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FIRST PUBLISHED IN FERTILIZER INTERNATIONAL, JULY/AUGUST 2007
published by BCInsight Ltd – www.bcinsight.com



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A new Purified Phosphoric Acid (PPA) production plant has started operation in China at the beginning of 2007. This is the first plant to produce PPA from merchant grade phosphoric acid in China and with a capacity of 100,000 t/a PPA, it is the second largest single plant of its kind in the world. The project, executed by Bateman Litwin, was successfully completed in accordance with the contract, and the products meet the international specifications for food and technical grade PPA.

The project is particularly well timed. During the past ten years, demand for PPA has risen sharply, especially in the wake of tighter environmental requirements in the advanced western economies. These requirements have had the following consequences:

- ◆ A drastic reduction in the use of STPP, the main industrial phosphate salt used as a component for detergent use.
- ◆ Shutting down or mothballing elemental P₄ production facilities, resulting in reduced thermal phosphoric acid production (TPA).
- ◆ Increased PPA production capacity using solvent extraction (SX) technology.
- ◆ The concentration of production facilities at larger production sites.
- ◆ Closure of most P₄ production facilities in the United States and Western Europe.

These developments have left China as the only significant producer of elemental P₄ phosphorus today. The world statistics



The Wengfu 100,000 t/a purified phosphoric acid plant is China's first to produce PPA from merchant grade phosphoric acid.

for the use of technical and food grade PPA indicate that the more developed countries have a higher use for food grade products. However, the forecast growth of demand is higher in the developing regions, especially China. The replacement of elemental P₄ thermal acid production by PPA solvent extraction has continued into the present decade, and this trend is expected to continue, including in China, especially

if China joins the WTO as expected.

Guizhou Hongfu Industry & Commerce Development Co. Ltd. (Wengfu) is the first Chinese company to make the change from P₄ to PPA, turning to Bateman Litwin to provide the appropriate technology package.

Bateman Litwin N.V. is a global supplier of turnkey projects for the oil and gas, power and chemical industries. The

Photos by courtesy of Bateman Litwin N.V.

Bateman Litwin N.V. – significant milestones and facts

The company can trace its roots back to South Africa in 1919, when Bateman was established to serve the mineral and metal industries. Bateman became an international player through the geographic diversification of its operations to the United States, Australia and the Middle East, and during the 1970s, it became active in the oil and gas industry, as well as in the power sector. During the 1990s, the Bateman Group further extended its operations into Russia and the Former Soviet Union. In February 2002, the Bateman Group was acquired by a private investment group.

In June 2004, the Group acquired Litwin, a French-based company involved in supplying technology to the international oil, gas and power industries. The addition to the Group's technological depth and geographic coverage prompted the restructuring of the Bateman Group into two independent, Netherlands-based affiliated companies:

- ◆ **Bateman International B.V. (BIBV):** This focuses on the oil and gas, power, chemical and solvent extraction industries, with operational centres in the United States, Europe, the FSU and the Middle East.
- ◆ **Bateman Engineering B.V. (BEBV):** This focuses on the global mining and mineral processing industries, with centres of operation in South Africa and Australia.

Bateman Litwin has remained on the acquisition trail since it was admitted in May 2006 to the AIM market operated by the London Stock Exchange. The most recent purchase was that of Pan Emirates Ltd. in November 2006.

Today, Bateman Litwin employs over 1,200 people worldwide, including 300 multi-disciplinary engineers. The company reported revenues of \$270.3 million in 2006 and an order backlog that was worth \$639.1 million (compared with \$556.0 million in 2005). Profit after tax in 2006 was \$14.2 million.

company has achieved an impressive roster of many hundreds of projects spread among more than 40 countries.

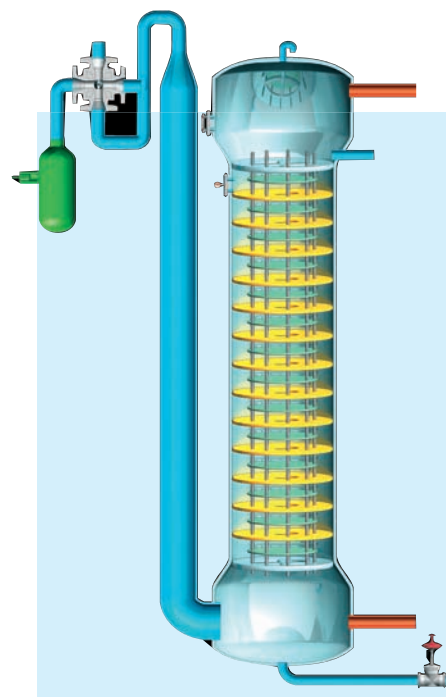
The company's Chemical Technologies Business Unit has accumulated a considerable volume of intellectual property and has developed several advanced technologies. The company specialises in meeting the needs of the world's phosphate and fertilizer producers, offering advanced solutions for:

- ◆ Minerals processing
- ◆ Phosphate rock and downstream production
- ◆ Chemical process industries
- ◆ Environmental protection.

Bateman Litwin has gained particular expertise in the fields of phosphate rock beneficiation, the techno-economic evaluation of new and existing processes, and the development of flow-sheets. The Chemical Technologies unit offers the engineered technologies and know-how to handle all types of phosphate minerals, from hard magmatic rocks to friable marine sediments. These technologies include:

- ◆ Comminution (crushing, grinding and screening)
- ◆ Wet and dry particle size classification
- ◆ Gravity and magnetic separation
- ◆ Coarse and fine flotation
- ◆ Filtration and settling
- ◆ Calcination and thermal processing
- ◆ Stockyard systems (stackers, reclaimers, homogenizers and blenders)
- ◆ Conveyor systems
- ◆ Rapid train-loading systems.

In the PPA sector, for both technical and food grade, Bateman Litwin's purification technology can be adapted to all wet-process acids and processes, to meet client product specifications by using the Company's proprietary solvent extraction (SX) equipment (pulsed columns and mixer settlers). In the industrial phosphate salts sector, Bateman Litwin has the know-how to design and build plants for the production of commercial industrial poly- and ortho-phosphate salts of sodium, potassium, calcium and ammonium. Working closely with leading proprietary equipment suppliers, Bateman Litwin's



Bateman Pulsed Columns enhance solvent extraction.

Chemical Technologies Business Unit can supply single- or multiple-usage plants to produce industrial salts that meet client specifications.

Bateman Litwin's Chemical Technologies have been taken from the initial stage of defining the customer's needs, followed by R&D and feasibility studies, through to plant modifications, expansion and the construction of new facilities. The projects are fully covered by performance guarantees and mechanical warranties. Bateman Litwin's technologies and services are backed by the company's R&D centre, which offers fully equipped laboratories, utilising advanced analytical tools, laboratory and pilot equipment.

Solvent Extraction

Bateman Litwin enjoys global leadership in solvent extraction (SX) technology. The company's capabilities in this sector include:

- ◆ In-house bench-scale and pilot testing
- ◆ Custom-made processes to meet client needs
- ◆ On-site pilot-plant studies
- ◆ Feasibility studies
- ◆ Basic engineering packages
- ◆ Operator training
- ◆ Chemical and analytical services
- ◆ The development of analytical methods and procedures.

Bateman Litwin's SX technology and proprietary equipment incorporate pulsed columns and mixer settlers. Bateman Pulsed Columns (BPC) are high efficiency contactors which enhance SX during the extraction, stripping and scrubbing or washing processes. The extraction process is continuous and excellent results are obtained, especially if many stages are required. The extent of dispersion of the phases, which governs the mass transfer rate, is controlled by varying the pulsation rate. The columns are mechanically simple, with no agitators or internal moving parts, and can easily be fully automated. The floor space that is required by the plant is about one tenth of that required by alternative systems, while maintenance and operating costs are low, with no shutdowns necessary for cleaning.

The pulsed columns can enhance virtually all industrial SX processes, particularly those with a fast rate of mass transfer. Among the most widespread applications:

- ◆ There are proven applications for the processing of nitric, phosphoric and hydrochloric acids and for treating inorganic salts and purifying organic solvents.
- ◆ In the minerals processing industry, the columns are well suited to the processing of copper, uranium, nickel, cobalt and vanadium.



The Wengfu plant is the second largest single plant of its kind in the world.

- ◆ Environmental protection includes the removal of nitrates, heavy metals and effluent treatment.

A BPC consists of a large diameter vertical pipe filled alternatively with discs and doughnut shaped baffles, which facilitate contact between the immiscible liquids assigned through the column.

The heavy (aqueous) phase enters through a disperser at the top of the column and the light (organic solvent) phase enters through a similar device near the bottom. A decanter at each end of the column permits the liquids to coalesce and be decanted separately. When the solvent phase is continuous, the interface between

the phases is in the lower decanter and when the aqueous phase is continuous, it is in the upper decanter.

The columns are pulsed by blowing air at the required amplitude and frequency of the pulses which are controlled using four-way solenoid valves.

The technology package supplied by Bateman Litwin to Wengfu included the supply of pilot tests, basic engineering and a solvent extraction (SX) package. The SX section in the Wengfu PPA plant utilises six Bateman Pulsed Columns and two mixer-settlers. Training and commissioning services were also provided as an integral part of the project. **PK**

Wengfu's rapid rise

In the space of barely 13 years, Guizhou Wengfu Chemi-Phos Import & Export Corporation has established a leading niche as a supplier of phosphate fertilizers and phosphate chemical products for the world market, reporting international sales of around \$250 million in 2005. It is now China's leading producer of phosphate fertilizers and chemicals.

Wengfu is a division of Guizhou Hongfu Industry & Commerce Development Corporation Ltd. (Hongfu). The company was formed in 1994 as a result of the merger of two projects to exploit the phosphate resources in Guizhou province: the Wengfu Phosphate Mine and Wengfu Phosphate Plant had attracted investments totalling around Rmb 5.85 billion (\$765 million) in the course of the Chinese gov-

ernment's Eighth (1991-95) and Ninth (1996-2000) Five Year Plans.

The Wengfu mine benefits from a rich phosphate resource. The explored geographical reserve totals 820 million tonnes, including proven reserves of 580 million tonnes at an average grade of 25% P₂O₅. The reserves have a low cadmium content, while the rock is highly reactive, thus favouring the production of high quality phosphoric acid and finished fertilizers.

Production at the Wengfu phosphate rock mine commenced in 1995. Capacity currently totals 3.3 million t/a of phosphate ore and 2.5 million t/a of concentrated phosphate rock.

Wengfu's downstream production comprises 700,000 t/a P₂O₅ of phosphoric

acid, 1.20 million t/a of DAP and 480,000 t/a of MAP, as well as 1.4 million t/a of sulphuric acid and 14,000 t/a of aluminium fluoride (AlF₃). Wengfu's requirements for sulphur and ammonia are met by imports. The downstream production facilities are supplied by a 30,000 kW plant which utilises waste heat.

More recently, Wengfu has extended its product range to include industrial and food grade phosphoric acid and STPP, enjoying a steady growth in these sectors too. The company emphasises the high quality of its product, having been granted ISO 9002 certification in 2000. In addition to supplying the domestic market, Wengfu has gained an import niche in such overseas markets as Australia and Japan.