“BIOPLASTIC OPPORTUNITIES FOR SOUTH AFRICA”

WORKSHOP PROCEEDINGS
Table of Contents

1 Introduction .................................................................................................................................................. 1
  1.1 Defining bioplastics ................................................................................................................................ 1

2 Workshop .................................................................................................................................................... 4
  2.1 Purpose of the workshop ............................................................................................................................ 4
  2.2 Workshop programme ................................................................................................................................ 5

3 Results .......................................................................................................................................................... 6
  3.1 Presentations .............................................................................................................................................. 6
    3.1.1 Opportunities for a local bioplastics industry ....................................................................................... 6
    3.1.2 Obstacles to a local bioplastics industry .............................................................................................. 7
    3.1.3 Current gaps in knowledge ................................................................................................................ 7
  3.2 Group discussions .................................................................................................................................... 8
    3.2.1 Viability of creating a local bioplastics industry ................................................................................... 8
    3.2.2 Opportunity feedstocks ....................................................................................................................... 8
    3.2.3 Obstacles to a local bioplastics industry .............................................................................................. 8
    3.2.4 Gaps in knowledge ............................................................................................................................. 10

4 Conclusions .................................................................................................................................................. 10

5 References ..................................................................................................................................................... 11

ANNEXURE 1: INDUSTRY-MEETS-SCIENCE WORKSHOP AGENDA
ANNEXURE 2: WORKSHOP BREAKAWAY SESSIONS
ANNEXURE 3: ATTENDANCE REGISTER
1 Introduction

This report presents the findings of a one-day Industry-meets-Science workshop on bioplastics. The workshop, held on the 21 January 2016, was organised by the Department of Science and Technology (DST) in conjunction with the South African Bioplastics Forum, an initiative of Plastics|SA. The workshop, which focussed on “Bioplastic opportunities for South Africa”, was aimed at assessing whether South Africa can create a local bio-based plastic industry (within a larger biorefinery industry), in line with the 10-year Waste Research, Development and Innovation (RDI) Roadmap for South Africa (DST, 2014) and Bio-Economy Strategy (DST, 2013). The workshop builds on the outcomes of two events held in South Africa in 2015 – the Plastics|SA Bioplastics Seminar (June 2015) and the Department of Environmental Affairs Bioplastics Workshop (August 2015).

1.1 Defining bioplastics

Bioplastic may be defined as a plastic that is derived (wholly or partly) from renewable biomass (plant) sources. European Bioplastics (2014) identifies three types of bioplastics (Figure 1) –

1. Non-biodegradable plastics that are biobased, or partly biobased, such as biobased PE, PP, or PET (so-called ‘drop-ins’) and biobased technical performance polymers such as PTT or TPC-ET
2. Biodegradable plastics that are biobased, such as PLA and PHA or PBS
3. Biodegradable plastics that are based on fossil resources, such as PBAT

Figure 1. “Material coordinate system of bioplastics” depicts how bioplastics can be classified according to their biodegradability and biobased content (European Bioplastics, 2014)
As noted by European Bioplastics (2014:1), “‘Biobased’ does not equal ‘biodegradable’. The property of biodegradation does not depend on the resource basis of a material, but is rather linked to its chemical structure. In other words, 100 percent biobased plastics may be non-biodegradable, and 100 percent fossil based plastics can biodegrade.” According to European Bioplastics (2015a) biobased plastics include:

1. Biobased, non-biodegradable plastics
   - Materials: Biobased polyethylene (Bio-PE), biobased polyethylene terephthalate (Bio-PET), biobased polyamides (Bio-PA), some biobased polyesters (PTT, PEF), starch-polyolefin blends, and other materials.
   - Uses: In packaging as well as in durable applications such as vehicles, buildings, household appliances, interior design, lifestyle goods, and electronics.

2. Biobased, biodegradable and compostable plastics
   - Materials: Thermoplastic starch, polylactic acid (PLA), polyhydroxyalkanoates (PHA) and others.
   - Uses: Short-lived applications such as in agriculture, catering products, packaging, or thin bags. Suitable for organic recycling, especially industrial composting.
   - Standards: In the EU, compostable products are certified under EN 13432 and EN 14995.

The focus of the Industry-meets-Science workshop was on biobased/non-biodegradable plastics, given that this is where the greatest growth in global demand is expected (Figures 2, 3 and 4).

Figure 2. Expected annual growth in global production capacities of bioplastics (European Bioplastics, 2016)
According to European Bioplastics (2016), “Drop-in solutions’ represent the single largest sector of the global bioplastics production. They are (partly) biobased, non-biodegradable commodity plastics such as PE, PET, or PP, and can be easily recycled along their conventional counterparts.” They therefore present no risk to the local recycling industries. The largest growth in bioplastics is expected in Bio-PET (Figure 3), this is largely driven by Coca-Cola’s conversion from fossil-based PET to Bio-PET. Coca-Cola has set the target – that 100% of their PET plastic, used in new bottles, contain first-generation PlantBottle™ material by 20201.

Figure 3. Expected global production capacities of bioplastics (by material type) (2014 to 2019) (Nova Institute, 2015)

Figure 4. Global production capacities of bioplastics (by market segment) (European Bioplastics, 2016)

The largest demand for bioplastics (by market segment) is expected to be in rigid packaging (Figure 4), with relatively small, niche market opportunities for biodegradable plastics.

The catalyst for holding this Industry-meets-Science workshop, is framed in Figure 5. Published data by European Bioplastics (2016) on the expected future global production capacities (by region), shows no activity on the African continent, despite significant biomass resources on the continent.

Figure 5. Global production capacities of bioplastics (2014 to 2019) (by region) (European Bioplastics, 2016)

This data on global production, prompted a question at the Plastics SA bioplastics workshop held in June 2015 – “What are the opportunities for bioplastic production from biomass and biomass waste in South Africa, given that the Waste RDI Roadmap identified both plastic and organic waste as priority waste streams; and that biomass waste (organic waste) is the single largest general waste stream generated in South Africa?” (presentation by Dr L Godfrey, 2 June 2015).

2 Workshop

2.1 Purpose of the workshop

The aim of this Industry-meets-Science workshop was to bring industry, government and academia together, to discuss the question –

- Can we, and how do we, create a local South African bio-based plastic industry in South Africa (within a larger biorefinery industry) (in line with the DST Waste RDI Roadmap and Bioeconomy Strategy).
  - That explores new market opportunities for existing resources, e.g. sugar, forestry, paper sectors
  - That drives local content in biobased products already on the market in South Africa
  - Thereby stimulating local economic development and job creation

That could stimulate –

- Industry response to identified opportunities
2.2 Workshop programme

Key sector representatives were invited to participate in the workshop. The morning focussed on presentations by Industry, Universities, Science Councils and Government. The brief given to speakers was to –

- Provide a brief overview of your organisations current activities around bioplastics
- Identify opportunities to establish a local bioplastics industry in South Africa
- Identify obstacles to a local bioplastics industry – what is stopping us from already having a local bioplastics industry
- Outline current gaps in knowledge – what don’t we know?

The afternoon session involved four smaller, break-away groups, each group was tasked with addressing the following questions –

- Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa?
  - Do local and export markets exist?
  - Do economies make sense?
  - What are the opportunities?

- Are there specific biomass feedstocks and waste streams that are immediately viable
  - Do we know where they are?
  - In what quantities?

- What are the obstacles to a South African bioplastics industry –
  - What is stopping us from already having a local industry?

- Are there gaps in knowledge in moving to this goal immediately, and if so –
  - What are these gaps in knowledge (be specific)?
  - How do we close these gaps quickly (technology or research needs)?

The workshop programme, outlining the speakers and presentation topics, is attached as Annexure A. All presentations made during the workshop are available online, on the Waste RDI Roadmap website (www.wasteredmap.co.za).
3 Results

3.1 Presentations

Delegates were invited to present on their organisations activities around bioplastics. In addition, they were asked to reflect on –

- Opportunities for a local bioplastics industry
- Obstacles to a local bioplastics industry
- Current gaps in knowledge

A summary is provided below.

3.1.1 Opportunities for a local bioplastics industry

1. Coca-Cola (Dr Casper Durandt)
   - PlantBottle™ supply chain evolution, optimised supply chains, including planned bMEG and bPET capacity in strategic markets, with diverse local feedstocks sourced responsibly by 2020, including the possibility of South Africa
   - Additional benefits include – less feedstock volatility; further carbon footprint reduction; diverse feedstocks benefiting local farmers

2. Sugar Milling Research Institute (SMRI) (Steve Davis)
   - Sugar industry is a well-established bulk agro-processor
   - Seeking better returns in depressed world sugar market
   - Willing to diversify product base (bulk chemicals)
   - Potential local source of bio-based chemical feedstocks (carbohydrates, lignocellulose)

3. Stellenbosch University (Prof J Görgens)
   - Create demand for bioplastics through engagement with consumers
   - Valourisation of organic wastes/residues
   - Expand agriculture to meeting growing demand for biobased products
   - Import replacement and/or export of biobased products

4. Department of Trade and Industry (Simphiwe Fikizolo)
   - Opportunities in the specialised markets like automotive
   - Carbon Tax
   - The increase of the demand for environmentally friendly products
   - Number of jobs within the value chain
   - Enhance farming skills
   - Polymer price in South Africa, especially PP
3.1.2 Obstacles to a local bioplastics industry

1. Coca-Cola (Dr Casper Durandt)
   - Size, volume, scale, capacity, bulk, wholesale, magnitude
   - bPET MEG small-scale plant 150,000 tons (equates to 450,000 tons of PET – almost double the South African market)
   - Oil price volatility and uncertainty
   - Energy cost escalation
   - Volatile labour market

2. Sugar Milling Research Institute (SMRI) (Steve Davis)
   - Feedstock suppliers need to know what bioplastics manufacturers need – chemical type, specifications, tonnage
   - Need to have mutually favourable pricing structure
   - Need to have long-term off-take agreements
   - Need capital to invest in manufacturing facilities

3. Stellenbosch University (Prof J Görgens)
   - Cost-competitiveness and/or performance of bioplastics compared to conventional plastics
   - SA cost-competitiveness with large, global production facilities
   - Environmental benefits are not ensured by using bio-based resources

4. Department of Trade and Industry (Simphiwe Fikizolo)
   - The current decrease in oil price
   - Availability of quality feedstock
   - Cost of manufacturing especially from second generation feedstock
   - Price of bioplastics
   - Skills needed in the value chain

3.1.3 Current gaps in knowledge

1. Sugar Milling Research Institute (SMRI) (Steve Davis)
   - Established (commercially viable) process routes and technologies from raw feedstock to chemical intermediate?

2. Stellenbosch University (Prof J Görgens)
   - Techno-economics and environment
     - Multiple potential products and production routes
     - Rigorous, comparative assessment of alternatives through simulations
     - Simulations should be based on technology performance at scale – limitations in technical information in public domain
     - Economics based on costing and technical performance
     - Does bio-based ensure that an environmental benefit is realised? (Life cycle emissions, biodegradable for disposal purposes)
3. Department of Trade and Industry (Simphiwe Fikizolo)
   - Highly skilled bioengineers
   - Not enough feedstock knowledge especially characterisation to know quality and yield
   - Integration of bioplastics within biorefinery
   - More work has been done on hydrolysis and fermentation but few on bioplastics
   - Economic and benefit analysis of producing bioplastics

3.2 Group discussions

3.2.1 Viability of creating a local bioplastics industry

The general consensus was that establishing a local bioplastics industry in South Africa is feasible, given the availability of biomass (although lack of sufficient detail), but it depends upon access to markets, either local or international. Targeting high-value markets may provide a logical first step towards a local industry. However, it was noted that there are currently no economic (incentives, disincentives) or legislative drivers to support the development of a local industry. Activities by the private sector will therefore be limited to immediate, sustainable business opportunities (since still considered high risk).

In addition to high-value, niche markets, immediate opportunity areas included bio-PET production for the beverage industry (with Coca-Cola as a market leader), bio-ethylene production, and biocomposites for the automotive and aerospace industries. Significant opportunities for local job creation from a bioplastics industry were recognised.

3.2.2 Opportunity feedstocks

Numerous feedstocks were identified for use within a local bio-economy (Annexure 2).

However, it was noted that the viability of a local market is dependent on the availability of feedstock (quality and quantity) and the conversion efficiencies to end-products. Although there are various sources of information regarding biomass in South Africa, questions were raised as to whether the information is detailed enough to support a local business case and reduce the risk of investment. A detailed feasibility study for different feedstocks would be necessary to support a business case for a local bioplastics industry.

It was suggested that non-food crops be targeted to reduce any risk to food security.

3.2.3 Obstacles to a local bioplastics industry

Obstacles to a local bioplastics industry centred around five main issues (Table 1) –
   - Feedstock
   - Markets
   - Conversion (from feedstock to end-use products)
   - Enabling environment
   - Expertise/skills
Table 1: Obstacles to a local bioplastics industry

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Markets</th>
<th>Conversion</th>
<th>Enabling environment</th>
<th>Expertise/skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Uncertainties around feedstock to product, type of business model</td>
<td>• Availability of market, e.g. niche market</td>
<td>• Complicated value chain (material is decentralised)</td>
<td>• Lack of Government regulation (or standards) and support e.g. landfilling (make it expensive)</td>
<td>• Need for trained/skilled staff</td>
</tr>
<tr>
<td>• Lack of understanding of current availability of raw materials and conversion rates</td>
<td>• Industry is risk-averse (need a strategy/vision)</td>
<td>• Lack of investors (risk averse)</td>
<td>• Lack of Government incentives (green economy subsidy, localisation targets)</td>
<td>• Need for skills in the upper stream</td>
</tr>
<tr>
<td>• Lack of available feedstock</td>
<td>• Need market security</td>
<td>• Need economy of scale – diverse applications</td>
<td>• Low oil price</td>
<td></td>
</tr>
<tr>
<td>• High feedstock costs</td>
<td>• Market awareness</td>
<td>• High start-up costs for certain polymers</td>
<td>• Import costs high – impacts on consumer acceptance of bioplastics at present</td>
<td></td>
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<tr>
<td></td>
<td>• Price of the finished product</td>
<td>• Technology is expensive</td>
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<tr>
<td></td>
<td>• Bioplastics are product specific</td>
<td>• High capital cost</td>
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<td></td>
<td></td>
<td>• Water availability for crops</td>
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</table>
3.2.4 Gaps in knowledge

The gaps in knowledge centred around –

- Improved data on the quality and quantity of feedstock
- Better understanding of the market
- Understanding of how bioplastics will disrupt local products and employment
- Technology and skills needs

Workshop delegates felt that these gaps could be closed through –

- Feasibility study
  - Techno-economic feasibility study to outline the size of the industry that could be viable in South Africa
  - Develop a business case that could get public and private sector support / buy-in
- Technology
  - Increasing pre-competitive research
  - Pilot scale demonstration of applicable technologies
- Policy
  - Setting targets
  - Supporting regulations and economic incentives

4 Conclusions

The Industry-meets-Science workshop on bioplastics provided a further step towards strengthening the research, development and innovation relationship between industry and the R&D community. Activities will continue to be supported through Government initiatives, such as the DST Bio-Economy Strategy and the Waste RDI Roadmap, and industry initiatives, such as the recently established South African Bioplastics Forum, an initiative of Plastics|SA.

The workshop provided an opportunity for stakeholders to constructively engage on the topic of bioplastics and explore the viability of a local bioplastics industry.

The workshop highlighted the need to improve our understanding of –

- **Feedstocks**: available biomass feedstock, including – biomass type, quantity, location, sustainability, risks, etc. *(in sufficient detail to inform local investment)*
- **Markets**: viable end-use markets for the conversion of (particularly) biomass waste, but more broadly from South Africa’s biomass resources, including – immediate opportunity biochemicals and biopolymers, market size, market location, market growth, market differentiation, etc. *(demand, market-pull)*
- **Process routes and conversion efficiencies**: viability of a local industry based on quantity of source, conversion ratios and end-use demand *(system flows and mass balances)*

There is also a need to think more broadly than just bioplastics. To explore opportunities for local biochemicals and biopolymers production, as part of a broader biorefinery agenda for South Africa. The Nova Institute (2015) report on “*Bio-based Building Blocks and Polymers in the World Capacities,*
Production and Applications: Status Quo and Trends towards 2020”, focuses exclusively on “bio-based building block and polymer producers, and the market data therefore does not cover the bio-based plastics branch. We must clearly differentiate between these two terms. A polymer is a chemical compound consisting of repeating structural units (monomers) synthesized through a polymerization or fermentation process, whereas a plastic material constitutes a blend of one or more polymers and additives.” This is a useful approach to take, to focus on the biochemicals and biopolymers that could be produced from biomass in South Africa, whether these intermediaries be converted into bioplastics, bioreins, biocomposites or other related products.

The findings of this workshop will be taken back into the activities of the Department of Science and Technology, in implementing the Bio-Economy Strategy and Waste RDI Roadmap.

5 References

DST (Department of Science and Technology) (2013). The Bio-Economy Strategy. Department of Science and Technology: Pretoria
European Bioplastics (2015a). The behaviour of bioplastic films in mechanical recycling streams.
# ANNEXURE 1: INDUSTRY-MEETS-SCIENCE WORKSHOP AGENDA

**“BIOPLASTIC OPPORTUNITIES FOR SOUTH AFRICA”**

**Date:** 21 January 2016  
**Venue:** CSIR, Ground floor Boardroom (Shark), 359 King George V (5th) Avenue, Durban

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Name</th>
<th>Organisation</th>
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<tbody>
<tr>
<td>9:00 – 9:30</td>
<td>Arrivals (Tea / Coffee)</td>
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<tr>
<td>9:30 – 9:40</td>
<td>Welcome and introductions</td>
<td>Ms Magamase Mange</td>
<td>DST</td>
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<td>9:40 – 9:50</td>
<td>Introduction to the Roundtable Discussion</td>
<td>Dr Linda Godfrey</td>
<td>CSIR</td>
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<tr>
<td>9:50 – 10:10</td>
<td>Overview of the global bioplastics industry and PlasticsSA approach to bioplastics</td>
<td>Mr Jacques Lightfoot</td>
<td>PlasticsSA</td>
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<td>10:10 – 11:00</td>
<td>Briefing on activities (10 min slots)</td>
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<td></td>
<td>• Ms Liesel Beires</td>
<td>Government</td>
<td>KZN edtea</td>
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<td></td>
<td>• Dr Casper Durandt</td>
<td>Industry</td>
<td>Coca-Cola</td>
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<td></td>
<td>• Mr Jaco Basson</td>
<td>Industry</td>
<td>I’m not Plastic</td>
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<td></td>
<td>• Mr Steve Davis</td>
<td>Industry / Academia</td>
<td>SMRI</td>
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<td>• Dr Bruce Sithole</td>
<td>Academia</td>
<td>CSIR</td>
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<td>11:00 – 11:10</td>
<td>Comfort break (10 min)</td>
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<td>11:10 – 11:50</td>
<td>Briefing on activities (10 min slots) (cont)</td>
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<td></td>
<td>• Prof Johann Görgens</td>
<td>Academia</td>
<td>SUN</td>
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<td>• Dr Anne Stark</td>
<td>Academia</td>
<td>UKZN</td>
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<td>• Dr Sudhakar Muniyasamy</td>
<td>Academia</td>
<td>CSIR</td>
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<td>• Mr Simphiwe Fikizolo</td>
<td>Government</td>
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<td>11:50 – 12:30</td>
<td>Roundtable discussion (Session 1) – Group discussions followed by Open feedback and discussion</td>
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<td></td>
<td>• Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa</td>
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<td>o Do local and export markets exist?</td>
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<td>o Do economies make sense?</td>
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<td>o What are the opportunities?</td>
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<td>12:30 – 13:00</td>
<td>Lunch Break (30 min)</td>
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<td>13:00 – 13:40</td>
<td>Roundtable discussion (Session 2) – Group discussions followed by Open feedback and discussion</td>
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<td>• Are there specific biomass feedstocks and waste streams that are immediately viable</td>
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<td>o Do we know where they are and</td>
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<td>o In what quantities?</td>
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<td>Organisation</td>
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<tr>
<td>13:40 – 14:20</td>
<td>Roundtable discussion (Session 3) –</td>
<td>Group discussions followed by Open feedback and discussion</td>
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<td></td>
<td>• What are the <strong>obstacles</strong> to a South African bioplastics industry –</td>
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<td>o What is stopping us from already having a local industry?</td>
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<td>14:20 – 14:50</td>
<td>Roundtable discussion (Session 4) –</td>
<td>Group discussions followed by Open feedback and discussion</td>
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<td>• Are there <strong>gaps in knowledge</strong> in moving to this goal immediately, and if so -</td>
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<td>o What are these gaps in knowledge (be specific)?</td>
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<td></td>
<td>o How do we close these gaps quickly (technology or research needs)?</td>
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<tr>
<td>14:50 – 15:00</td>
<td>Discussion</td>
<td>All</td>
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<tr>
<td>15:00 – 15:30</td>
<td>Q&amp;A telecon with Mr Michael Knutzen</td>
<td>General Manager: Plant Bottle</td>
<td>Coca-Cola (Atlanta, USA)</td>
</tr>
<tr>
<td>15:30</td>
<td>Recap, way forward and closure</td>
<td>Mr Douw Steyn</td>
<td>Plastics SA</td>
</tr>
</tbody>
</table>
### Workshop Group 1

#### 1. Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa?

<table>
<thead>
<tr>
<th><strong>Yes, have resources – raw materials</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conversion rate?</td>
</tr>
<tr>
<td>• Biomass is there sufficient? Need to check mass balance/quality/quantity etc.</td>
</tr>
<tr>
<td>• Infrastructure?  Logistics?</td>
</tr>
<tr>
<td>• Need to coordinate all information</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th><strong>Do local and export markets exist?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not in general but targeted specific areas e.g. Coca-Cola - growth</td>
</tr>
<tr>
<td>• Need clarity around biodegradability/not what is bio?</td>
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<tr>
<td>• Is renewable</td>
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<tr>
<td>• EU definitions</td>
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<tr>
<td>• Standardisation</td>
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<tr>
<td>• Renewable ethylene – yes – 20,000 tonnes</td>
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<table>
<thead>
<tr>
<th><strong>Do economies make sense?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Initially target high value markets</td>
</tr>
<tr>
<td>• Need export market or target high value markets</td>
</tr>
<tr>
<td>• Job creation</td>
</tr>
<tr>
<td>• See Question 4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>What are the opportunities for South Africa in terms of bioplastics?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>See Question 2</td>
</tr>
<tr>
<td>• Are SA consumers ready?</td>
</tr>
<tr>
<td>• Automotive biocomposites industry?</td>
</tr>
<tr>
<td>• PET bottles</td>
</tr>
<tr>
<td>• Cosmetics</td>
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<tr>
<td>• Niche (plus renewable ethylene) – needs to be cost competitive oil price at 75 US$/barrel = break even for sugarcane</td>
</tr>
<tr>
<td>• Bioplastics, biocomposites</td>
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<tr>
<td>o Aviation sector</td>
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<td>o Denel?</td>
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<tr>
<td>o Automotive</td>
</tr>
<tr>
<td>o Medical sector – gels for wound care – speak to Dr Bruce Sithole at CSIR UKZN – purity of product is of paramount importance in medical field</td>
</tr>
<tr>
<td>o Dental applications?</td>
</tr>
<tr>
<td>o PFA thermoset, poly furfural alcohol – CSIR Port Elizabeth</td>
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<tr>
<td>o Cosmetics pharma – micro plastics need to be biodegradable</td>
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<thead>
<tr>
<th><strong>2. Are there specific biomass feedstocks and waste streams that are immediately viable?</strong></th>
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<tbody>
<tr>
<td>• Viability depends on conversion rate: mill (paper) sludge is available</td>
</tr>
<tr>
<td>• Where are they? Paper mills – Springs, KZN, etc.</td>
</tr>
<tr>
<td>• Bagasse? – sugar mills currently using it</td>
</tr>
<tr>
<td>• Green Algae? (UPE and DUT) Dow Chemicals – green algae – polyethylene</td>
</tr>
<tr>
<td>• Food waste?</td>
</tr>
<tr>
<td>• How much sugar do we need to feed a 150 000 ton plant? Of bioplastic bottles for Coca-Cola</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Do we know where they are?</strong></th>
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<tbody>
<tr>
<td>• Check KZN green growth.com</td>
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</table>
**Sugar cane (SASA)** – (352 000 hectare at moment)
- Timber (FSA)
- Grow specific crops?
- Potential for student to find what are information gaps – do basic literature review across potential for sector or full-time person (3 months)
- Access unemployed engineers etc?? to do basic research – Plastics SA to drive and coordinate

### Do we know in what quantities they exist?
- Not as much as would like? Quality and consistency
- Maths for ethylene production – conclusion currently not viable
- 350 kt polyethylene plant need 7 million hectare sugar – SA has 352 000 hectare of sugar cane
- 0.05 tons per hectare – need 800 000 hectares of sugar cane locally all made to ethylene
- And only viable at 70 US Dollars/barrel/oil – (cost in 2009 ± R15 per kg of ethylene)

### 3. What are the obstacles to a South African bioplastics industry?

What is stopping us from already having a local industry?
- Uncertainties around feedstock to product, type of business model – go with smaller
- Lack of understanding of current availability of raw materials and conversion rates
- Size of niche market? Is there a known niche market? Green chemicals from pulp mill streams?

### 4. Are there gaps in knowledge in moving to this goal immediately?

- Market research? What do consumers really think? e.g. packaging
- In cosmetics would they buy if it’s in a renewable, or is purchase only driven by cost
- R&D job is to give people “what they going to want before they do”
- Need to convince them they need biodegradable

Yes, are gaps
- Proper techno feasibility studies: how final product financials compare with original product
- Don’t make assumption will be more expensive e.g. Danone example

### What are these gaps?

- See Question 2 on raw materials
- Cyclical of costs or raw materials and material substitution – focus on potential replacements and get timing right

### How do we close these gaps quickly (technology or research needs)?

- Pre competitive research – need to be better at doing collaborative research – USA spends billions
- Pilot plant commercialisation phase – funding
**Workshop Group 2:**

1. **Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa?**

   Yes

   Feedstock raw – Technology and Research – Bioplastic – Technology and Research – end market/products

   **Do local and export markets exist?**

   Yes

   - Packaging (Coca-Cola)
   - Crates, film (Agri)
   - Automotive
   - Export Africa markets – especially rand value

   **Do economies make sense?**

   Sometimes

   - Depends on raw material cost, availability
   - Amount of waste available
   - Current rand/dollar exchange rate
   - Labour cost
   - Growing demand

   **What are the opportunities?**

   - Production of ethylene possibility; PLA and bio-composites; BHPs; BMEG; Raw materials
   - Export
   - Job creation
   - Bio-economy strategy – make it practical

2. **Are there specific biomass feedstocks and waste streams that are immediately viable?**

   Yes

   - Saw dust waste
   - Trees e.g. branches, leaves (forestry waste)
   - Sugarcane
     - Sugar – juice – molasses – harvesting residues
     - Waste
   - Maize (agricultural) and wheat
   - Invasive plants (Working for water) – create jobs
   - Biomass (Gis)
     - Bioenergy Atlas
       - Shellfish
       - Abattoir waste
       - Poultry industry (chicken feathers)
       - Algae (waste water/industrial effluent)
       - Low value animal feed
       - Spend grain (malt)
       - Feed waste

   **Do we know where they are?**

   Yes, refer to above

   **Do we know in what quantities they exist?**

   Yes and no

   - Biomass GIS (Bioenergy Atlas)
   - PAMSA/PRASA
   - Poultry Association
   - Abattoir Association
   - SAB Miller
3. **What are the obstacles to a South African bioplastics industry?**

What is stopping us from already having a local industry?
- Lack of available feedstock
- Industry in risk-averse (need a strategy/vision)
- Need market security
- Lack of Government regulation e.g. landfilling (make it expensive)
- Lack of Government incentives (green economy subsidy)

4. **Are there gaps in knowledge in moving to this goal immediately?**

Yes
- What is the optimal size (economies of scale vs feedstock)
- What is the market requirement (current and future)
- We do not get data from industry (IP)

**What are these gaps?**
- Data of feedstocks
- Quality of feedstocks
- Adaptation (technology) – to CA (?) conditions (pilot scale and demonstration)

**How do we close these gaps quickly (technology or research needs)?**
- Industry wide research a feasibility study
- International comparison
- Policy (set targets) – regulation – enforced and incentivised (if you are bio)
- Pilot scale demonstration of applicable technologies
### Workshop Group 3

#### 1. Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No legislation pushing bio-based plastics in South Africa</th>
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<td>Yet, much interest and support</td>
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</table>

#### Do local and export markets exist?

| • Local markets very small – public not well educated |
| • Export markets small |

#### Do economies make sense?

| • Bio-based plastics still cost much higher than fossil-based |
| • Economies of scale not yet established |
| • Paying high import taxes on imported materials |

#### What are the opportunities?

| • Cellulose sources likely to be cheaper in long term |
| • May be driven by Coca-Cola – market leader |
| • Take a regional approach (into Africa) for economies of scale |
| • Europe keen to draw on Africa’s bio-resources |

#### 2. Are there specific biomass feedstocks and waste streams that are immediately viable?

| • If prices right, up to 1Mt sucrose may be available from industry |
| • Potentially cellulose available from bagasse / cane trash – quantity would need to be determined |
| • Chitosan? |
| • Keratin? |

#### Do we know where they are?

| • Sugarcane in KZN/Mpumalanga |
| • Wheat Straw in Cape for cellulose |
| • Forestry products in KZN/Mpumalanga |
| • Alien vegetation widespread |

#### Do we know in what quantities they exist?

| • Sugar industry has figures available |
| • Forestry – PAMSA |
| • Alien vegetation – working for water/wetlands |

#### 3. What are the obstacles to a South African bioplastics industry?

| What is stopping us from already having a local industry? |
| • Market awareness |
| • Lack of legislation and government support |
| • Low oil price |
| • Import costs high – impacts on consumer acceptance of bioplastics at present |
| • Need economy of scale – diverse applications |
| • Trained/skilled staff |
| • Lack of investors/risk averseness |
| • High start-up costs for certain polymers |
| • High feedstock costs |
| • Water availability for crops |

#### 4. Are there gaps in knowledge in moving to this goal immediately?

| Yes |
| What are these gaps? |
| | Knowledge of yields/conversion rates for monomers, e.g. how much sugar needed to make 1t ethylene – leads to appreciation of cost structure |
| | Need map linking feedstocks – intermediates – polymers – consumer products |
Will determine value chains
- Ideal is to develop “flexible” feedstock from which diverse bioplastics can be produced

- Don’t understand interdependencies with other industries

**How do we close these gaps quickly (technology or research needs)?**

- Provide tax relief for retailers using bio-based packaging
- Techno-economic studies to show what size of industry would be viable – develop business cases to get Government support/buy-in
Workshop Group 4

1. Is the concept of establishing a local bioplastics industry (e.g. bio-based plastics manufacturing) feasible for South Africa?
   - Quick answer, yes.
   - Bio-based plastics are currently more expensive, so high end markets will be the first step.
   - Bioplastic is a very small market, but can grow with consumer awareness and retail pressure.

Do local and export markets exist?
No, but the global trend of using more sustainable products and materials will increase the push to use bioplastics e.g. Coca-Cola is the catalyst to introduce bioplastics to the public and retailers.

Do economies make sense?
Depending on the economics of scale
   - Small volume (small/medium companies) will have a high cost implication and it will not make sense.

What are the opportunities?
   - Coca-Cola production
   - Closing the waste stream loop
   - Impact on job creation
   - Biomass feedstocks (non-food)
   - First adopters – automotive and aerospace

2. Are there specific biomass feedstocks and waste streams that are immediately viable?
   - Agri Waste
   - Sugar (Bagasse)
   - Sorgum (Grain)
   - Paper and pulp (40% is usable)
   - Grass (Elephant)
   - Algae
   - Wheat Straw
   - Water Hyasinth
   - Sugar Beet
   - Pineapple waste
   - Cheese whey

Do we know where they are?
   - Sugar – KZN
   - Grain – North-West
   - Pineapple – Eastern Cape, NKZN, Northern Province
   - Sugar Beet – Fish River
   - Elephant Grass – KZN
   - Pulp – Mpumalanga
   - Wheat Straw – Western Cape, Free State
   - Seaweed –
   - Grapes –
   - Barley –
   - Whey Protein –
   - Castor Oil –

Do we know in what quantities they exist?
   - Sugar – 27 Million Metric Tons/year of sugar is produced in SA
   - Grain - ?
   - Pineapple - ?? 80 000 tons
   - Sugar Beet - ??
   - Elephant Grass - ??
   - Pulp - ??
### 3. What are the obstacles to a South African bioplastics industry?

What is stopping us from already having a local industry?

- Economies of scale
- Technology is expensive
- Complicated value chain (material is decentralised)
- The need for regulations (standards)
- Price of the finished product
- Bioplastics are product specific
- Oil prices
- Lack of skills in the upper stream
- High capital cost

### 4. Are there gaps in knowledge in moving to this goal immediately?

Yes!

**What are these gaps?**

- Consumer behaviour uncertain
- Industrial scale production not known
- Knowledge of quality and quantity feedstock
- Not knowing how bioplastics will disrupt products and employment
- Skills development
- Reaction of South African market

**How do we close these gaps quickly (technology or research needs)?**

- Technology testing on small scale
- Specific financial incentives
- Government buy-in
- International collaboration
- Sharing of the existing knowledge

---

- Wheat Straw - ??
- Kelp - ??
- Algae - ??
- Grapes –
- Barley –
- Castor Oil –
- Cheese Whey - Lots
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