Bioremediation in the petrochemical sector

In response to increasingly stringent environmental legislation, combined with the need to preserve topsoil and prevent landfills from filling up too quickly, GK-IT Environmental Services, a local leader in bioremediation and environmental products, is able to offer risk-averting solutions, particularly for hydrocarbon-contaminated soils in the petrochemical and oil refinery sectors.

Focusing on the bioremediation of hydrocarbon-contaminated soils, director Chris Cooper explains that organic compounds in the gasoline and diesel range can be degraded to levels below 100 ppm using its products. In addition, volatile, semi-volatile, and polyaromatic hydrocarbons can be degraded to below 50 ppb (parts per billion).

This is in accordance with the National Environmental Management Waste Act, 59 of 2008 (NEMWA), of which Chapter 4 Part B contains provisions for contaminated land, which is defined as ‘the presence in or under any land, site, buildings or structures of a substance or micro-organism above the concentration that is normally present in or under that land, which substance or micro-organism directly or indirectly affects or may affect the quality of soil or the environment adversely’.

A proudly South African company established in 2003, GK-IT Environmental Services has developed a range of unique bioremediation products based on microorganisms such as aerobic and anaerobic bacteria, fungi, yeasts, and moulds. Cooper himself has a background in microbiology. The company is a subsidiary of the Man-Dirk group, a specialist supplier of engineering tools and equipment in the maintenance, repair, and operating (MRO) sector.

“We are focusing on the petrochemical and oil refinery sectors as potential growth areas, as there is a considerable risk of spillage and contamination there. The traditional approach to contaminated soil has been a simple ‘dig-and-dump’ approach, which involves physically removing and transporting the material to a toxic landfill site. This not only incurs hazardous-transportation costs, but also poses a major environmental risk whilst on route,” Cooper explains.

GK-IT Environmental Services is able to offer a total ‘on-site’ solution premised on returning contaminated soil to its original pristine condition, a process that normally takes ten to 12 weeks. “The fact that we are such a small, focused company means we are so much more flexible in terms of our response times. Having said that, we have nevertheless been involved with some of the biggest bioremediation projects ever undertaken in South Africa, directly or via distributors,” Cooper notes.

The company has a production facility in Randfontein, and also manufactures products for other suppliers. “We use industrial waste streams in our production. The fact that we design and produce all of our own products differentiates us from other companies focusing exclusively on environmental management.”

While the company has focused traditionally on the mining industry, Cooper reveals that the potential industry and customer base is much larger. “Our target customers are essentially any customers that use petrochemical products, be it oil, diesel, or petrol. The company’s focus on lowest-risk total solutions for its customers continues to give it a leading edge in the market, according to Cooper.

“GK-IT Environmental Services’ product range covers oil, petrochemical, and chemical absorbents, bioremediation products, ‘green’ degreasing chemicals, oil/water coalescing plate separators, oil/water disposal stations, oil collection stations, and water/waste coalescing plate separators. Services offered encompass input on the construction and licensing of bioremediation facilities; the bioremediation of contaminated soil and separator sludges; 24/7 onsite spill response; speciality industrial cleaning; high-pressure cleaning; oil collection; and small volume hazardous waste handling.

Cooper says that whereas the international trend is towards bioremediation, South Africa still favours the traditional ‘dig-and-dump’ approach. However, increasingly stringent environmental legislation, combined with the need to preserve topsoil and prevent landfills from filling up too quickly, means that GK-IT Environmental Services is able to offer far more effective and low-risk solutions.

Biochemicals from microalgae reduce landfill waste

Gem3Bio Inc, a Purdue, Indiana, USA, foundedry-affiliated company, is developing a unique process that could more effectively and affordably transform microalgae into bio-based chemicals to maximise the value of biofeedstock and reduce landfill waste.

There’s been a huge movement toward greener, renewable products for the sake of the environment and that includes biofuels and biochemicals,” says Kelvin Okamoto, founder of Gem3Bio. “Conventional biofuels are derived from sugars of crops, which can take a considerable amount of land and water to produce. Algae has a low carbon footprint, is renewable and can be accessed in large quantities, so overall it is very environmentally friendly. It’s a great alternative to meet the expected demand for bio-based products in the future,” he argues.

Okamoto is scaling up and commercialising an autotrophic, efficient and low-cost algal extraction method to lyse open the algae cells, which releases and separates the fats, sugars and proteins using a mix of commercially available enzymes. The different chemical components can be sold or further converted into ‘green’ biofuels, bioplastics, food and bioscalars. The technology was developed at the University of Toledo.

“Companies use algae for things such as wastewater treatment or fluss gas remediation. Additionally, there are algae producers and harvesters who clean up fish farms or natural waters,” he explains. “Usually after the algae has been used for its initial purpose, it’s disposed of in landfills or converted into animal feed supplements or field nutrition supplements. While the last two are great uses, companies do not receive much money from these options. It’s more profitable to convert the by-product algae into high value biochemicals.”

Okamoto comments that the most common current processes to extract biochemicals from algae often degrade a large portion of the cell contents and are energy-intensive. Gem3Bio’s process could allow companies to earn a profit on the sugars and proteins from the cells being sold to specialty chemical companies, with sales of biodiesel adding to revenue. The company is seeking funding to further develop the technology and once the process has been optimised, it plans to licence the technology to its end users.

“We would offer a design and installation package for the equipment as well as an ongoing package support to licences,” Okamoto says. “Since most of the companies interested in this technology would be small, we would also distribute or consign by-product bio-based chemicals upon request. This type of support would allow us to combine the resulting chemicals from these smaller facilities to get a larger, more attractive volume to the market.”

In South Africa, directly or via distributor, Cooper notes that apart from some of the biggest bioremediation projects ever undertaken in South Africa, GK-IT Environmental Services also offers ‘design and install’ projects to its original pristine condition.

“We have been involved with some of the biggest bioremediation projects ever undertaken in South Africa, directly or via distributor. Cooper notes.

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Trash may be treasure for SA manufacturers

Over the past three months, over 190 000 tonnes of waste has been diverted from landfill and converted into valuable feedstock for South African industry as part of the Industrial Symbiosis (IS) Programme at the National Cleaner Production Centre South Africa (NCPC-SA).

Between April and June 2017, 25 participating IS Programme companies in Gauteng and KwaZulu-Natal diverted over 192 000 t of landfill waste, eliminated 56 053 t of greenhouse gas emissions and saved 1 422 800 m³ of industrial water.

The IS Programme is a joint South Western Cape Industrial Symbiosis Programme, which is run by Green Cape, features 490 member companies that have collectively diverted over 7 900 t of waste from landfill, resulting in over R335 million in cost saving and new revenue, and the creation of 127 jobs.

It’s time for businesses to reap the rewards of this low-hanging fruit.

Although SA is still regarded as the African manufacturing powerhouse, its competitiveness has been waning in recent years. Local industries remain under increasing pressure; from investors to maximise bottom line profit, from unions to retain jobs, and from government to consumers to be more environmentally friendly and sustainable.

Every year at least R17-billion worth of valuable secondary resources are lost to the SA economy as waste disposed of in landfill. Up to 70% of the country’s estimated 59 million tonnes of general waste can be diverted into materials recovery (recycling) and the balance into energy recovery.

This ensures that valuable materials are reused within the environmental, waste management and cleaning technologies sector, creating direct job opportunities for low-skilled and unemployed citizens, as well as the opportunity to establish new enterprises, thereby stimulating a local green economy.

The IS Programme is a direct, easily-accessible solution to these challenges, and industry leader and innovator NCPC-SA is at the forefront of reinforcing the concept that ‘one man’s trash is another man’s treasure.’

The IS Programme enables participating companies to save money on raw materials, explore innovations for wasted resources, generate new business opportunities, reduce their carbon footprint and improve their environmental performance,” says Ndivhuho Raphulu, director at the NCPC-SA, national agencies programme.

South Africa has the ability to mirror Britain’s success, but only with full support from government and industry.