



## Green Charcoal

### To protect forests, climate and people in Africa

#### Green charcoal, an ecological fuel

In Africa, 70% of the primary energy used comes from wood. This figure, which hides strong disparities between countries, can be explained in particular by **the use of wood as a domestic fuel**. However, the use of wood is a **major cause of deforestation**, which accentuates drought, desertification and climate change.

In urban areas, wood is mainly used in the form of charcoal: according to the FAO, Africans burn more than 35 million tonnes of it each year. This represents a turnover of US\$15 billion, employing more than 7 million people in the sub-Saharan zone. With strong population growth and urbanisation on the continent, **demand for charcoal will only increase**, exacerbating tensions on the forest stock.

To address this issue, **we can produce charcoal without wood, using plant waste as raw material**, and in particular agricultural waste. The resulting product, called **green charcoal**, is comparable to traditional charcoal, but does not contribute to deforestation. Its industrial production (as opposed to the artisanal production of the majority of charcoal in Africa) ensures better carbonisation, and therefore a **higher calorific value**.



*Green charcoal briquettes*

#### The Altran Foundation awarded our manufacturing process

Pro-Natura International developed the **CarboChar technology**, which was awarded the 1<sup>st</sup> prize for technological innovation from Altran Foundation. This continuous pyrolysis machine turns unused agricultural residues into green charcoal. All wood waste, including sawdust, can also be charred, with a yield approximately 3 times higher than conventional charring processes.



*CarboChar-1 is the most compact model. It can produce up to 1 tonne of green charcoal per day. The larger model, CarboChar-3, can produce up to 5 tonnes per day.*

After carbonisation, the biomass comes out in the form of a black powder, which is then compacted as briquettes. This process requires mixing the green charcoal powder with a binder (starch, gum arabic, molasses or clay). The wet briquettes then pass through a dryer to remove water.

**The carbonisation yield is between 35 and 45%** depending on the biomass used, which is a much higher rate than artisanal production (around 10%).

## A powerful tool to fight global warming

The production of green coal using the CarboChar technology allows for a **significant reduction in greenhouse gases emissions**:

- Avoided deforestation by reducing the use of charcoal
- Avoided CH<sub>4</sub> emissions created by traditional charcoal production
- Reduction of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from the combustion and degradation of agricultural residues (a common farming practice to get rid of excess biomass).

As a result, producing **1 tonne of green charcoal avoids the emission of 4 tonnes of CO<sub>2</sub> equivalent** (average figure calculated using the UNFCCC AMS-III.BG methodology). Green charcoal thus **contributes to mitigate climate change**.

## A way to improve the living conditions of the people

Green charcoal **also has social benefits**, particularly with regard to its cost and its health benefits:

- The industrial efficiency of its production, combined with the very low cost of raw material (unused agricultural waste), **makes green charcoal relatively inexpensive to produce**. It can therefore be sold at an **affordable price**. **On the other hand, the cost of traditional charcoal continues rise** due to wood scarcity, thus placing a significant burden on household budgets.
- The very good carbonisation of agricultural waste with CarboChar allows green charcoal to **significantly reduce the emission of toxic fumes**. This is a major benefit compared with traditional charcoal, whose artisanal production leads to incomplete combustion and the release of fumes harmful to the eyes and lungs. In sub-Saharan Africa alone, the WHO estimates that these toxic fumes are responsible for nearly 600,000 premature deaths.

## Fighting deforestation by combining green charcoal and biochar

If green charcoal is not compacted into briquettes, it can be mixed with the soil as is (in powder form); we thus obtain a new product – biochar. **Biochar is a soil amendment which, in combination with organic fertilisers, acts as a catalyst for soil metabolism.** Our experience in different climates has shown that introducing 10 tonnes of biochar per hectare can **increase crop productivity by 50 to 200%**. A single application creates and maintains fertility for a very long time (over 100 years). It is also a way to sustainably sequester carbon in the soil, recommended since 2018 by the IPCC to fight climate change on a large scale.

Pro-Natura International advocates for a **coordinated use of green charcoal and biochar in Africa** in order to best protect forests and biodiversity. This is because **green charcoal prevents deforestation while biochar accelerates reforestation** thanks to the faster growth of planted trees. The main meta-analysis on biochar applied to trees (Thomas and Gale, 2015) shows a **41% increase in tree biomass** on a variety of temperate and tropical trees; much greater effects are observed on tropical trees alone, where the increase can reach 300%. Biochar is indeed relatively more effective on poor soils, as found in Africa.



In Belize, biochar-treated cacao tree on the left has started producing pods significantly earlier than the non-biochar treated tree on the right – both are three years old

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