Vinnolit

Leadership in PVC

EU-LIFE-Project

PVClean – Optimising Process Water Handling in S-PVC Production

Layman's Report

Supported by funds from the EU in project LIFE06 ENV/D/000470
Duration 1 Dec 2005 to 31 Dec 2008
Total project length 37 months
Conducted at the Knapsack site of Vinnolit GmbH & Co. KG

Introduction

PVC is the polymer which, in terms of quantity produced, is in third position worldwide. It is used in Europe up to 70 % for durable construction articles. Pipes are made of PVC, as are window frames, flooring and sealing sheeting. Other important applications may be found in the areas of electrics/electronics, automotive and packaging.

The worldwide demand for PVC is approximately 35 m tonnes annually. In Europe, Germany is the largest PVC consumer with about 1.7 m tonnes, followed by Italy with about 900,000 tonnes, as well as Great Britain and France with 600,000 tonnes annually. Globally, an average consumption growth rate of 4 to 5 % is anticipated. The largest growth rates are expected in Asia.

Water Consumption During Production

PVC is produced through polymerisation of vinyl chloride (VC). The process normally takes place under pressure in an aqueous system. The water used during the process accumulates as waste water after separation of the plastic, is cleaned in biological waste water treatment plants, and is discharged into the receiving waters.

The polymerisation takes place discontinuously; that is, in batches or "portions", in a large reactor using the suspension technique (S-PVC). Vinyl chloride, fully demineralised water, and various additives are heated under pressure until the polymerisation begins. After several hours, at the end of the process, about 90 % of the vinyl chloride has converted to PVC which is suspended in the form of small particles in water. In centrifuges, the water and the PVC particles can be separated from one another. This separation, however, is not 100 % effective, resulting in particular in the finest particles of PVC remaining in the water.

When the waste water containing the particles is fed back into the production process, the quality of the PVC is worsened in an unacceptable manner. Thus, the water is normally discharged and fed as sewage to the waste water treatment unit of the site.

For each new production batch, new water is used. About 3 to 4 cubic metres of fresh water are needed per tonne of PVC. Because the water is not consumed during polymerisation, however, it could be led back into the production process if it were appropriately purified.

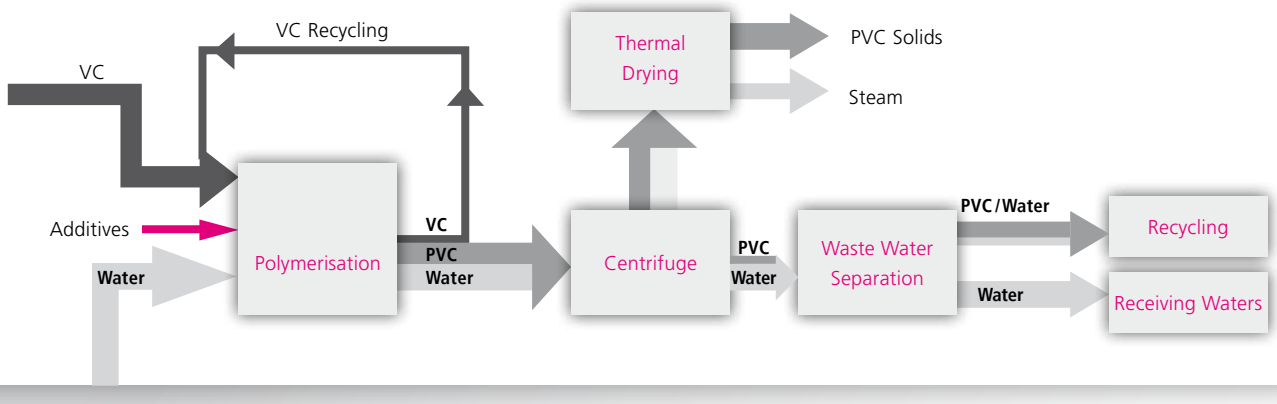
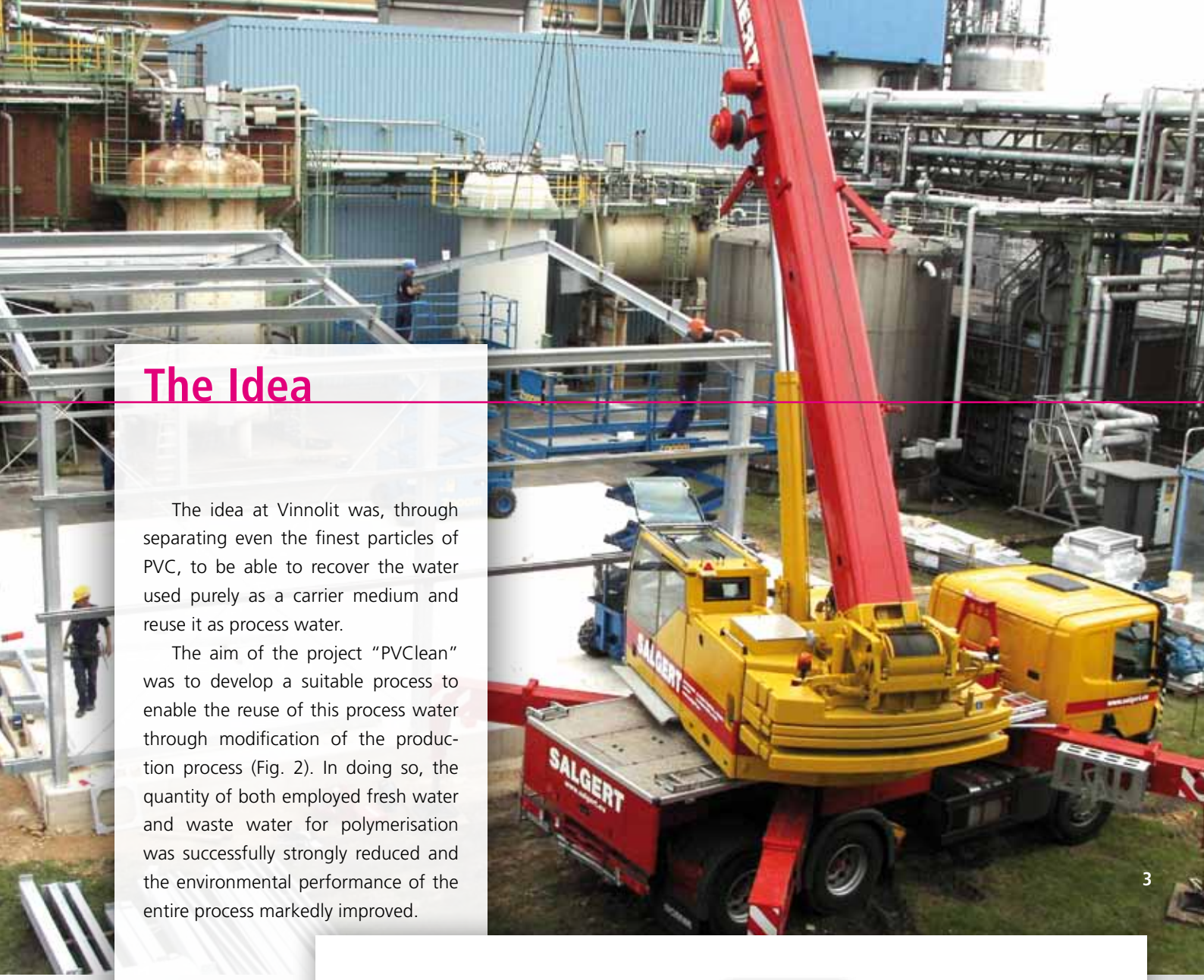


Figure 1: State-of-the-art material cycle for S-PVC production

The Idea

The idea at Vinnolit was, through separating even the finest particles of PVC, to be able to recover the water used purely as a carrier medium and reuse it as process water.

The aim of the project "PVClean" was to develop a suitable process to enable the reuse of this process water through modification of the production process (Fig. 2). In doing so, the quantity of both employed fresh water and waste water for polymerisation was successfully strongly reduced and the environmental performance of the entire process markedly improved.



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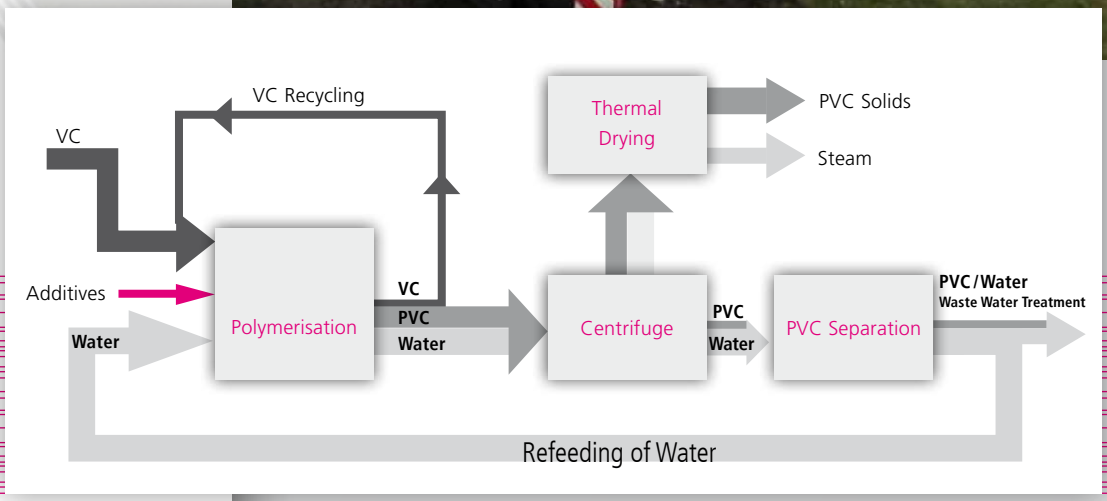

Figure 2: "PVClean" process

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The Realisation The Result

After complex pilot tests, in the context of the project, an ultrafiltration method was developed with which the PVC particles of only a few micrometres in size could be filtered from the process water. This filtration unit was subsequently planned, built, and put into operation for large-scale application in the suspension PVC facility in Knapsack (Figures 3 and 4).

With ultrafiltration, the process water is fed through filter elements (Fig. 5) whose pores are large enough that the water can flow through well, but small enough that the PVC particles are retained.

Vinnolit has succeeded in integrating the ultrafiltration unit into the normal operations of the production facilities.

With this technology, the water originating from S-PVC production is processed and largely freed of the PVC particles (Fig. 6). The processed water can then be fed back into the production stream. Owing to this, only about 1.4 to 1.5 cubic metres of fresh water per tonne of S-PVC are needed—about 50 % less than before.

The filter performance remains constant in the long term, so that the technique to recycle process water is also economically worthwhile.

Figure 6: Efficiency of the process (left, water directly from S-PVC production; centre, rententate [concentrated]; right, filtered water)

With an uninterrupted cycle feed, the initial goal of a 50 % savings of water was reached. Through the further development of the process, the potential for additional savings is expected to be increased.

In the first six months of integration into standard operations, the ultrafiltration unit achieved an operating time percentage of over 99 %. The process and the unit have proven to be very robust. With the achieved filter performance, the project aim of saving fresh water during S-PVC production, and correspondingly reducing the waste water amount through processing and feeding back the process water, was fully reached.

Figure 3: Constructing the hall and the infrastructure

Figure 4: This hall contains the actual ultrafiltration unit.

Figure 5: Installed ceramic filters

The Future

The process may not only be used in new facilities, but also—as proven by the project—be integrated into existing production environments. In particular for PVC manufacturers in arid nations in Europe (Spain, Portugal), Asia (China, India) and the Middle East (Arabic countries), the process offers an opportunity to use the scarce resource of fresh water sparingly.

The market launch of the technology is to occur in the following steps, whereby the transferability of the process must always first be tested at the respective production facility:

1. Introduction at Vinnolit production sites
2. Presentation to the existing licensees of Vinnolit GmbH & Co. KG
3. Long-term distribution through acquisition of new licensees

Through this action, not only a clear reduction of the waste water discharge should be achieved locally, but also, through the use of the technology, around the globe and in the long term, fresh water consumption in the area of PVC manufacture—estimated at this time at 90 to 120 m cubic metres annually—should be sunken by about 25 to 40 %.

Vinnolit Group

Vinnolit is—with a capacity of 780,000 annual tonnes—one of the leading PVC manufacturers in Europe and worldwide under the top ten of PVC manufacturers. The national and international activities of the company are managed from Ismaning (Munich). Production sites are in Burghausen, Gendorf, Knapsack, Cologne, Schkopau and Hillhouse (UK). In fiscal year 2008, Vinnolit achieved a turnover of € 846 m and employed approximately 1,500.

Vinnolit produces and markets a wide range of PVC products suitable for all common PVC applications, which are used daily in, for example, the construction industry, automotive industry, and medical sector. Whether PVC for window profiles, pipes and fittings, rigid film, flooring, wall covering, technical coatings, automotive underbody sealant or medical applications, Vinnolit is able to offer a suitable product process for every product requirement. In the area of PVC products for special applications, Vinnolit is the worldwide market and technical leader.

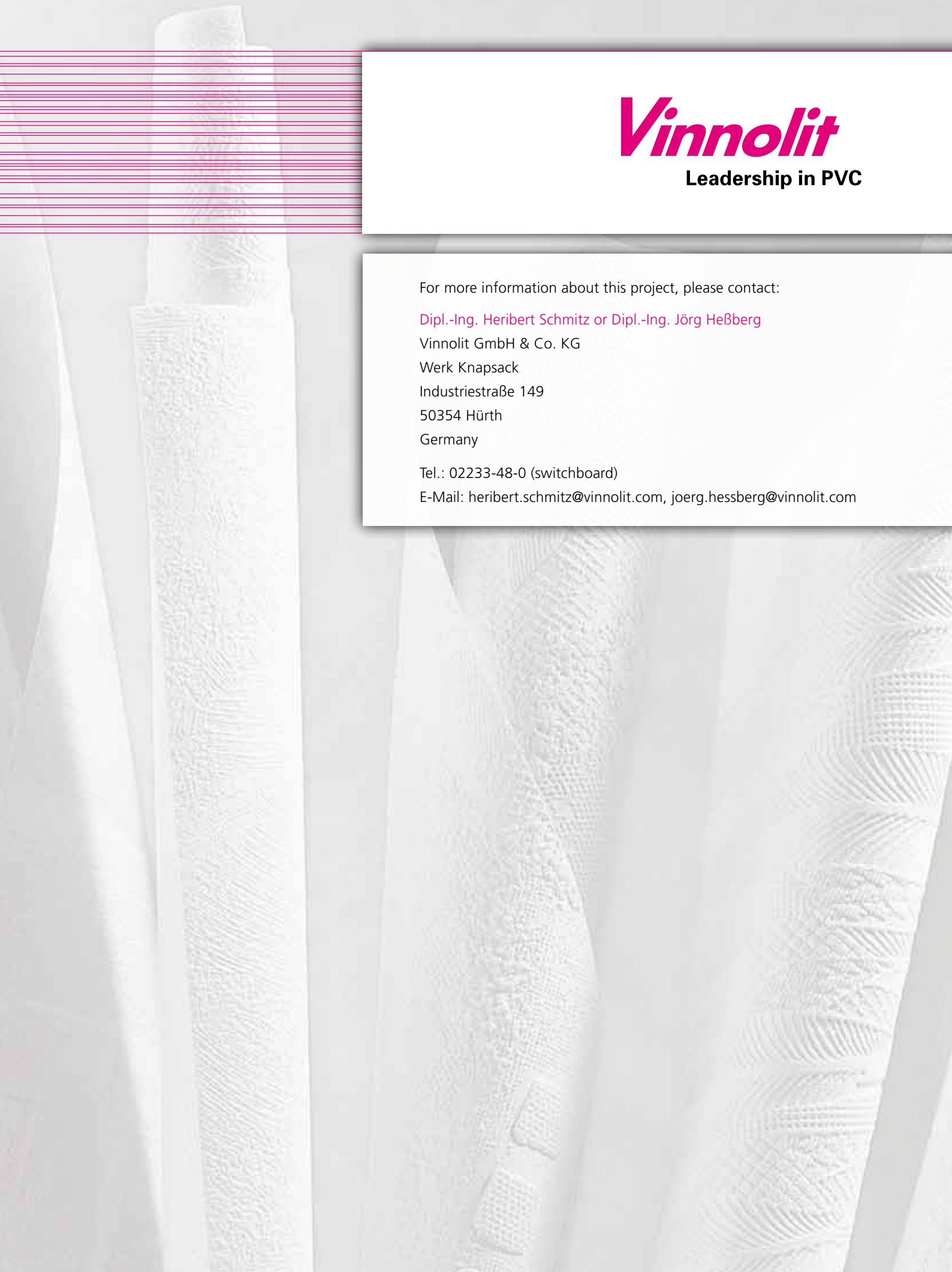
Additionally, Vinnolit is a leading manufacturer and supplier of intermediates such as caustic soda, vinyl chloride and tin tetrachloride, which are required in the chemical industry as well as in other sectors.

In conjunction with plant constructor Uhde, Vinnolit licenses the complete process chain from 1,2-dichloroethane, vinyl chloride and PVC to individual plant components and products such as, for example, catalysts for direct chlorination and cyclone dryers for PVC drying. In addition, the company possesses considerable experience in planning, constructing and modernising existing production facilities.

Vinnolit is a member of the PVC and Environment Consortium (Arbeitsgemeinschaft PVC und Umwelt e. V.) and PlasticsEurope Germany, the association of German plastics producers. For coordination and processing of environmentally relevant issues at a European level, the company is a member of PlasticsEurope, the association of European plastics manufacturers, and the European Council of Vinyl Manufacturers (ECVM).

Vinnolit supports Vinyl 2010—the voluntary commitment of European PVC manufacturers to sustainable development.

The project "PVClean" was developed and implemented at the Vinnolit site in the Knapsack Chemical Park, southwest of Cologne.



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