

Energy Efficient Technologies – Lignosulphate Conditioning

Lignosulphonate clay conditioners have been shown to provide benefits such as improved clay workability and increased extrusion rates which result in reduced power consumption during extrusion. Biokeram additives reduced the current drawn by the extruder by almost 7%.

The additives are said to also improve dry strength; reduce salt scumming and provide an overall improvement in clay brick quality

**John Volsteedt**

Swisscontact

for the Energy Efficient Clay Brick   
(EECB) Project

Lignotech South Africa

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## Technical Contributors

# Energy Efficiency Technology Demonstration

### Lignosulphonate clay conditioning at Langkloof Brick & Algoa Brick

## Background

Both Langkloof Bricks (Langkloof) and Algoa Brick (Algoa) are privately-owned brick manufacturers located on South Africa’s East Coast. Coastal regions are relatively far away from usual sources of firing energy such as coal and hence, there is significant motivation to pursue energy efficiency (EE) opportunities.

Both manufacturers focus predominantly on non-facing plaster products (NFP) which are produced from raw materials mined on site. LB operates Vertical Shaft Brick Kilns (VSBK’s) while AB operates tunnel kilns.

Both Langkloof and Algoa have been operating in depressed markets and have struggled with demand and margin. Efficiency has become a key focus point for survival and as energy usage can amount to 40% or more of total expenses for a brick manufacturer, Energy Efficiency measures are critical in the focus on efficiency.

## About this Energy Efficiency Measure

A body additive in the clay brick industry can be generally defined as anything added to the clay body that is not water. Many different types of additive have been tried but one type that has found consistent success is lignosulphonate, a by-product of the paper pulp production process.

In studies conducted elsewhere in the world, lignosulphonate clay conditioners have been shown to provide benefits such as improved clay workability; increased extrusion rates; reduced power consumption during extrusion; improved dry strength; reduced salt scumming and an overall improvement in quality.

There is not much data available from South African brick producers and for this reason, the EECB undertook to co-fund trials run at two different brick manufacturers using different kinds of raw materials.

Lignotech South Africa kindly supplied modified lignosulphonate (branded as Biokeram) for trial purposes. Process optimisation benefits are stated as:

* Reduces water needed by decreasing stickiness of raw material mixtures
* Saves energy by improving extrusion rates
* Reduces waste by limiting shrinkage and cracking during drying

## Key Achievements

|  |  |  |
| --- | --- | --- |
|  | LANGKLOOF BRICKS | ALGOA BRICK |
| Implementation period | October 2016 – March 2017 | |
| Estimated annual benefit | R24,655 | R64,228 |
| Estimated annual energy saving | 26,654 kWh | N/A |
| Estimated annual cost of Biokeram | Refer to Lignotech SA.  Dependent on transport cost | |
| Total project cost (including M&V and report) | R120,629 | |
| Estimated annual GHG reduction (t CO2)1 | 26,121t | N/A |

***1*** *Eskom Annual Report 2013: 1 kWh = 0.98 kg CO2*

## Implementation

Baseline information was drawn from mostly from regular plant QA measurements such as current drawn by the extruder, extruded moisture content, column penetrometer readings etc. At Algoa, the additional step of unpacking a limited number of dry cars was added in order to consider any improvements after drying.

Addition of the lignosulphonate into the clay mix was undertaken by a purpose-procured pneumatic diaphragm pump after attempts to use existing pumps had failed. Once the addition of Biokeram had commenced and the flow rate checked, the extruder operators were left to modulate the water addition rate into the mix. Data was then recorded in a similar manner to the baseline and comparisons were drawn.

## Results

### Langkloof Brick

Biokeram additives reduced the current drawn by the extruder by 6.9% equating to an annual potential saving of 26,654 kWh or R24,655. It was also possible to maintain the extruder current but reduce the water addition rate. A reduction in extruded moisture content can bode well for drying. However, due to the quantity of dryer fuel that Langkloof is mandated to use as well as their shift structure, there is little incentive for them to improve drying efficiency.

Nevertheless, a reduction in overall green waste from 4.5% to 1.2% was recorded which can be attributed to an increase in green strength. Unfortunately, labour issues prevented measurement of any change in fired waste production and there were no changes seen in the aesthetics of fired bricks.

### Algoa Brick

Automated water addition at Algoa prevented any measurement of a reduction in extruder current. However, an increase in extrusion speed of 4.7% was measured with Biokeram addition.

Currently, Algoa’s operating structure does not lend itself towards leveraging this extrusion speed increase but theoretically, an annual benefit of approximately R64 228 could be derived from this. Biokeram additives also increased column hardness suggesting a useful increase in green strength even though extruded moisture content actually rose slightly during the test (possibly due to AB’s automated water addition system).

Notwithstanding the increased green strength, no meaningful quality or waste differences could be detected after drying nor was there any change in the percentage fired waste produced – this suggests that Algoa’s issues run deeper than a clay conditioner can penetrate. Nevertheless, a marked improvement in the aesthetic appearance of the fired product was seen due to scumming reduction. Unfortunately, Algoa’s focus is on the plaster brick market where price is much more critical than aesthetics. Hence, the manufacturer has no business case that will justify any cost expended on aesthetics.

## Financial considerations

The capital implications of adding a lignosulphonate such as Biokeram are relatively low at an estimated investment of R60 000. The operating expense of using lignosulphonate is for negotiation with suppliers such as Lignotech South Africa but transport costs can be a large factor (as seen at the coastal plants in this study). Readers interested in undertaking projects focussed on energy efficiency are encouraged to refer to the “Clay brick Sector Energy Efficiency Finance Guide”. Unfortunately, it is often not straightforward to predict the potential savings nor exactly where they may come from but similar projects delivered elsewhere can provide a useful guide.

The 12L tax incentive (refer to the “Clay brick Sector Energy Efficiency Finance Guide” available from the Clay Brick Association (CBA) of South Africa) cannot be regarded as a potential source of funding as monies are only returned via a reduction in tax well after the expense occurs. In addition to this drawback, the potential cost of a 12L application can be significant. For these reasons, if outcomes similar to this trial are anticipated, the 12L incentive is likely not viable.

The projected annual benefit from a reduction in current drawn by the extruder at Langkloof came to R24 655. At Algoa, the theoretical annual benefit of using Biokeram was estimated at R64 228. While the cost of Biokeram is not clear, it would not be possible to transport the annual quantity required by each plant for the value of the projected savings. Notwithstanding, should LB be able to leverage the benefits provided by the increased green strength and reduced green waste towards reducing brick weight, this could result in a significant energy and cost reductions. Similarly, should AB’s output of face brick grow, the proven aesthetic benefit provided by Biokeram on the local clays may be of significant benefit.

Readers interested in undertaking projects focussed on energy efficiency are encouraged to refer to the following EECB project publication on the Clay Brick Association of South Africa website (<http://www.claybrick.org/eecb>)

* The South African Clay Brick Sector Energy Efficiency Guidelines. This document defines South African benchmarks and investigated various opportunities for the implementation of energy efficiency measures.
* The “Clay Brick Sector Energy Efficiency Finance Guide”.

## Lessons learned

* Starting with a purpose-designed lignosulphonate addition system would have saved time and money
* The literature on lignosulphonate addition was generally seen to be consistent with what can be expected in the South African clay brick industry
* Practical issues such as shift length and mandates to use a specified amount of waste can impact potential EE projects
* Different clay bodies with different clay preparation processes react in different ways to the addition of lignosulphonate
* The potential benefit obtained from lignosulphonate has to be considered against the potential cost, especially if the brick manufacturer is relatively distant from the source
* Adequate project management and measurement / metering is crucial to establish the effectiveness of the intervention

**For further information:**

Energy Efficient Clay Brick Project

The Clay Brick Association of South Africa

Website: [www.claybrick.org](http://www.claybrick.org.za)/eecb