

The Hydraulic Wash Column:

Highly efficient and scalable solid-liquid separator ready to conquer the world.

FIRST2RUN Project: SoliQz partner presentation
Role in the project and expectations beyond the project



**ONE STEP
PURIFICATION;
ENERGY SAVINGS
20% TO 90%; TRULY
CONTINUOUS
PROCESS; PROVEN
AND SCALABLE**

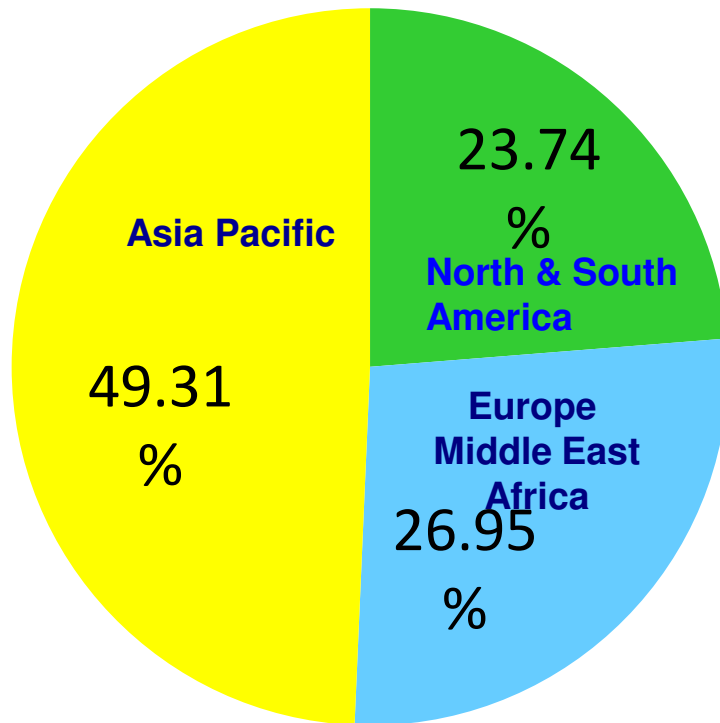
Brussels, July 23rd, 2015

SoliQz B.V. Snapshot

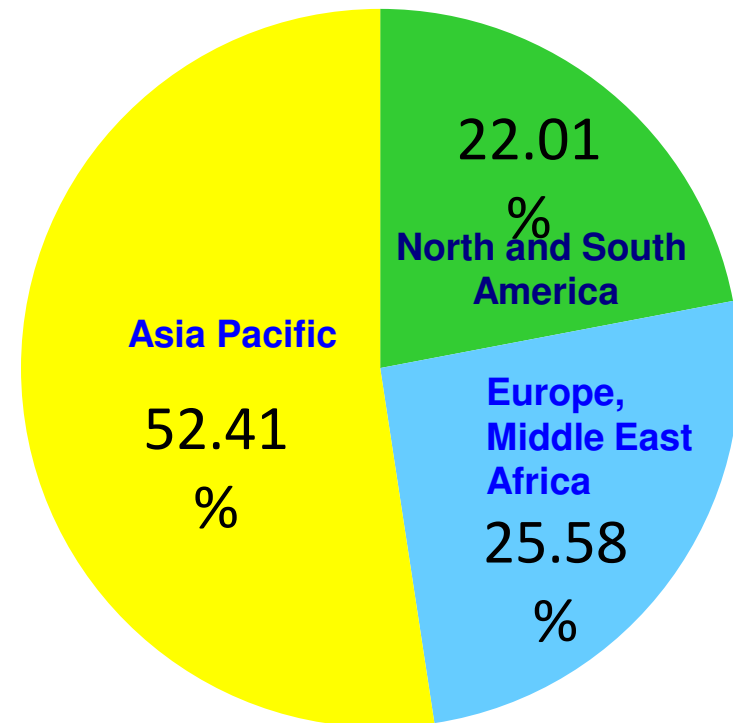
- **SoliQz B.V.** provides services and equipment for highly efficient solid/liquid separation and ultra-purification of (chemical) compounds.
- **SoliQz B.V.** brings together the proven Hydraulic Wash Column (HWC) technology from TNO, the state-of-art crystallisers and the (pilot) plant design and building experience from partner engineering firms to commercialise the HWC for a broad range solid/liquid separations.
- Present status:
 - Founded in november 2013
 - Technology development at TNO in the Netherlands for 15 years, fully scalable with two semi industrial plants
 - Rapidly growing funnel of opportunities
 - Design of pilot plant ongoing; construction to be completed in October 2015
 - Projected sales of 6-9 MM€'s per annum

There is a sizable market for crystallization: growing fastest in Asia.

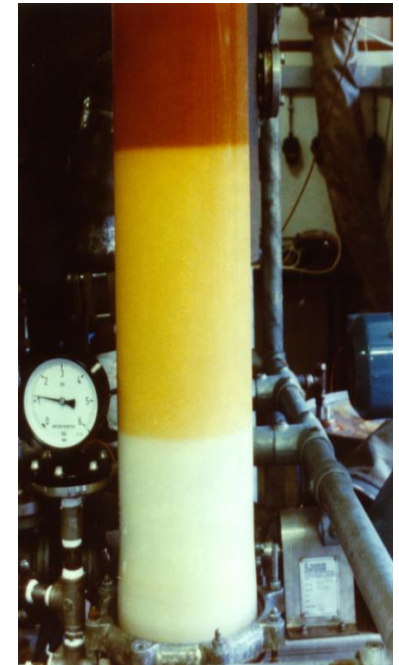
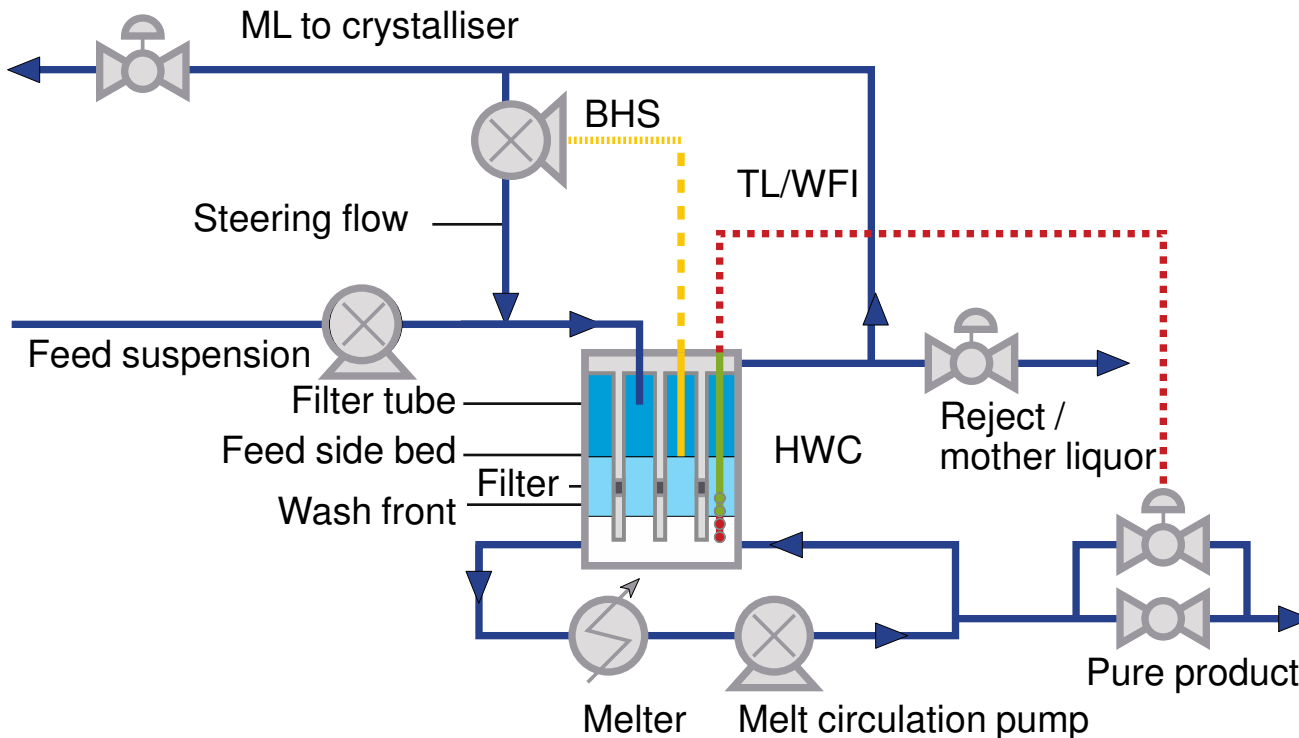
2013: 170m€'s



2020: 230m€'s



SoliQz offers solid-Liquid separation (MC) with highly efficient counter-current washing (HWC)



15 cm Hydraulic Wash Column operating with para-xylene

Key benefits and competitive advantage of MC+HWC

- **Product purity up to 99,9% in one step**
- **Energy savings of 20% up to 90% versus distillation.** Conversion of the final purification step of a 150,000MT/A Caprolactam unit would have a pay-back time of 2-3 years.
- **No use of solvent; no wash liquid consumption.**
- **50% higher throughput in the hydraulic wash column as process is truly continuous.**

Operational benefits:

- Stable operation (self-correction for bed height and wash front).
- Reliable operations and lower maintenance (absence of rotating and moving parts).

The SoliQz offering:

SoliQz B.V. supports its customers throughout the entire technology implementation process with:

- Feasibility studies for proof of principle for purification
- Pilot plant trials (in-house or at the SoliQz facility)
- Scale-up
- Supply of industrial scale equipment

Products and services delivered:

- Research studies (feasibility stage)
- Pilot scale trials (customers can verify the feasibility; SoliQz pilot plant to be completed in H2 2015)
- Lab and pilot scale equipment (in co-operation with engineering firms)
- Industrial scale equipment (in co-operation with engineering firms)

SoliQz role in the FIRST2RUN project:

Purification technology for bio-based products and materials:

- Feasibility studies for purification for azelaic acid with the HWC (WP2)
- Pilot plant trials HWC (at SoliQz facility and on location) on azelaic acid (WP2)
- Scale-up: design of the specific pilot scale facility for azelaic acid (WP3)

Expectations beyond the execution of the project:

- Continue co-operation with Novamont to implement HWC technology at full commercial scale
- Name recognition of SoliQz as provider of highly efficient purification technology for bio-based materials.
- Follow-up projects in bio-based and other applications.

SoliQz FIRST2RUN Partner Presentation

KOM, Brussels July 23rd, 2015

Back-up slides

SoliQz key Team members

Nicolaas F. Viets (CEO) has over 25 years of business experience in the chemical and petrochemical industries. He gathered technical and commercial experience as Project Engineer at Shell, Sales and Marketing Manager at Dow. During the past fifteen years he worked at DSM, first as Marketing & Sales Director at DSM Elastomers and later as Director of the Innovation platforms in nanomaterials.



Nicolaas Viets
CEO

Nicolaas graduated in 1984 at Delft University as a Mechanical Engineer in the Process Engineering Group. Nicolaas is 100% dedicated to SoliQz.

Dr. Dirk Verdoes (CTO): Over more than 20 years Dirk has gained a reputation as an industry expert in the field of crystallization and solid-liquid separation methods. Dirk led the group at TNO that developed the Hydraulic Wash Column.

Dirk studied Chemistry at the University of Leiden (MSc degree in 1986) and completed his PhD in 1991 at the Delft University of Technology.

Dirk will stay operationally involved at SoliQz throughout 2015 and as a Senior consultant thereafter.



Dirk Verdoes
CTO (a.i.)

Press Release

SOLVAY

Brussels, 20 April 2012, at 7:30 am

SOLVAY ADDS HIGH PURITY SEMICONDUCTOR GRADE PHOSPHORIC ACID TO ITS WET CHEMICALS PORTFOLIO

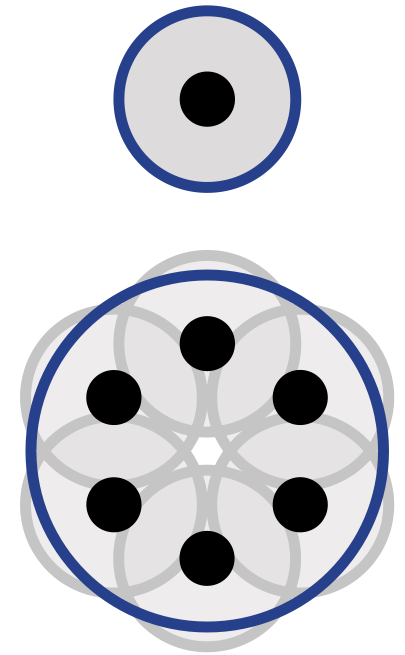
High purity phosphoric acid plant based on a novel and very precise crystallization technology has successfully started production

Solvay announced today its new high purity semiconductor grade Phosphoric Acid plant in Bernburg, Germany, is supplying this high added value etching acid to manufacturers of electronic devices and components and the semiconductor industries. This new high purity acid complements Solvay's product portfolio of high purity wet chemicals for the electronics and semiconductor industries such as hydrogen fluoride and peroxides. The plant which uses a novel and very precise crystallization technology has been developed by Solvay and its Dutch technology partner TNO.

"This new Phosphoric Acid plant complements a number of investments and capacity expansions carried out by the Electronic Wet Chemicals Division over the past two years, especially in China and the USA, in other high purity products like Hydrogen Peroxide, Hydrofluoric Acid and Ammonium Fluoride. With Phosphoric Acid we are adding a new critical material to our product range whilst relying on our analytical, logistics and customer support capabilities to improve our offering to our semiconductor customers", said Steve Dobson, Head of Solvay's Electronic Wet Chemicals Division.

Proven scale up and scale down of HWC technology

Code	Diameter (cm)	# filter tubes	Typical production capacity (kg/hr)
HWC-2	2 NEW	0	1-2
HWC-8	8 (new pilot plant)	1	5-75
HWC-15	15	6	50-400
HWC-30	30 (in industry)	16	200-1,500
HWC-55	55 (in industry)	50	1,000-5,000
HWC-110	110	200	4,000-20,000



Scale-up principle
Keep filtration area
around tubes constant



HWC-2



HWC-30



HWC-55