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Desalination:

Antiscalants keep the water flowing in reverse osmosis

BWA Water Additives has been a major supplier of water treatment additives for almost 40 years. The company's antiscalant additives are now playing a vital role in keeping reverse osmosis systems working efficiently in desalination plants throughout the world. Mark Holmes talks to Dr. David Cartmell, executive chairman and chief executive officer about the development of the company and the launch of the first biodegradable antiscalants for reverse osmosis systems.

With headquarters in Manchester, United Kingdom, BWA Additives is now a \$200 million/year business as a leading supplier

of antiscalants, corrosion inhibitors and industrial biocides. The company's products are now sold in over 80 countries and BWA has number one or two market share positions wherever its products are used. However, the road to the present day has involved many twists and turns and changes of ownership.

Ciba-Geigy then branched out into industrial water treatment in the late 1970s, which offered further big opportunities. By the early 1980s the business had become 70% industrial applications. David Cartmell joined the company in 1985 with a research background in controlling corrosion in nuclear plants.



David Cartmell, executive chairman and chief executive officer of BWA Water Additives.

Thermal desalination

"The genesis of the business dates back to the early 1970s," explains David Cartmell. "Ciba-Geigy was asked to come up with a solution to a problem in the Middle East where acid was being used to control the scale and the precipitation of calcium carbonate in thermal desalination plants. The plants were corroding quickly through the use of acid, which reduces the pH of the water, but the lifetime of a plant just was not long enough. Scale the thickness of a fingernail will reduce the efficiency of a plant by 10%, because scale is highly non-conductive of heat and blocks pipes and pumps. A product was developed that became Belgard – a brand new polymer that prevented the formation of scale in pipes. The new product worked well in seawater and in thermal desalination plants in particular. The first commercial sales on that product were in 1973. This resulted in a very strong position for the business in the Middle East at that time."

"Control of scale, stopping corrosion and controlling bacteria are the three main problem areas that we deal with as a company, he adds. "The first project that I worked on as a research chemist was reverse osmosis and getting approvals for the product from various membrane companies. We built a new reverse osmosis plant in the laboratory and then extended this to trials in plants all around the world. The business continued to develop with membranes and also into the oil and gas sector. Ciba-Geigy was a highly technical organisation and was widely regarded in the market place for having high performance additives in the fields that it operated in. However, this did limit some of the markets that you could operate in. One of these was wastewater where the margins were low and the technology fairly generic and success was about low cost production."

By the 1990s, the nature of the business was established, as a global player selling into over 80 different countries through the



Antimicrobial testing in the US laboratories of BWA Water Additives.

Ciba-Geigy international network, and was heavily based on technology. However, in 1992 it was acquired by FMC – a US company with a portfolio of predominantly low cost commodity products where price was the key factor.

“We were different from the rest of FMC’s businesses,” says David Cartmell, “because we would be talking about new chemistries, research programmes and be positioned as a provider of high performance products. But what we learned was financial discipline and it was a great learning experience. I became head of the business in 1997. However, we knew that you either competed on cost or on performance, and through manufacturing in the US and the UK we needed to maintain our emphasis on performance.”

Brand leaders

David Cartmell continues: “In 1999 the business was acquired by Great Lakes Chemical Corporation, which had a strong swimming pool additive business – a market that we had been trying to enter. It is a very different business, but there are still problems of scale, corrosion and bacteria. We needed to get away from the industrial approach, and we became part of the Biolab Water Additives business. This was great for us. Biolab was all about branding and imagery. We spent six years within Biolab, in which we were encouraged to promote our position as brand leaders. It was a very US-centred business with 91% of pool chemicals being sold in North America. The product was marketed as a high performance alternative to chlorine and it was great to be part of that.”

However, by 2003 there were indications that Great Lakes was looking to diversify certain businesses. “Even though we were still part of the Biolab business, we were still ring-fenced and continuing to do our research and product development,” adds David Cartmell. “I looked at trying to do a management buyout at that point, but the deal fell through. However, I realised then that taking the business independent was the best way forward. The operation was earmarked to be sold along with other industrial businesses. Being assimilated into new companies is difficult and having been through two acquisitions I did not want to go through it again and consequently I left briefly in 2005 to take up another opportunity.”

Stand-alone company

By now Great Lakes had merged with Crompton Corporation and had become Chemtura Corporation. David Cartmell recalls that now being outside the business made the company easier to buy and an offer was made. The deal took the best part of a year, but by May 2006 BWA was a stand-alone company.

“The offer appealed to Chemtura because they were looking to make disposals and it could be conducted quickly because we knew the business so well,” he continues. “We also made the decision to stick to the strategy that we had followed since 1997 and stay focused on a single market - water. Under Great Lakes we were encouraged to look at other markets, such as textiles and particleboard, to increase volumes. But we had little knowledge of those markets. We made the decision to work very hard in markets that we knew. We are a water treatment business, selling high performance chemicals and knowledge in particular.”

BWA also made another important decision during the acquisition. The company had run plants in Manchester and in Michigan and there had always been the pressure to maintain a high throughput through the chemical plants. So as part of the acquisition process, BWA decided to take all the intellectual property and everything else to do with the products, but not the manufacturing plants.

David Cartmell continues: “The agreement left the manufacturing plants with Chemtura, because they were skilled at operating them. Whereas we are a water treatment knowledge company, good at inventing chemicals and knowing how to use and apply them. Getting our products made was not the issue. We know the process and the intellectual property relating to it, but we did not need to make it ourselves. So we now have 2-3 key established suppliers that can manufacture product for us under confidentiality arrangements. We can work with our suppliers to get new product made and on the market within a year, without the need or expense of building

a plant to make it. Then perhaps three years later the plant might need re-engineering because the product has been improved. This arrangement provides us with flexibility. We want to sell what we can create, not be constrained by what we can make.”

BWA now has established relationships with its suppliers and have now become key parts of their businesses. The company is now one predominantly comprised of chemists. As such BWA believes that it is able to offer a high degree of integrity because it can make recommendations based on the chemical need and not because of a requirement to fill the plant.

“We are focused on a narrow market, whereas other companies are selling the same product into different markets,” adds David Cartmell. “We have a range of products, but we also have the application knowledge that comes of knowing the water market so well. We are strong player in a narrow niche market and get a lot of respect from our customers because of it. When it comes to something new, the membrane manufacturers will come to us. We are able to understand the problem and do research on it very quickly. If it needs a brand new approach or chemistry, then it does not matter to us because we are not fixed on a particular line of chemistry.”

BWA has also applied this philosophy recently in the oil and gas business. In the US, the



Mixing biodegradable antiscalants.



Testing biodegradable antiscalants.

company has solved a bacteria problem in shale gas production, as well as in tar sands production where the technique using steam to get the material out is very similar to thermal desalination.

David Cartmell continues: "Although the market for water is always going to be there, within the industry the market is changing all the time so it is all about knowing what the trends are. On oil rigs where seawater is pumped down the well, it meets formation water. These two are incompatible and scale results. So what oil companies are now doing

is removing sulphates from the seawater before it goes down the well. This is known as desulphation and is being done through reverse osmosis, which requires a particular additive."

Environmental expectations

BWA has identified two major trends in its direct business - the environmental impact of its products and ease of handling. Customers want products that are easier to manage, handle and apply. So the company has looked at some solid products, as well as monitoring

procedures so that discharges can be checked. Finally, BWA has been investigating making its products more biodegradable, which it believes will be a major consideration for the industry in years to come.

"At some point in the future the industry will want biodegradable water additives," explains David Cartmell. "We started our research programme a few years ago and are now bringing these first commercial products to market. Are our customers ready for this yet? Probably not, but it might only take a further year or so. Standard biodegradability for water is a 28 day test and we are looking to move the biodegradability from around 10% to 70%. This is a massive shift. All the products are benign and have drinking water approvals, so it not a case of making them safe products. They are already safe. However, we have fundamentally changed the product to make a genuinely degradable product that remains a high performance product. This research has taken 4-5 years, but we now have a portfolio of biodegradable products that will come on to the market over the next 2 or 3 years. This was a genuine breakthrough. I believe in five years time, this technology will be a major part of the market and our portfolio."

David Cartmell believes that BWA's ownership is important too. The company's backers have made a long term commitment, which has permitted this degree of forward thinking. He believes that the ownership position matches its business perfectly.

BWA has now launched its first two biodegradable products – one for membranes and one for the industrial sector. "If you think about a desalination plant, the seawater will only stay in the plant for a short period of time and our products are then hitting the environment within minutes and hours," he continues. "As a chemical producer, we have a duty of care. There are not many chemicals that can have such a direct impact on the environment as antiscalants for membranes in a desalination plant. Our products are designed to help the equipment and stop the membranes from scaling. So they are making the plant more efficient but the environmental impact is almost immediate. However, what we have not done is compromise on performance. The performance is better than previous products. We have been able to create both a biodegradable product that also offers a higher degree of performance." ●

Biodegradable antiscalant for reverse osmosis systems

BWA has developed Flocon® 885, which is a neutralised aqueous solution of a specialised polycarboxylic acid that is highly effective in controlling the deposition of inorganic scale forming salts on membrane surfaces.

Flocon 885 is readily biodegradable in salt water conditions and inherently biodegradable in fresh water conditions. The product is both phosphorus and nitrogen free. It can be monitored in the feed water and concentrate using a fluorimeter, due to its inherent fluorescence properties. BWA says that it has excellent antiscalant properties for calcium carbonate and barium sulphate, as well as offering good calcium and strontium sulphate, and calcium fluoride inhibition. Flocon 885 is compatible with all major membranes and has international potable water approvals.

Flocon 885 is not affected by chlorine or other oxidising biocides under normal conditions of use and may be used in membrane systems using chlorine and sodium metabisulphite. No special requirements are needed regarding materials of construction of dosing equipment. The recommended injection point is into the feedwater downstream of any filtration equipment and cartridge filters. The additive is miscible with water in all proportions, and may be applied as the neat product, or as a solution in permeate. A minimum dosing solution strength of 10% w/w is recommended.

Flocon 885 is dosed continuously and proportionately to the feedwater flow to maintain the recommended dose level. The dose level required is dependent on the quality of the feedwater and the saturation indices of the various scale forming species present in the concentrated brine. Computer software is used to calculate scaling indices and optimum system recovery.

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