BIOMIN Newsletter
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EKATO Combijet – delivering on power reduction at Bogoso’s 1500 m³ BIOX® primary reactors

Golden Star Resources Limited (GSR) is a Canadian federally-incorporated, international gold mining and exploration company with the principal office located in Toronto, Ontario. GSR has two operating mines in Ghana, namely the Bogoso/Prestea and Wassa mines. The Bogoso/Prestea operation is located approximately 35 km north-east of Tarkwa. Bogoso has both a CIL and BIOX® plant with capacities of 1.5 mtpa and 2.7 mpta respectively. Bogoso has been using BIOX® since 2007 to treat an 820 ton per day (design) pyrite/arsenopyrite refractory sulphide concentrate.

A unique feature of the BIOX® plant is the large installed reactors. These have a live volume of 1500 m³, making them the largest operational bio-oxidation reactors in the world. The BIOX® plant consists of two modules configured as four primary and three secondary reactors.

The large reactor sizes, coupled with sulphide sulphur concentrate contents in the range 17% to 21% and the concomitant oxygen requirement, saw the installation of 330 kW SPX Lightnin agitators to perform the mass transfer and solids suspension duties. In conventional BIOX® plants, it is typically the installed BIOX® agitators and low pressure blowers that contribute to around 75% of the average continuous power draws. With the ever-increasing costs of electricity worldwide, Ghana included, the Bogoso team have been constantly looking at ways of reducing the overall BIOX® power consumption. Recognising power as an important cost driver in BIOX®, BIOMIN in the mid-2000s started working with established mixing equipment stakeholders in assessing ways of improving the mass transfer delivery through reduced reactor power specific volume inputs, which formed part of the BIOMIN BIOX® Generation 4 process design philosophy. In 2010, one such stakeholder, EKATO HOLDING GMBH, one of the world’s largest agitator manufacturing suppliers, introduced BIOMIN to a novel method of gas dispersion – the Combijet+ – which relied on a combined axial/radial flow pattern to realise the efficient oxygen mass transfer requirement, and more importantly, at an established lower power input.
The unique design of the Combijet reduces the size of the gas cavities while ensuring stable gas dispersion and performance across a wide range of operating conditions at lower power inputs. Importantly for BIOX®, the Combijet offers a higher agitator flooding limit compared to conventional impeller types. EKATO already has an established track record of landing the approved Isojet B mixing units in BIOX® plants. In 2013, BIOMIN and EKATO jointly conducted test work at the Fairview 21 m³ test reactor using the Combijet+, as well as the Combijet (no singular gas injection but original ring sparger arrangement) configuration. This test work was preceded in 2012 by testing of the Combijet and Combijet+ at EKATO’s Schopfheim research facility and follows BIOMIN’s rigorous internal policy of development tollgating at different scale-up dimensions.

Bogoso installation

Towards the end of 2013, EKATO and Golden Star realised the first commercial BIOX® installation of five 200 kW Combijet units. Analyses of the new units showed that all the process requirements are successfully being met under the current process requirements. The Combijet over the last two years has thus proved to be a real option for BIOX® applications, yielding considerable operating power cost savings. Golden Star have noted that they are very satisfied to date with the performance following:

• the benefits obtained in the power reduction;
• the reduced fluctuations in the power draw;
• reduction in reactor frothing and foaming;
• the overall return on investment;
• the mechanical reliability.

In addition to the process and mechanical benefits, the reduced power inputs result in a reduced agitator size and, as a consequence, support structure. Other advantages, such as reduced requirements for the backup power, result in a substantial reduction in investment costs for green-field projects.

Closing remark

The BIOX® process has proven itself to be a robust and environmentally friendly technology for the treatment of refractory gold-ore bodies. BIOMIN continually strives to improve the technology by continuing to work with approved mixing companies such as AFROMIX, EKATO, MIXTEC and SPX LIGHTNIN to continually deliver improved and energy-efficient mixing systems to new and existing BIOX® operations. BIOMIN will also be furthering its investigations on delivering improved mass transfer efficiencies in 2015 by visiting various BIOX® operations to evaluate in-situ derived oxygen utilisations.

Reference list


Inoculum build-up is often an area of concern for the project team since it has a significant impact on the overall commissioning schedule of a BIOX® and ASTER™ plant. At the initiative of FCF Minerals, BIOMIN supplied equipment to the Runruno Gold Molybdenum project that allows for the production of flotation concentrate and inoculum (both BIOX® and ASTER™) during the first four inoculum build-up stages.

The Mini Plant lab facility at Runruno comprises of the following equipment:

**Inoculum build-up container (IBC)**

This turnkey metallurgical facility comprises tanks, agitators, pumps and heating/cooling systems required to build the inoculum volume up from the 10 litres of BIOX® inoculum shipped to site, to 3 m³ of active BIOX® inoculum that is well adapted to the Runruno concentrate. The container is located on the Runruno process site and functions as a fully stocked BIOX® metallurgical laboratory with a range of process diagnostic instrumentation and laboratory equipment (excluding analytical). An image of the inoculum build-up container is shown in Figure 1 below.

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**Mill-float laboratory container (MFC)**

This unit complements the inoculum build-up container and includes milling, classification, flotation and liquid solids separation circuits. The pilot plant negates the need to employ the full-scale milling and flotation circuits to produce the concentrate required for the first four stages of BIOX® inoculum build-up. The pilot plant is used to produce the required mass of concentrate at the targeted start-up sulphide sulphur grade of the full-scale plant. An image of the mill-float laboratory container is shown in Figure 2 below.

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Commissioning of the two containers was started during October 2014. A roof was also fitted over the two containers and side walls fitted to create a covered, secure pilot bay area as can be seen in Figure 3 (next page). Despite certain commissioning challenges such as the non-compliance of certain supplied motors to the country frequency rating of 60 Hz and wear problems associated with the mill feed end liner, the first batch of flotation concentrate was successfully produced through the mini plant during December 2014.

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BIOX® inoculum build-up began in early January 2015, with the BIOX® culture successfully adapted to concentrate produced via the mini plant during March 2015. The inoculum build-up will soon move into Reactor B (500L), followed by build-up in Reactor C (3 m³).

According to Nick Holder, Manager Processing: Runruno Operations, the Mini Plant Facility is a valuable asset for the Runruno project and has proven very handy in:

- Producing sufficient concentrate to satisfy the BIOX® inoculum build-up requirements to date,
- Allowing for new operators to gain practical experience by operating the milling, flotation, thickening, BIOX® and ASTER™ mini-plant sections in a non-production environment;
- Demonstrating the various unit processes at small scale to visitors and non-process members of the Runruno team.

The Mini Plant Facility will also be used by the onsite team for the determination of optimum process parameters required during plant start-up, and to test new ore bodies prior to the commencement of processing via the full-scale plant.
Marketing update

An article on ASTER™ available on Wikipedia now

In April 2015, an article about the ASTER™ Process was contributed to Wikipedia at http://en.wikipedia.org/wiki/The_ASTER_process. The article provides a brief overview of the ASTER™ process and information on current commercial ASTER™ operations.

Events attended by BIOMIN in H1 2015

2015 Mining Indaba

BIOMIN’s Managing Director, Jan van Niekerk, attended the forum “Investing in African Mining Indaba 2015”, held on 9-12 February 2015 in Cape Town, South Africa.

The event is an annual professional conference dedicated to the capitalisation and development of mining interests in Africa. It is currently one of the world’s largest mining investment events and Africa’s largest mining event. The Indaba is a summit that brings together major mining players and provides a platform for further investment around the continent. The 2015 Mining Indaba has drawn more than 7,500 investors, mining corporations, government leaders, global press, and other industry stakeholders, 1,800 international companies and 40 government delegations from 110 countries.

PDAC 2015

During 1-4 March 2015, Jan van Niekerk, BIOMIN’s Managing Director, attended the Convention of Prospectors & Developers Association of Canada (PDAC) in Toronto, Canada. The PDAC Convention is the industry’s largest annual event, and provides an opportunity for attendees to learn about the latest trends, technologies and personalities shaping the mineral exploration and mining sector. The PDAC Convention 2015 attracted more than 23,500 attendees from over 100 countries. The event was attended by investors, analysts, mining executives, geologists, prospectors and international government delegations from all over the world.

MiningWorld Russia Conference “Gold and Technologies 2015”

In April 2015 Rail Fatkullin, BIOMIN’s Marketing Manager, attended the MiningWorld Russia Conference “Gold and Technologies 2015” organised within the framework of the MiningWorld Russia 2015 event. The event took place on 22 April 2015 in Moscow at the Crocus Expo exhibition center, and was supported by the Russian Union of Gold Producers. Every year the conference brings together political, business, financial and scientific leaders of the global gold mining industry, allowing them to share experience, hold high-level discussion of current issues, develop partnerships, introduce new products and attract investment.
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