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Effective opportunities for Bioeconomy Development in Africa and the Global South

Biorefinery opportunities for Bioeconomy Development in the Global South: Technologies, skills & infrastructure

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Biorefinery Industry Development Facility

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DSTI/CSIR BIOREFINERY INDUSTRY DEVELOPMENT FACILITY

Provide competence to biomass processing Industries and SMMEs in product and process development and scale up, to bridge the gap between R&D and commercial implementation

BACKGROUND

The BIDF was established in 2014 and was officially launched by Minister of Science and Technology in 2018.

One of four industry facing programmes within the CSIR supported by Department of Science, Technology and Innovation (DSTI)

It has the objective of supporting industry through the development of market ready technologies and products.

Recent investment by DSTI has led to the upgrade of the pilot scale infrastructure and equipment to strengthen its industry facing focus and relevance.

The Facility is based in the CSIR Chemicals Cluster within the Biomanufacturing Impact Area.

BIOREFINERY IMPLEMENTATION STRATEGY

The BIDF aims to provide competence to industry in biorefinery product and process development and scale up, to bridge the gap between R&D and commercial implementation.

These established competences continue to provide new opportunities for growth. Previously they were largely public sector funded, but opportunities are now being pursued with private sector and international organisations, while continuing to maintain public sector support.

The focus is the development of processes for the combined bio- and chemical conversion of waste biomass feedstock to generate high-value (platform) chemical products and materials, with the aim of replacing fossil fuels as a feedstock.

Through Industry and SMME engagement we offer:

- **Technology Development:** Demonstration of a pool of emerging, transformative technologies from processing of primarily waste lignocellulosic biomass

- **Technological Advisory:** Analytical support to evaluate new biomass waste development opportunities and to help unblock stalled existing business ventures through technology troubleshooting

Waste Beneficiation Biorefinery Technologies in the Circular Economy – Focus areas

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	Forestry waste - Hardwood and Softwood	Food/agricultural waste	Other Organic waste	Spent Liquor
Waste streams	• Sawdust • Wood chips • Wood shavings • Sludge • Alien invasive plants	• Farmers markets • Hotels • Farms • Hemp	• Corn steep liquor • Chicken feathers • Molasses • Fruit pomace	• Volatile organic compounds • Effluent • Sludge • Lignin • Hemicelluloses
Processing techniques	Rapid Displacement Heating digestion Pyrolysis Chemical and mechanical fractionation Solvent extraction	Biogas production via co-digestion Chemical and mechanical fractionation Solvent extraction	Acid hydrolysis Solvent extraction Fermentation	Chemical and mechanical fractionation Solvent extraction Acid hydrolysis
Products	Composite board, Wood Plastic Composites, Engineered Transparent wood Biochar, Activated Carbon Bio oil, wood vinegar Pellets Cellulose Nano Crystals, Microcrystalline Cellulose	Biogas/ Biodigestate/Community garden Tissue Corrugated board Paper Hemp pulp	Glucose to Single cell protein (SCP) – Fish feed Chicken feathers to keratin Cosmetics Bioplastics Grape Pomace to biostimulants	Speciality chemicals Xylose to Xylitol Lignin as Dust suppressant, Asphalt application

SMME SUPPORT 2018 - 2025

SMME	OBJECTIVE	SMME PROGRESS
eThala (Pty) Ltd	Bioethanol/petrol blending demonstrated at the small scale	Technology demonstrated at TRL 4
Green Corridors (Pty) Ltd	Processing of lignocellulosic biomass. “Green” paving/brick technology demonstrated.	Technology demonstrated at TRL 4
ForestChem (Pty) Ltd	Pine oil extraction from waste sawdust has been demonstrated at small scale.	Technology demonstrated at TRL 4
Corruseal (Pty) Ltd	Enzyme based bonding of paper/packaging. Tested and implemented at commercial scale.	Technology advisory complete
Polyftero(Pty) Ltd	Keratin extraction from waste chicken feathers	Technology demonstrator complete – TRL 6
Ukuqala Okusha (Pty) Ltd	Technology for breeding Black Soldier Flies and fractionation into several products including fertiliser, protein and oil.	Technology advisory complete
Selokong Sa Dimelana (SSD) (Pty) Ltd	Phase 1: Advisory on castor seed oil characterisation and application for bio-derived products	Technology advisory complete
	Phase 2: Valorisation of castor oil seeds for an integrated production of castor oil, and castor oil-based bio-coating	Technology development complete
Oratech (Pty) Ltd	Phase 1: Assessment of biomass for biorefinery opportunities in North-West Province	Technology advisory complete
	Phase 2: Feasibility study on production of biochar from alien trees, timber waste from underground mines, and Acacia tree plantations	Technology advisory complete
	Phase 3: Development of Business Case for setup of a biorefinery pyrolysis plant in Rustenburg	Technology advisory complete
GIA Health Care (Pty) Ltd	Technology to extract Resveratrol from Grape and Apple waste	Technology development complete

SMME SUPPORT 2018 - 2025

SMME	OBJECTIVE	SMME PROGRESS
EcoSavvy (Pty) Ltd	Biodegradation testing on plastic to be used in biodegradable diapers and sanitary pads	Technology advisory complete
National Precious Metals (Pty) Ltd	Beneficiation of used X-ray films - exploring the use in “Green Crete”	Technology advisory complete
Lindon (Pty) Ltd	Evaluation of different drying techniques for the Cannabis sativa L. plant	Technology advisory complete
MSSR (Pty) Ltd	Fermentation of sugar in sugar rich feedstock (Food waste) to produce bioethanol	Technology advisory complete
Vitasoil (Pty) Ltd	Evaluation of Raw Wood Vinegar (RWV) as a Wood Preservative	Technology advisory complete
Quiver Green (Pty) Ltd (Kimberly)	Production of charcoal using Drum Kiln Technology	Technology advisory complete
Ziziba (Pty) Ltd	Development of a production process and product offering for a single cell protein using a glucose rich waste stream	Technology demonstrator complete – TRL 6
TMGG (Pty) Ltd	Lactic acid fermentation using the indigenous microbiota found in the co-digested feedstocks	Technology demonstrator complete – TRL 6
FONG (Pty) Ltd	Food waste to biogas – Biogas digester installation in Eastern Cape	Technology demonstrator complete
Ndoyenk (Pty) Ltd	Food waste to biogas – Biogas digester installation in KZN	Technology demonstrator in-process
Nonyanda (Pty) Ltd	Technology development/prototype/product development for biofuel from biocrude oil	Technology demonstrator in-process
Green Movement (Pty) Ltd	Develop binding agents to improve current product – Woodies (Briquette).	Technology demonstrator in-process
Plastech Industrials (Pty) Ltd	Sawdust/Recycled polypropylene composites for the manufacture of bottle caps/ storage crates	Technology demonstrator in-process
Boom organix (Pty) Ltd	Development of a biogas enrichment technology using biochar as a bio-additive	Technology demonstrator in-process
Green Fibre insulation (Pty) Ltd	Wet process technology for producing cellulose fibre insulating materials for the home	Technology development complete – TRL 6

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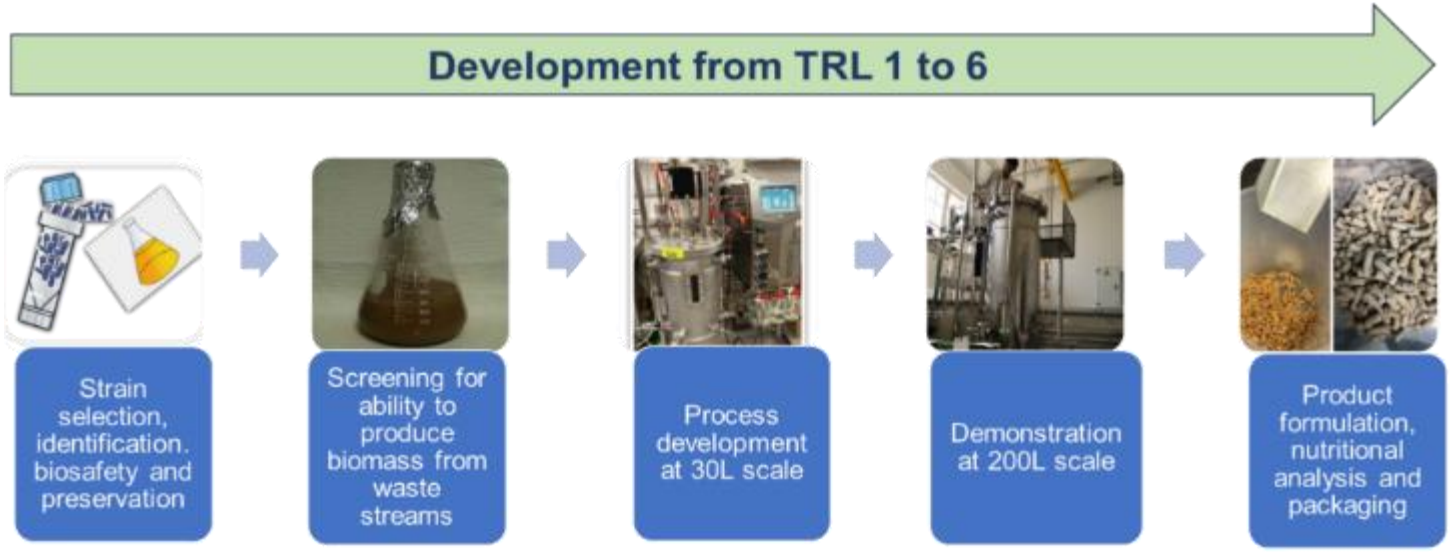
Case studies

Technology commercialisation of biochar

BIDF BIOMASS PROCESSING – BIOCHAR PILOT PLANT

Biochar pilot plant (50kg/hr- feed rate –Yield ca. 25% to 35%).
Biochar can be used as alternative source of fertilizer, replacing chemical-based fertilizers
Carbon black
Biochar

PRODUCTION OF SINGLE-CELL PROTEIN USING ORGANIC WASTE STREAMS



- CSIR is preparing to enter into a manufacturing contract with SMME to produce approximately 10,000 tons of SCP per annum.

- The SCP produced at the CSIR will be sold via the SMME to its industrial partner in Egypt, to generate revenue whilst establishing its facility in Dube Trade port.

- The fish trials involving the SCP-rich fishmeal will be conducted SMME partner, in Egypt.

- SMME is also exploring other business avenues within its portfolio, such as incorporating probiotics, discussions are underway with CSIR.

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BIDF Infrastructure

RAPID DISPLACEMENT HEATER (BIOMASS FRACTIONATION)

RDH digester pilot plant (30 litres). RDH digester's system is a proven technology and is scalable. Application in fractionation of woodchips (Biomass) into cellulose, hemicellulose and lignin - to be accomplished in a single stage process.

Rapid Displacement Heater (Biomass Fractionation) In operation

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PARR DIGESTER (SAWDUST FRACTIONATION)

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Challenges and opportunities

Challenges

- Infrastructure availability for SMMEs to commercialise technologies
- Access to funding by SMMEs to set up commercial manufacture plants
- Competition with fossil-fuel based technologies on price
- Industry focus to adoption of waste biomass beneficiation technologies

Opportunities

- Development of scalable biorefinery technologies that can be implemented in different settings and scales allowing for high-added value and safe products, efficient use of resources, sustainable and competitive industries.
- Biomanufacturing facilities available at the CSIR to enable contract manufacturing whilst SMME sets up commercial manufacture plant
- A strong need for open methods of communicating what is working and what has been done. Sharing of experiences and lessons learned.
- Strengthened Impact through enhanced internationally collaborations. Focus on indigenous communities and youth.
- Encouraging better use of bioresources. Making more from less.
- Building business cases for empowering communities while contextualising processes of getting high value products. The need to derisking funding for early-stage research.
- Encouraging knowledge sharing, promoting partnerships between different key stakeholders and changing mindset to embrace sustainability

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Thank you