

A photograph of a laboratory incubator filled with numerous petri dishes. The dishes are arranged on metal wire shelves and contain various colored agar cultures, including yellow, orange, and red. Some dishes have small white labels. The lighting is bright, highlighting the textures of the agar and the metallic surfaces of the incubator.

Industrial enzymes for application in industry, environment, and agriculture in eastern Africa

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Background

As the African continent embraces industrialization as the driver for economic growth, governments are acutely aware that this has to be done in an environmentally sustainable way. Lessons from other parts of the world have shown that industrialization could also lead to massive environmental degradation if not well managed. Recent developments in industrial biotechnology offer an attractive mechanism for mitigating environmental degradation associated with industrial activities.

The East African region is endowed with several unique and extreme habitats all harboring a rich microbial diversity. Most industrial enzymes currently in use are obtained from microorganisms. Already some enzymes with attractive potential for industrial application have been discovered in the region. Despite its huge potential for biotechnology innovation, to date, the region is not exploiting this microbial resource. To use this resource for the benefit of the region, it is important that enzyme producing companies emerge in the region and compete in the global industrial enzyme market.

In the Eastern Africa region, the leather tanning industry is one of the fastest growing manufacturing sectors. Governments in the region have already recognized this potential and are encouraging investors to set up processing industries whilst discouraging export of raw and semi-processed animal skin/hide. Ethiopia has a vibrant leather tanning industry while in Kenya the government initiated an



expansion plan to build six more tanneries to boost its leather export capacity in 2012. The conversion of raw hides and skin into leather products is a multi-step process involving the use of different chemicals like chromium as processing aids. Microbial enzymes are also an option in this process. Internationally there is growing interest to develop and optimize the use of enzymes as processing aids to fully replace chemicals in all the tanning processes. This however is not the case in eastern Africa due to lack of technical know-how and cost issues.

To demonstrate the potential usefulness of the regions microbial genetic resource as a source of valuable enzymes, a research consortium

was formed to identify and produce enzymes from local microbial resources and test their applicability in the leather tanning industry in the region for ultimate scaling up and commercialization.

The Project Goal

The objective of this project is to test the application of microbial enzymes in the different stages of leather tanning under actual industrial conditions in the region.

The project will be conducted in two stages:

- 1 **Stage 1** will involve a proof of concept step to isolate and produce enzymes from microbial strains available in the region using solid state and submerged fermentation processes at a small scale and demonstrate their efficacy and application on leather processing at the Ethiopian leather Development Institute.
- 2 **Stage 2** pilot demonstrations of the enzymes produced in stage 1 in collaboration with private sector partners in the region under actual leather tanning industrial conditions.

The Innovation

Microbial enzymes suitable for leather processing will be produced, formulated and stabilized in a form suitable for industrial application.

Milestones achieved and expected outputs

- A total of twenty-two enzyme producing microbial strains have been identified and enzymes extracted.
- Formulation for the stabilization of



the enzymes during storage has been developed.

- Preliminary testing at lab-scale on the applicability of the enzymes during bating, soaking and dehairing stages has been conducted. Validation is on-going.

Future prospects

- Scaling up of the innovation is to be guided by a full idea feasibility and techno-economic analysis to evaluate the cost-benefit analysis of the innovation versus alternative chemicals and/or imported microbial enzymes to determine the business case potential of the enzymes.
- Clear IP implications of the innovation in order to develop action plan for commercialization with focus on IP regulation, investment requirements, and team for implementation.



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