuleth, volume 4,2 l
- type Sangerhausen, volume 300 l
- type Sangerhausen, volume 1700 l

The equipment is batch operated, the cylindrical vessel is fit by horizontal stirring device. Heat transfer is arranged through heating jacket by hot water or by steam. The solvent vapours are transferred through condenser by means of vacuum water pump. The bag filter is joined moreover in the case of production unit (1700 l).



Cylindrical dryer

Suitable for drying of paste or crystalline compounds from solvents

- type Lodige , volume 80 l, temp. max. 90 °C

The equipment is batch operated, cylindrical vessel with horizontal stirring device is heated through jacket by hot water. The solvent vapours are led out by inert gas and separated in the condenser.

Fluidized bed dryers

Recommended for drying of crystalline or powdered compounds, cooling or granulation.

Vibrofluid bed dryers

- type APV Anhydro AS-grid surface 0, 9 m², max. temperature 100 °C
- type Niro 0,3- grid surface 0,3 m²

Drying air is heated by steam and distributed through the dryer grid. The vibrofluid trough can be applied for granulation processes, too. The trough jets are used for adhesive component feeding.

Flowing bed fluidization (FBF) systems are developed for the processing of heat unstable and inflammable materials, drying, granulation and surface treatment of particles. FBF system ensures temperature and concentration homogeneity, enables safe and economic processing and extends its application for many wet and almost non-fluidizable materials.

Air distributor FBF is the most important component. The air streams rise through a dense network of orientated ducts. The fluidized particles move from centre to periphery of apparatus and then along the bed to the central cone.

Atmospheric tray drying chamber

Drying of paste and crystalline compounds from water media.

- type VUOS – 60 trays

The compounds distributed on trays are dried by hot air. The air is heated in the steam exchanger. Trays in the kiln truck are transferred to the drying chamber. Fresh as well as waste air are filtered.

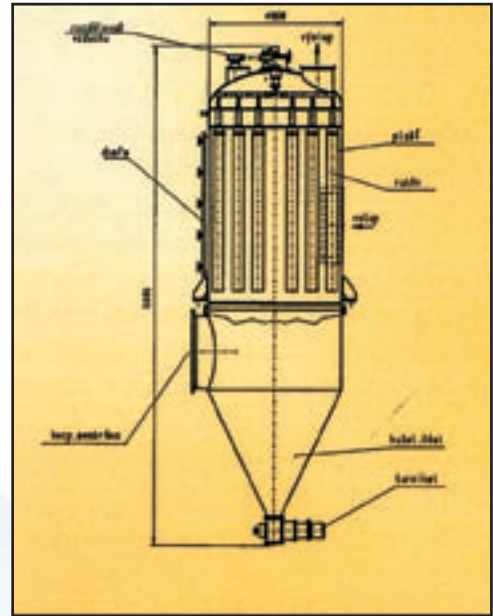
VUOS provides process development and equipment delivery for the dust separation from the air.

In the course of long years experience there have been developed number of classic cloth filters, sleeve filters for piping, selfcleaning systems with mechanical or compressed air cleaning. Selfcleaning cloth filters – type Rotapulzer resulted from the own development. Equipment was built several times during the last years at home or in foreign countries.

Filters Rotapulzer are manufactured in three types:

- Rotapulzer 2; filter surface 2 m², air flow 300 Nm³/h.
- Rotapulzer 16; filter surface 16 m², air flow 2000 Nm³/h.
- Rotapulzer 70; filter surface 70 m², air flow 6000 Nm³/h.

Filters are provided by antiexplosion membranes. Exhaust air is sucked by air blowers through filter cloth. The dust filtered is disengaged by air pressure impact and filter cloth is regenerated by this way. Collected dust is carried out by the rotary feeder.



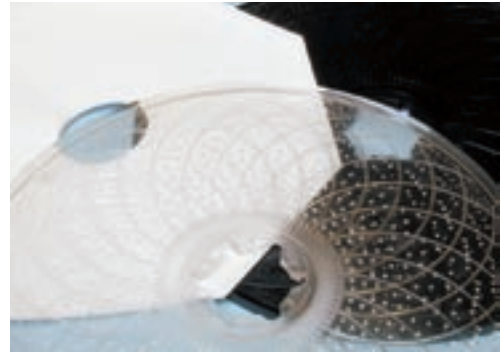
Rotapulzer

Process description

Membrane system is applied mostly as a separation unit, the separation activity of which is fit through semipermeable membrane, where some component only is separated.

The separation principle is based on the size of particles or molecules and on the different diffusivity and solubility of components or different particle charges, the mode of action is found very often in their combination. The driving forces of membrane separation depend on differences of temperature, pressure, concentration or el. potential.

VUOS is intended mainly on pressure forced separation processes, slightly in pervaporation or membrane absorption; the aim is its application in separation technology.



Membranes and discs

Process application

- Nanofiltration of waste water from dyestuffs and intermediates production.
- Soil remediation – reverse osmosis.
- Production (desalination) of liquid dyestuffs.
- Ammonia recuperation by membrane absorption.

Laboratory and pilot plant testing

Pressure forced processes

- Static cell for 1 pc flat membrane dia. 80 mm.
- System of 10 pcs. dynamic cells, each for 1 pc flat membrane dia. 75 mm.
- Dynamic cell for 1 pc disc membrane dia. 100 mm (the own design).
- Laboratory apparatus ARNO for testing of different designed 1 modulus.
- Experimental RO apparatus by Berghof, equipped by 1 disc modulus with flat reverse osmotic membranes.
- Pilot plant unit VUOS, set up by three disc modulus with flat membrane of their own design.



Ultrasonic welder of membranes

Pervaporation

- Laboratory equipment designed for testing in double membrane system of area 70 m² or one modulus with the hollow fibres.

Membrane absorption

- Experimental unit assigned for separation of gaseous impurities from the air flow using suitable absorption solution; it is set up by 5 pcs modulus with hollow fibres.



Nanofiltration apparatus for dyes desalting

VUOS offers development and delivery of complete engineering for chemical plants in the capacities of about 10 000 t/y.

The documentation contains:

- process flow sheet
- raw materials and auxiliary materials specification
- process control proposals
- waste materials, quantity and their nature
- processing and equipment for wastes treatment
- detailed specification of the process equipment
- dimensional sketch of apparatus
- economic evaluation of investment homecoming
- structure materials

VUOS offers complete know-how for these technological procedures:

Nitration

Nitration using concentrated or diluted nitric acid, mixed acid, nitration by nitric acid in a mixture with solvents.

Production of nitrosubstituted derivatives of benzene or toluene (nitrotoluene, nitro-xylene, trinitrotoluene).

Esterification

Esters production by esterification of alcohols by acids (ethylacetate, methylacetate, butylacetate).

Production of aliphatic and aromatic nitroesters (2-ethylhexylnitrate).

Production of butylmetacrylate-reesterification.

Amoxidation

Amoxidation in catalytic bed, production of benzonitriles, chloro- and fluorobenzonitriles.

Glycerine refinement

Purification (refining) of waste glycerine from the bio-oil production.



Apparatus design is carried out at AutoCAD – Mechanical 2000i+ Power Pack. Technical documentation can be delivered in the printing and in electronic form as well. Deep knowledge and useful experience from the previous units implementation are utilized in designing and manufacture of equipment. Special equipment is manufactured at own workshops, heavier machinery is realized in cooperation with engineering works, with guarantee for perfect processing.

Examples of development and equipment implementation

Unit for hermetic sealing of plastic cans

The equipment is recommended for hermetic sealing of plastic cans by melting the screw cap to the can neck. The seal-packs made from plastic and aluminium foils fit tightly to the neck. Plastic sealant is inductive heated through aluminium foil and melted to the neck. The can is hermetically sealed after cooling it down, even if the cap is screwed off.



Hermetic sealing of plastic cans

Technical values:

capacity	max	3500 pcs/hr (cans 0,5 l)
cap dia.	from	20 to 50 mm
can volume	from	0,5 to 10 l
electricity		1,5 kVA, 380 V/50 Hz

Equipment parts:

stand, inductive welding head, control box, conveyer, cooling system

Multi-purpose filling unit for cans

Equipment is set for filling the cans volume from 5 to 25 l. The unit composed from measuring cylinder, filling mouth, frame, conveyer for movement of empty and filled cans. The equipment operates as a double piston system (suction – compression).

Palettizing device for bags

Technical values:

Output nominal	500/h
Palette-No.of layers	2 – 8
No.of bags in one layer	3
Palette dimensions	800 x 1200 mm
Unit dimensions	6200 x 6500 mm

The device is fixed to the frame and consists of the following parts: supply conveyer, calibrating device, positioning and shifting devices, lifting device, palette, container and rolling conveyer. The filled bags are fed by means of supply conveyer. The operation is controlled automatically according to the programmes. Filled palette is transferred by rolling conveyer and empty one is fixed in automatic operation.

Exact filling and feeding into drums, bags or big-bags

The mobile equipment consists from the feeding screw, cover, scaling and control system. The useful advantage of the unit is in easy changes the filling position and place.

The main parts of equipment:

- mobile frame
- feedings screw conveyer
- cover with feeding neck
- scaling platform
- scaling and electronic control system

Technical values:

weighability, max.	100 kg
exactness of feeding	± 200 g
feeding capacity	25 kg/3 min
temperature ranges	- 10 to 40 °C

Conveyers screw, chain, skip and others

Design and transport capacity of screw and chain conveyers are solved according to the technical requirements. The screw conveyers horizontal, vertical or inclined are designed and offered. The screw is installed in the tube or in the charging trough. VUOS supplies spiral or spring conveyers as well.

Screw mixers

VUOS offers equipment for mixing of solid and liquid matters by means of screw conveyers. The equipment consists of frame and vessel with double screw system. Mixer comprises vessel cover with feeding hopper and the neck for suction off.

Technical values:

batch	250 kg
No.of revolutions	30 min ⁻¹
capacity	1 500 kg/h

Sifting machines

Technical values:

capacity	5 – 500 kg/h
size of crushed particles	5 – 20 mm

Grinding according to the properties of material used.
Manufacture of knives and impact desintegrators.

Grinding machines

Manufacture and delivery of rotation or vibration sifting machines according to the customer s order.

Vibrating oneflat sifters are used for screening of particles mesh size from 2 mm up to 50 mm.

Flat valves for powdered materials

Different laboratory and pilot plant equipment

Design of of the steel structures

VUOS is engaged in the field of process control and systems development as well, e.g. manufacture of devices for measurement and control of physical data, diazotization and coupling sensors or manufacture of sensors by Béchamp.

Measurement and control of physical properties

The devices for measuring of pressure, temperature, flow, conductivity, pH etc. are composed from the commercial parts and set up with local signalling or/and remote control. The control device operates according to the order: continuous, step-by-step, inclusive blocking systems etc.

Manufacture of diazotization and coupling sensors and sensors by Béchamp

Diazotization sensor is composed from the two electrodes from precious metal in glass body.

Coupling sensor is made from stainless steel or titanium body with special electrode from the precious metal - the measuring surface is continuously cleaned.

B-sensor; electrode from precious metal in the special electrolyte is tightened by special epoxide material. In comparison with normal hydrogen electrode it has a zero potential in limited tolerance ± 10 mV.

All the sensors work at the principle of potential measurement. They are used for measuring and control of diazotization, coupling reactions and control of aromatic compounds reduction.



B-sensor

VUOS departments secure all services in the range of measuring and control systems, engineering activities, design, manufacture of devices, plant running-in and consulting.

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