

ECOWAS REGIONAL BIOENERGY FORUM

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Pyrolysis and Biochar for Soil Enrichment

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Research areas - 2nd Generation Biofuels

Paradigm shift in conception of waste as a resource

- **Faecal Sludge-Fed Biodiesel Plants:
The Next-Generation Urban Sanitation Facility funded by Bill and Melinda Gates**
- **Biofuel production from lignocellulosic materials – 2GBIONRG – funded by DANIDA**
- **FaME (Faecal Management Enterprises): Providing sanitation solutions through value chain management of faecal sludge led by SANDEC and funded by the EU**
- **Diesel fuel production via the catalytic depolymerization - Transformation of waste material in Diesel, water and fertilizer in collaboration with Dr. C. Koch of ALPHAKAT GmbH, Germany**
- **Conversion of agricultural wastes into Biodegradable Plastics - Africa2Green**
- **Conversion of agricultural residues into biochar and other products**

Trends

- Slashing and burning of agricultural and agro-forest residues as wastes
- Export of agricultural residues on grounds of non-availability of appropriate technology
- Non recognition of the immense role of biochar in the fertilizer mix –
- **Need for incorporation in national policies**

Biochar

- ❖ **Biochar is a fine-grained porous carbonaceous solid, high in organic carbon and largely resistant to decomposition. It is characteristically comparable to charcoal produced from agricultural residues**
- ❖ **produced by heating biomass materials in the absence (or under reduction) of air**
- ❖ **has physiochemical properties suitable for the safe and long-term storage of carbon in the environment and, potentially, soil improvement. (Lehmann *et al* 2009)**

Significance of Biochar

Any bioenergy production leads to removal of biomass or carbon from the land. Resultant effect of soil degradation with negative effects on soil productivity, habitats and off-site pollution.

Biochar addresses the dilemma, as about half of the original carbon can be returned to the soil.

Biochar systems can reverse soil degradation and create sustainable food and fuel production in areas with severely depleted soils, scarce organic resources and inadequate water and chemical fertilizer supplies.

Feed stocks for biochar production

- Feed stocks for biochar production in the form of waste biomass products are readily available



Sawdust from existing timber industry

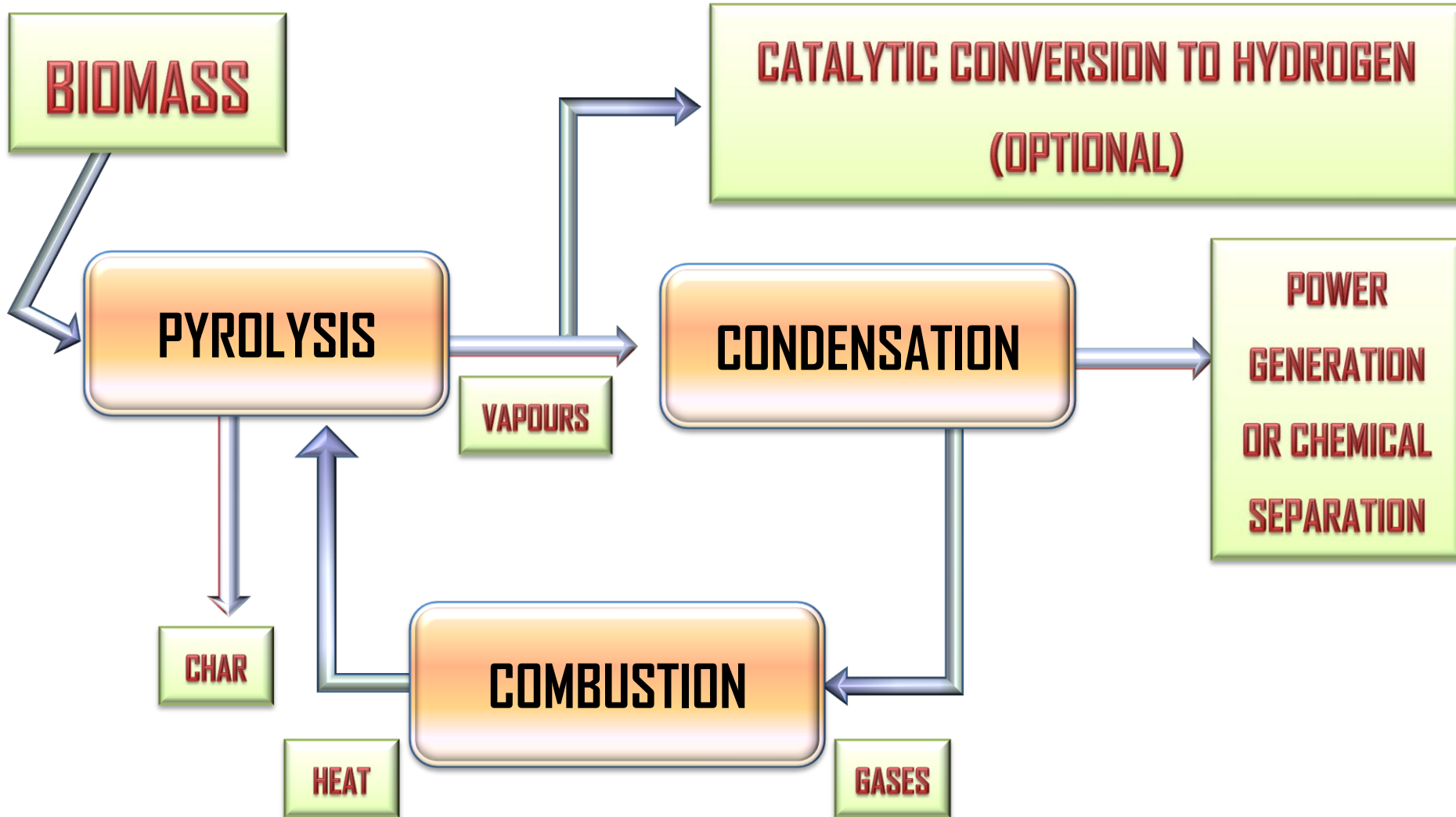


Maize stover

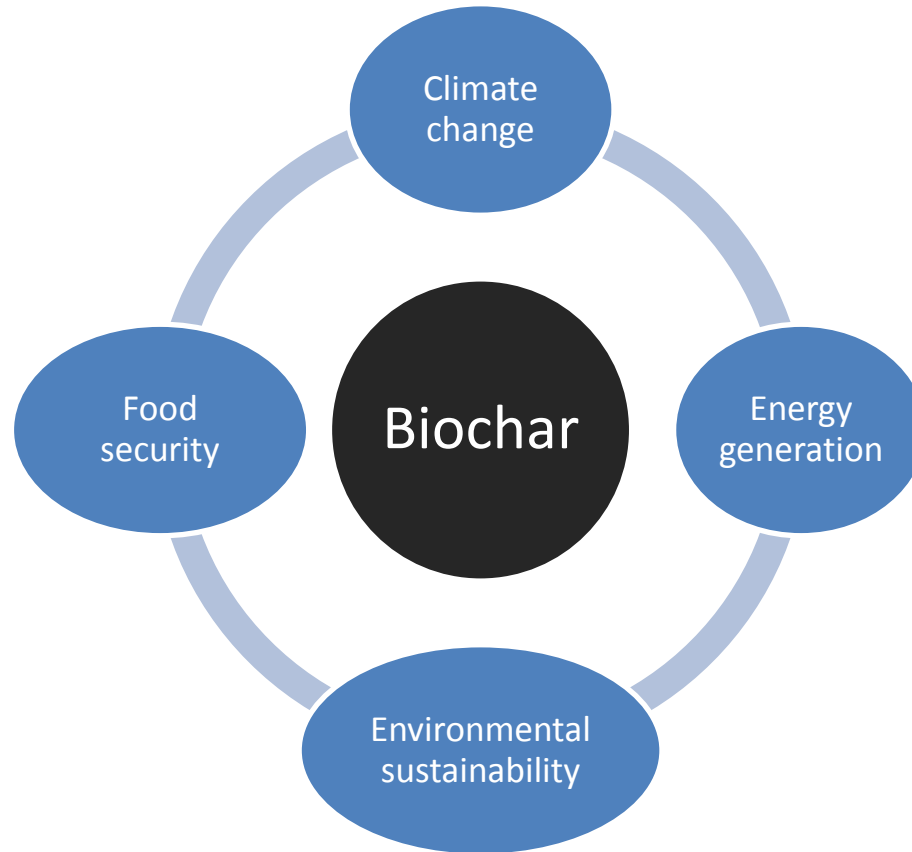
INTRODUCTION

- **Pyrolysis is the thermal degradation of biomass under the absence of oxygen.**
- **Pyrolysis results in three products: biochar, non-condensable gases and condensate (tars and water).**
- **The proportion of each is a strong function of the feedstock and the operating conditions of the pyrolyser.**

FLOWCHART OF PYROLYSIS



The centrality of biochar to global issues



Drying of biomass (saw dust)



Heating of reactor



Temperature reading during heating



Weighing of biomass before feeding



REACTOR OPERATIONS



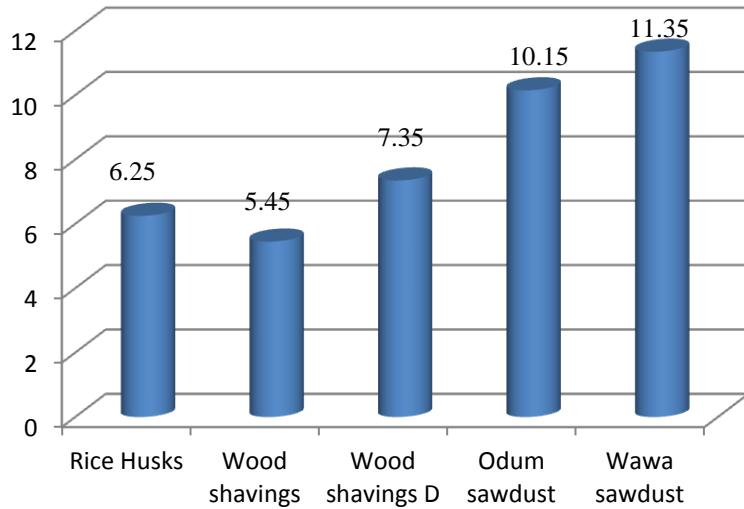
Old Reactor



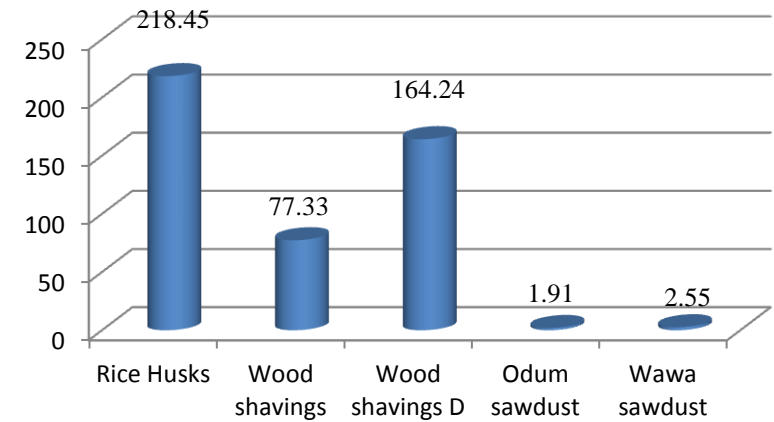
New Reactor

RESULTS

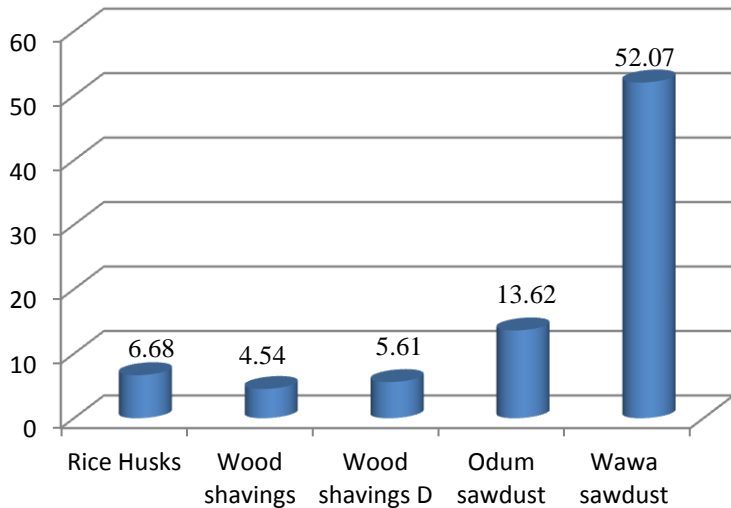
pH of some Biochar samples



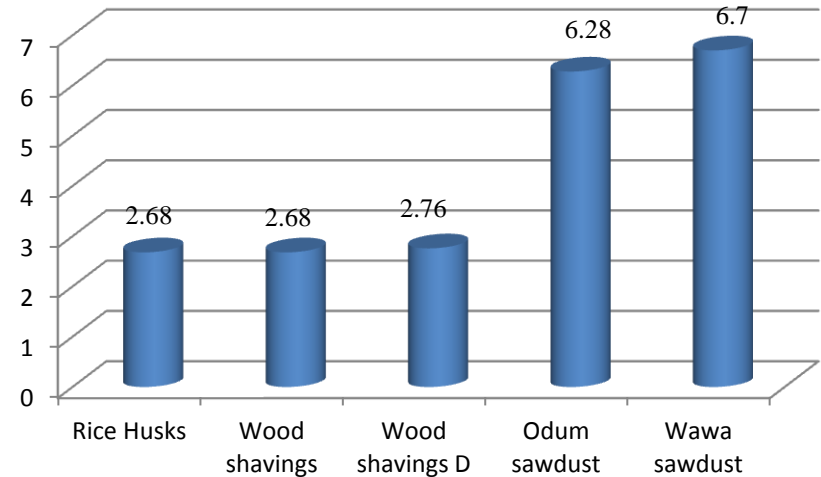
Amount of P (g) in some Biochar samples



Amount of Mg (g) in some Biochar samples

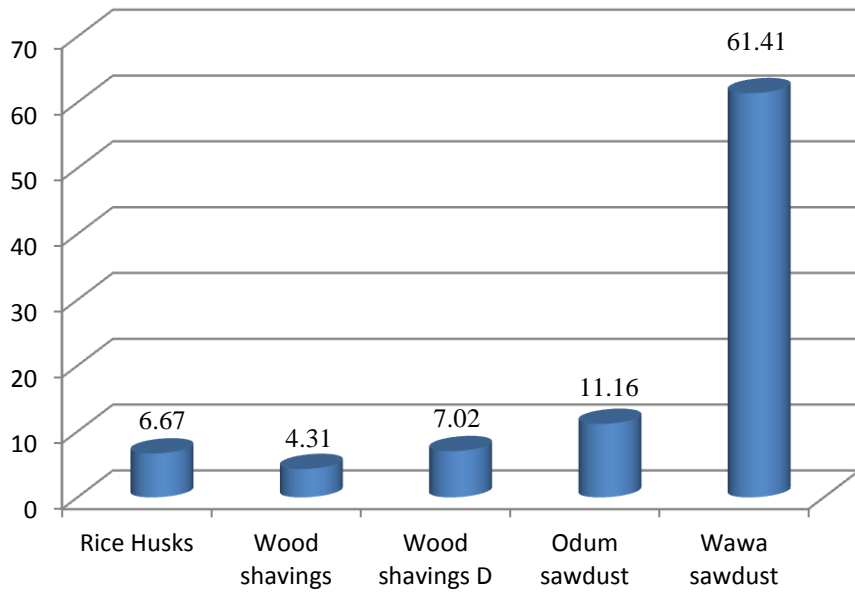


Amount of Na (g) in some Biochar samples

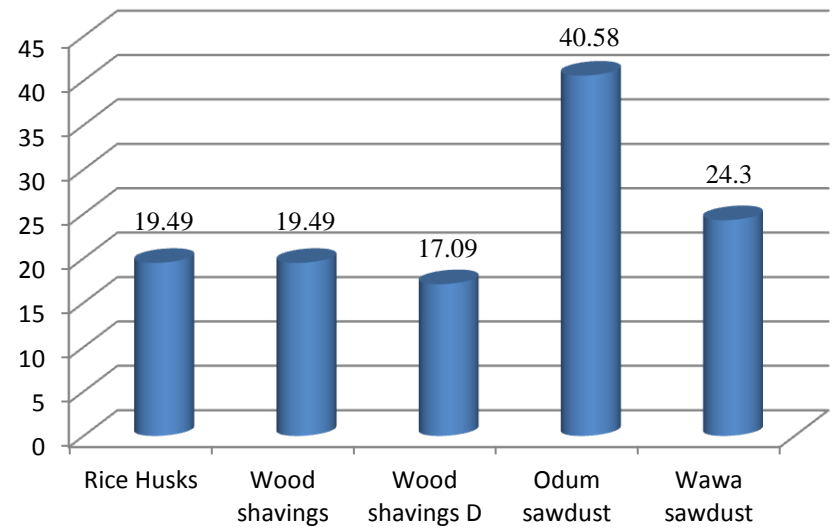


RESULTS

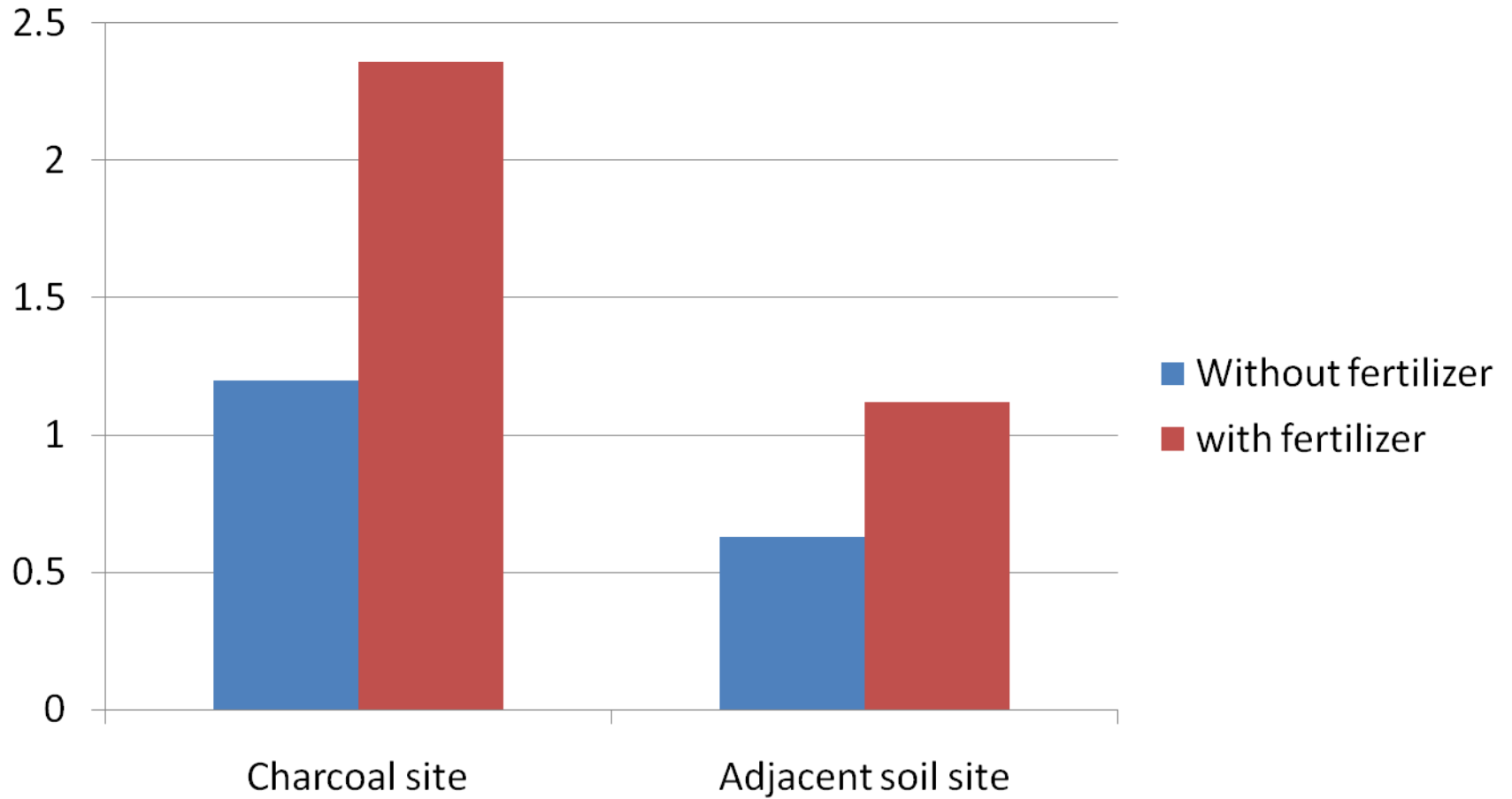
Amount of K (g) in some Biochar samples



Amount of Ca (g) in some Biochar samples



Effect of crop yields



Source: Oguntunde et al, 2004 (Ejura, Ghana)

Production of Biochar in Ghana

A contract has been awarded through competitive bidding by CSIR for installation of 10 biochar reactors in Ghana (one in each region, ideal for communal settings)

Development of clean burning cookstoves for household energy and biochar production by the Chemical Engineering Department, KNUST (ideal for smallholder rural settings)
This provides multipurpose use of the cookstoves both for cooking as well for biochar production.

Techno-economical Barriers

(i.e. SSCF, Syngas clean-up)

Impact of research on

Use of available
processing facilities

Feedstock variability

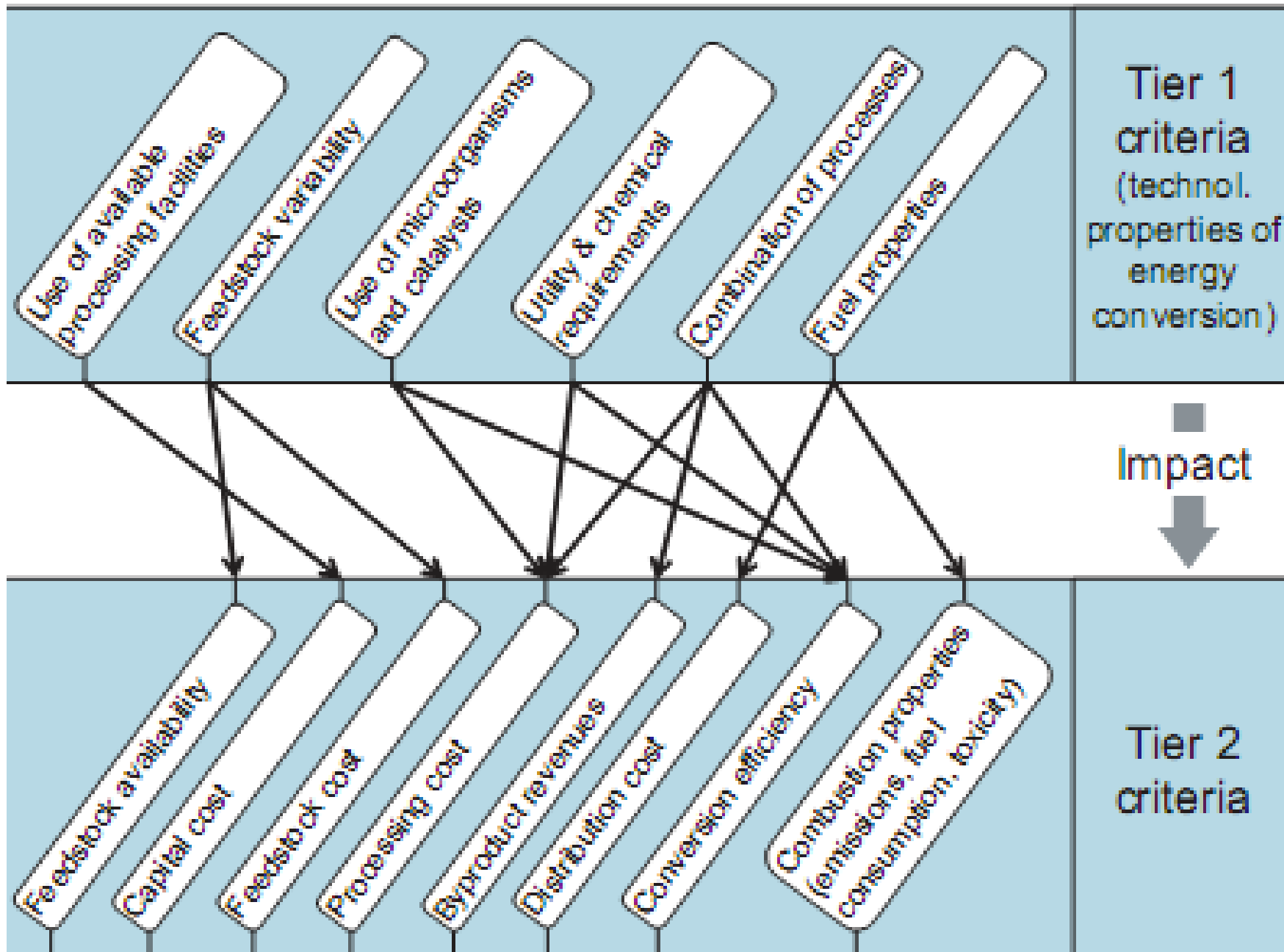
Use of microorganisms
and catalysts

Utility & chemical
requirements

Combination of processes

Fuel properties

Tier 1
criteria
(technol.
properties of
energy
conversion)



Future Prospects

- **Every country world wide has a large amount of low quality, low value, humid (~50% water content) agro-forestry residues; most of that do not find a practical economic utilisation and a market.**
- **This project is being further developed connecting different commercial technologies, allows to produce biochar, activated carbon and syn-gas or hydrogen at very attractive prices**

Thank you very much for your attention!

