



## ACHEMA 2003 19–24 May 2003 Frankfurt am Main/Germany

*The opening ceremony of the 27th ACHEMA was performed in the Congress Center at the Frankfurt Exhibitions Grounds. From Monday, May 19 2003 the gates to the world's biggest chemical engineering Exhibition/Congress and International Meeting on Chemical Engineering Environmental Protection and Biotechnology were opened to the public for 6 days.*

*The special technical and trend reports of ACHEMA 2003 exhibition were prepared for publication and released by internet as press information by authorities from DECHEMA. Trend reports covering present and future state of research and development in the field of Supercritical Fluids, Pharmaceutical Engineering and Biotechnology and Bioprocessing, as well as those referring to Catalysis, Nanotechnology, Process Safety Management and Microreactor Technologies, Large-Scale Engineering Projects, Measurement, Control and Process Control Engineering were presented in the last three issues of Hemijska industrija (Chemical Industry Journal, No 4, 5 and 6, respectively). This issue give some key information on the E-Services for the Process Industries and Water Treatment Technology.*

### E-SERVICES FOR THE PROCESS INDUSTRIES

*The rapidity with which IT is developing, the expansion of intracompany networks worldwide and the heightened demand for "just-in-time" processing and delivery over the last few years has revolutionized communications in the process industries. Internet-based services, procurement via trade portals (e-procurement solutions), coordination of goods and product flows by supply chain management software form part of this trend and have become an indispensable basis for handling business processes and for "transparent" management.*

For global players the application of such tools has now become a matter of course; this is not the case with smaller companies for whom the implementation and intensive support required for the software products are too expensive. In both the exhibition and the congress ACHEMA 2003 will contribute to the ongoing discussion of the application and the benefits of this technology and will pinpoint further potential for these services.

### E-commerce Trends in the Process Industry

In the past three years, many different e-commerce projects have been started in all sectors of industry. They focused on the topics that are essential to the companies involved in them. Regardless of the industrial sector, "process optimization" is always a central issue in all e-commerce solutions. Meanwhile, in the process industry – an industry whose name is programmatic – the importance of optimizing processes in order to reduce the total cost and thereby improve the company's performance, is even greater than in other industries.

In the process industry, an efficient supply chain is a substantial and competitive factor, and for this reason the optimization of the entire value-added chain is very much in demand. Due to the complexity of process steps and the number of people involved, the demand for e-commerce solutions as a tool of process optimization is particularly high in the areas of purchasing goods and services and cooperation between companies. In these areas, standardized

processes or standardized software have a direct impact on the internal communications of a company and between companies, with the result of accelerated processes and lower costs.

### E-procurement Solutions

The long process chain in purchasing, the number of people involved in the process and the multitude of media being used, leads to correspondingly high procurement costs. As purchasing accounts for up to 60% of the total expenses of industrial companies, cost reduction in this field has an immediate impact on a clear improvement of the margins. A comparable improvement of margins can usually be reached only by an extremely high increase in a company's turnover. In the past few years, many corporations have internally streamlined their procurement processes. The introduction of electronic data processing tools and the creation of data and information networks led to more transparency. After the internal optimization has been accomplished, many companies see the outsourcing of process steps to an external platform as the next logical step. In 2000, there were about 6000 marketplaces in Europe which offered companies the platform and the purchasing tools for the procurement of raw materials and indirect goods. The concepts behind them differed greatly, depending on the orientation of the purchasing organization.

Many companies, for example the Bayer AG, are involved in various e-commerce projects in order to provide a suitable solution for each section of the company and for all purchasing areas. Despite this backing from large corporations from the Old Economy, many e-commerce solution providers did not succeed in turning their technical concepts fast enough into operating businesses. In addition, they did not succeed in gaining customers outside the circle of founders and thus could not generate enough revenue to offer investors the prospect of profitability in a reasonable time. Therefore there were daily news about bankruptcy, merger or insolvency of software suppliers and platform operators. From the 6000 platforms in Europe, only 100

marketplaces were still alive at the beginning of the year 2003.

### **e-Procurement of Raw Materials**

Trading in raw materials is a strategic business. Long-term supplier contracts guarantee the availability of raw materials and thereby the ability of companies to produce. Platforms such as elemica, ChemConnect, Omnexus and Trade-Ranger, which are focusing on raw materials and direct goods, provide participating companies a transaction platform that, in addition to technically connecting buyer and supplier, also highly focus on the security aspects of the entire ordering process. The platform is a hub that enables connected companies to exchange data and optimize their purchasing and supply processes. A single technical connection creates the basis for multiple business relations.

elemica and Omnexus were initiated by chemical companies who are buying their raw materials and direct goods through the platform. Both platforms also target customers outside the circle of founders and aim at doing business on an international scale. Trade-Ranger, on the other hand, seems to confine itself to the North American market and to the founders of the platform, in order to successfully startup the solution within that group first.

### **Transactionality and Content**

Unlike the purchasing of raw materials, the procurement of indirect goods is not part of the strategic purchasing. The procurement of indirect goods is characterized by highly standardized products whose procurement involves a large number of process steps while the transactional volume is low, compared to the raw materials business. A platform with a focus on indirect goods such as cc-chemplorer, offers its customers the technical connection between suppliers and buying companies and additionally provides digital content in the form of standardized digital catalogs.

In order to generate the catalogs, product information of several suppliers has to be aggregated into uniform databases. The marketplace handles the labor and time intensive catalog management. In the catalogs, buyers find the products offerings from different suppliers next to each other, and from there they can put together their individual shopping carts and place orders. The automated ordering system simplifies authorization and release processes. A few months ago, cc-chemplorer has taken the next step of technical development. It now also offers its clients configurators which allow the tailoring of complex goods based on the catalogs and make it possible to order those goods through the marketplace.

For the electronic processing of orders, the one-time connection to a transaction platform is clearly more cost-effective than the connection between a buying company and a supplier on a 1:1 scale. In addition, companies can benefit from the standardization services that the platform provides for

their data formats, processes and communications. In the future, there will be a strong increase in the transaction volume of transaction platforms, whereas proprietary and individual solutions will become less and less attractive.

The remaining marketplaces will also play an important role in the future because they offer marketplace participants the infrastructure for their business relations, and because a community of connected companies is forming around the marketplaces, which assume the role of information and trading hubs. The exchange between the companies and the shared experience of implementing an e-commerce solution and mastering the necessary Change Management processes not only strengthens the formal but also the informal communications and puts a stronger focus on common interests and issues.

Since many vertical marketplace projects have been closed down in the last two years due to lack of functioning technology and insufficient volume, companies from affected sectors are now looking for available solutions outside their own industry. The surviving marketplaces with a focus on one industrial sector and a limited range of products have an advantage over platforms that start off horizontally. A clear focus is also a plus because it allows the a more effective use of resources.

The remaining platforms now use this advantage and extend their offering to a circle of customers that goes beyond the industry, while the focus remains on a special kind of products. As technology today is mostly ready to use and reliable, it is not any more the critical factor for the success of a platform. Meanwhile, the importance of digital content is growing. Once the connection between a company and a marketplace has been established, any kind of order can be processed through the platform. What is evolving is that in the future the suppliers of transaction platforms with digital content have an advantage over transaction platforms without that asset, as platforms with digital content can offer their customers added value through available catalogs and professional catalog management.

According to studies, companies in the process industry will do much more electronic purchasing with higher revenue in the next few years than in the past. In 2002, about 1 to 2 percent of the procurement volume in the process industry was supported by electronic solutions. This number will grow to 30 to 40 % in the next five years. For marketplaces that survive the consolidation period, this increase will bring an enormous growth of their market share.

Platforms that are contributing to the optimization of inter-company processes will have the greatest potential for growth and the biggest success in the medium and long term. The successful suppliers will be offering comprehensive solutions from one source. The solutions will support the entire supply chain and will become a fundamental success factor in the optimization process that continues outside the company itself. Besides the comprehensive suppliers

with industry-specific products or beyond, also small suppliers which find their place in the market, provided they concentrate on their core competencies and provide know-how and services for special and niche markets.

### **Purchasing Services**

In the process industry, corporate structures are increasingly changing and companies create new organizations. In this process, the previous contrast between centralized and decentralized procurement is disappearing as well. Centralized organizations are transformed into more flexible networks. Independent parts of large corporations handle the purchasing of the whole company on a global basis. At Bayer, for example, purchasing has been transformed into a strategic unit. There is also the trend to optimize external processes, after internal processes have been successfully improved. Bayer Business Services (BBS) took these two developments as an incentive to enter the service business and offers the services that it originally only provided for internal parts of the corporation also to other companies outside the group.

Another example is Infraserb chemfidence, a service supplier that emerged from the purchasing department of the former Hoechst AG. It acts not only on behalf of the Infraserb Hoechst Group, but also targets external, mainly medium-size companies of the processing industry, offering them products and services needed in that sector. chemfidence's own experiences with the optimization of purchasing processes form the core of its consulting services. Early movers have a clear advantage – they can turn their head start in e-commerce solutions into additional revenue by passing their know-how along to companies who did not venture into e-commerce earlier.

The expansion of e-procurement activities in large corporations goes hand in hand with the transformation of purchasing into a more strategic unit. When there are fewer conventional administrative tasks to fulfill, the purchasing staff can focus on strategic tasks such as the drafting of long-term contracts, material specification and supplier standards – all of which means a more efficient cost management for the company.

### **E-commerce Solutions for Cooperation between Companies**

There is another area besides purchasing where e-commerce solutions have a big stake in the optimization of processes and cost reduction: the coordination between companies who work together in individual projects or who continuously have to harmonize their production and sales processes and align their data streams. Whenever two or more companies communicate with each other, the large number of interfaces and the complex processes offer a great potential for lowering error rates and misunderstandings and speeding up the process. In many companies, "real time" processes have metamorphosed from a mere vision to daily practice.

Vendor Managed Inventory (VMI) is such a real-time solution. Buying companies and suppliers coordinate their planning and invoicing data through interconnected ERP systems, thereby reducing stock and costs. In VMI, the supplier remains the owner of the stock, while managing the stock of the customer. This enables him to optimally adjust the shipments to the demand of his customers and as well optimize turnover times.

The buying company grants the supplier access to information on stock on hand and sales forecasts, so that the supplier can plan exact supply quantities and delivery dates according to demand. This allows suppliers to reduce the stock by up to 75%. Standardized data exchange, which is processed via ERP systems without switching media, also leads to higher security and lower error rates. VMI is of particular importance in the petrochemical industry and in the consumer goods industry. Both individual and marketplace solutions are likely to be implemented in the future, as platforms could also offer expanded services to their clients, based on their existing infrastructure.

Another facet of this trend is the coordination of merchandise and product streams through Supply Chain Management software (SCM), which integrates suppliers and customers in the information chain. In case of deviation from the delivery schedule, for example, the Supply Chain Event Management software (SCEM) diagnoses a deviation from the plan by using the previously defined parameters. This information is communicated to the relevant contacts inside the company, and with the help of control and intervention options, the production process can be adjusted accordingly.

Real-time management is also achieved by using Manufacturing Execution Systems (MES). They serve as a link between production control on the manufacturing side and planning control on the administrative side. MES solutions make it possible to communicate without any delay and create greater transparency. After companies have been able to considerably improve their business processes with the help of ERP systems in the last few years, it is now manufacturing and sales that have to be connected in a better way and the respective systems have to be integrated through MES. This will further increase the efficiency of the entire operating process.

Collaborative Engineering is real-time management of a different flavor. It is of particular interest for plant engineering, as in the development of a plant it is a basic necessity that companies at different locations work closely together. Here, e-commerce solutions are not aimed at standardizing inter-company processes, but at standardized software, which optimizes the communications and processes. A good example is the case of around-the-clock task-sharing between a customer who drafts the plant concept and a supplier in a low-salary country, who handles the time-intensive compilation of the large amount of data

that is necessary for the development of the plant. In this case, it is necessary that the data be continuously synchronized between the two sides.

Special solutions for this area have not yet seen a successful placement in the industry. Likewise in the United States, companies such as Dupont and IBM who had set their hopes on Collaborative Engineering solutions already during the early phase of the e-hype and therefore created industria Solutions, did not succeed and had to close industria down. Meanwhile suppliers of CAD systems such as Intergraph have reached a better market positioning. For several years, plant designers, builders and operators have been offered services for project engineering and information management. Yet, due to the complexity of the data exchange and the complicated nature of plant engineering, no concrete solutions via marketplaces seem to be presently available.

There is a very high demand for e-commerce solutions that support the cooperation between companies. Although previous solutions for Collaborative Engineering were not successful, studies assume that the development in the next few years will reach a stage where software with the desired optimization effect will become available, either an individual solution or as a standardized solution through a transaction platform. Real-time management is likely to be one of the dominating trends of the next few years.

## Conclusion

The development and implementation of e-commerce projects is cost-intensive, and every investment needs to be thought through well and justified with a business plan. Only two years ago, many solutions lacked the economic basis. This is one of the reasons why many solutions from the era of the e-commerce hype have disappeared. Many solutions that have been developed during the euphoria of early e-commerce, and many technologies planned back then, have matured from being a mere idea to the ready-to-use stage. The consolidation of the last two years, on the side of the suppliers as well as on the side of the e-commerce solutions, has cleared the market. It is now easier for companies to get an overview and find the solution that fits them best.

For the suppliers of e-commerce solutions, performance, quality, reliability and customer service will be decisive success factors. It is also necessary to coordinate business processes and IT systems and make the applications user-friendly. In the end, even a technically perfect solution cannot be successful if it disregards the individuals who use them and does not tie their expectations and requirements into the whole concept.

## WATER TREATMENT TECHNOLOGY

*Industrial water usage in Germany continues to decline, but in absolute terms consumption is still very high. Industrial consumers use about 9 billion cubic meters of water for cooling, transportation or as a*

*solvent. Before water is used in industrial applications, untreated water, which is extracted from wells and rivers or other surface water sources, must first be treated or conditioned. This is often the case for municipal drinking water as well. Reliable water treatment technologies (filtration, ion exchange, membrane, UV and ozone systems) can be used to meet the diverse requirements of industrial users. Some applications require extremely complex systems and combinations of technologies. These issues will form one of the focal points at the ACHEMA 2003 exhibition and conference, which will be held May 19–24, 2003 in Frankfurt am Main, Germany.*

The increased cost of obtaining fresh water and disposing of waste water is forcing corporate decision-makers to look at new ways of treating industrial and process water. The focus in the future will be on achieving production-specific quality requirements for treatment of industrial and process water rather than on adhering to waste water requirements. There is growing recognition that the "total water management" concept has significant advantages. At ACHEMA 2003, a whole range of suppliers will present holistic approaches as a basis for discussion.

Of course, appropriate software support is available, such as WADO (Water Design Optimization) from Siemens. This tool supports cost-effective design of process water systems. According to information provided by Siemens, WADO differs from the usual end-of-the-pipe solutions by analyzing downstream usage and re-use of water, thereby reducing consumption by up to 30% and optimizing treatment performance.

## An increasingly dynamic market for water technology

The term "process water" covers a wide spectrum. At one end of the spectrum, it is important for the water used in breweries to contain many natural minerals. Ultra-pure water for medical products in the pharmaceutical industry is at the other end of the spectrum: all particulate and dissolved substances including microorganisms must be completely removed from the water. Process water is also used for cooling, heating, rinsing and washing. Despite the divergence of applications, there is one common thread: the market for water treatment systems continues to grow.

Suppliers benefit from a number of factors, including the increasing importance of super-pure water as a standard requirement, a cross-industry trend towards an independent water supply and a shift from chemical to physical treatment. Products and processes, which have been optimized to meet economic and ecological requirements and reduce or even eliminate the use of chemicals, as well as treatment technologies that reduce water and energy consumption, are experiencing above-average growth.

Approximately 200 to 250 companies are active in the overall industrial process water treatment market. According to information provided by Frost & Sullivan, the market leaders are Vivendi Water Systems, Ondeo Degrémont and the Best Water Technology (BWT)

Group. As always, a large number of suppliers will be present at ACHEMA 2003, and they will offer products ranging from individual components to complete turnkey systems.

### **New ion exchange resins**

An ion exchanger system releases ions from an insoluble, permanent material (resin) into the medium and then extracts other, undesirable ions from the water. The most common use of ion exchangers is desalination of water, for example the generation of boiler feed water or water used in pharmaceutical production (normally for pretreatment prior to reverse osmosis).

The increase in quality requirements placed on water treatment has led to demand for higher performance ion exchangers and more efficient treatment technologies. Water quality requirements in the pharmaceutical industry relating to residual conductivity and TOC, for example, are so high that only specially purified ion exchangers are used.

Bayer Chemicals has developed resins using polishing cycles that meet this more stringent requirement profile to a very high degree (ultra pure). Chelating Lewatit TP 207 exchange resin is another specialty product. In a study supported by the German Federal Ministry for Education and Research (BMBF), this ion exchanger was the only product capable of removing nickel from drinking water. Following the commencement of operations at the world's largest production facility for mono-dispersed ion exchangers in Bitterfeld and the takeover of Sybron Chemicals in the USA, Bayer is now among the world's leading producers of ion exchange resins.

### **Copying nature: Membrane technology**

Membrane filtration includes physical processes to separate substances with the aid of a semi-permeable membrane: microfiltration, ultrafiltration, nanofiltration and reverse osmosis (listed in order of increasing selectivity). The cross-flow principle is a common characteristic of a membrane filter. Part of the pressurized, untreated water penetrates the semi-permeable membrane as clean water (permeate). The rest leaves the membrane as a concentrate. Membrane filtration is used for applications such as the supply of ultra-pure water in the pharmaceutical and electronics industries. The current issue of the CD-ROM VOICE OF ACHEMA 2002 (World Catalogue of International Chemical Equipment) contains more than 400 companies active in the field of membrane technology.

Filtration of waste water is a new application for microfiltration and ultrafiltration. Government regulations requiring treatment of waste water before it is released into sewage systems is driving this trend. If the waste water contains valuable substances, there is a possibility that they can be recovered in the concentrate. It can make sense to reuse concentrate containing valuable substances in the appropriate industry or for other purposes. Filtered water (permeate) can also be re-used

in other ways, for example for washing or rinsing rather than simply being discharged into the sewage system. Permeate created during microfiltration or ultrafiltration can also be subjected to an additional reverse osmosis process, creating pure water.

Development activity in the field of membrane technology is concentrated on the creation and testing of new membrane materials, improving resistance to pressure and finding solutions to fouling and scaling problems. The search is also on for ways to selectively separate substances contained in water, for example to recover chemicals from process water. ACHEMA 2003 will reveal how much progress manufacturers have made in this area.

### **Increased sea water desalination capacity**

Worldwide capacity at desalination facilities to treat brine and sea water is on the increase. A study showed that global capacity of all facilities increased by 105% between 1998/1999 and 2000/2001. The increase was actually 140% for facilities that process sea water only. According to the EUWID information service, Wangnick Consulting in its "2002 IDA Worldwide Desalting Plants Inventory, Report No. 17" estimates current total output to be 24 million cubic meters per day and reports that a new turnover record was set in 2001, with plant capacity reaching 3.5 million cubic meters per day. In 2000, turnover was 2.5 million cubic meters per day, and in 1999 it was 1.5 million cubic meters per day.

There has been an increase in the use of both thermal and membrane technology in new facilities. Thermal technology was the dominant method used in the past, but membrane technology is gaining market share. With the exception of the Arabian Gulf region, membrane technology is increasingly becoming the solution of choice. Due to difficult water conditions in the Arabian Gulf region, thermal technology is the more suitable solution there. Currently, membrane systems have a 36.5% share of the market. For the period 1990 to 1999, Wangnick Consulting reported a 34.8% share.

### **Ozone treatment for cooling water**

In addition to avoiding corrosion and build-up of deposits, there are other factors that enhance fault-free operation in cooling systems. It is also important that biological deposits be prevented. Temperature levels and impurities introduced into cooling circuits provide a very favorable environment for bacteria, algae, fungi and mussels to develop, and this leads to the creation of a microbiological coating in the system, which results in corrosive damage and reduced heat transmission.

To contain biological growth, inorganic and organic biocides have been used in the past with the familiar disadvantages. To ensure the effectiveness of chlorine, for example, the pH value must be kept in the neutral range. During operation in the alkali range, significantly higher doses must be used to compensate for the resulting reduction in effectiveness. Chlorine also promotes corrosion of steel components, and by introducing chloride it increases the desalination rate.

The generation of adsorbent organic halogen compounds represents a serious problem when organic biocides that separate chlorine or bromine are used, as does a rise in COD in the cooling circuit water caused by biocides/biological dispersion agents.

Treating cooling water with ozone offers an alternative. Ozone generators create ozone directly at the point of usage. Ozone dosages are automatically added to the cooling water as required. This eliminates the cumbersome acquisition, transportation and handling of hazardous chemicals. The use of ozone can significantly reduce germ colony counts (CFU, colony forming units) in cooling systems. Ozone treatment can substantially reduce existing biological growths within a few weeks, and it often can eliminate growths altogether within a few months.

An in-situ ozone generator creates ozone from atmospheric air, or from industrial oxygen in very large cooling systems. A very effective blending system is used to introduce ozone into the cooling system.

### **Contracting provides a single source of supply**

Industries such as water supply, process water treatment and waste water treatment have not escaped the trend towards outsourcing. According to an analysis performed by Frost & Sullivan, the outsourcing contract volume in Europe is expected to rise from \$US 590 million in 2001 to nearly \$US 1.5 billion in 2008, which equates to 14.1% annual growth. The highest demand comes from companies in the food and beverage industry (20% of turnover in 2001), the chemical industry (18%), energy providers, the petrochemical and pharmaceutical industry and paper and cellulose companies (around 10% each).

Companies outsource principally to reduce costs and to improve efficiency and performance. The customer does not make any investment in personnel, equipment and technology. Instead, the company acquires a supply of process water as a product at a fixed price and at the desired quality level. Contracting is, however, not limited to situations where funds are in short supply. The often-heard admonition to concentrate on core business, along with associated continual reduction in engineering, product and maintenance know-how within a manufacturing company, promotes the concept of contracting. It facilitates conformance to legally binding regulations and orders and qualitative and quantitative requirements. Efforts to adhere to the EU Water Quality Framework Directive (2000/60/EG) may result in increased outsourcing.

A large chemical company in the Hochrhein region has already found a suitable partner. It has signed a contracting agreement with Gelsenwasser AG for the supply of fully desalinated water. The term of the agreement is ten years, and the agreement contains an option to expand cooperation between the companies to include other supply facilities. The chemical company

manufactures special chemical products for the cosmetics industry, among others. Some of the products are very sensitive and require the use of highly sterile water. A modification to the production process led to increased demand for fully desalinated water. Gelsenwasser will construct and operate a dual-line reverse osmosis facility with an annual capacity of 500,000 m<sup>3</sup>. Modern process technology and the use of high-grade RO membranes will ensure a fully continuous supply of water with very high availability. According to information provided by the company, telecontrol and the creation of an emergency service that can always be contacted will provide a high level of support for water treatment operations. A modular process will be used, which can be expanded at short notice to supply greater volumes. Untreated water will be extracted from the Rhine and subjected to mechanical sedimentation and filtration prior to use.

Another contract has now been finalized as well. Aventis Pharma Germany has awarded a contract to Infracore Höchst to provide the entire media and energy supply for a new insulin production facility at the Höchst Industrial Park. The task is very complex, because it involves not only standard energy generation and distribution, in other words electricity and steam, but also the supply of refrigeration, compressed air, nitrogen, drinking water, ultra-pure water, fully desalinated water, ammonia and recooling water. Infracore was able to complete this ambitious investment project in somewhat less than twelve months following contract award.

Although contracts for the provision of ultra-pure water are now very common, outsourcing of wastewater treatment is still relatively new. Integrated water management from supply through the production process right up to and including the discharge of wastewater is still in the early stages, but it is widely recognized as being a fundamentally sound approach. However, it may entail the risk of increased dependency on a contractor, and this aspect must be watched carefully. It is vital that a very thorough appraisal be made of any potential partner, and ACHEMA 2003 will offer ample opportunity to do just that.

### **Current trends in the water technology industry:**

- a. Water technology that uses little or no water.
- b. Increasing worldwide demand coupled with more stringent environmental and health regulations for drinking water and waste water.
- c. A significant increase in industrial demand for water recycling technology.
- d. Internationalization of the business as a result of customer globalization activities.
- e. Holistic water management: customers prefer total solutions from a single source.
- f. A move towards increased concentration in a very fragmented industry.

