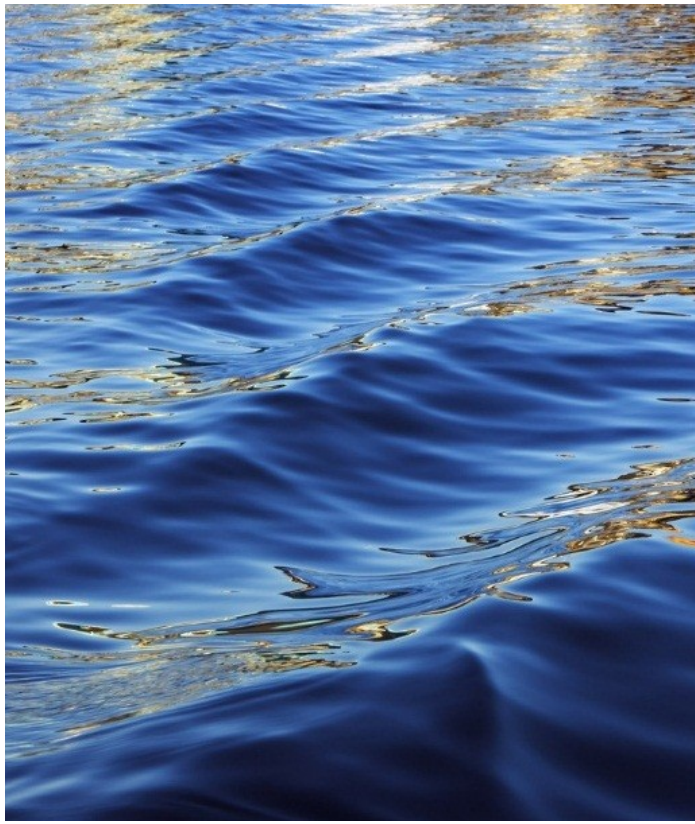
BIONIK SACHSEN
MAKE THE WORLD CLEANER

GREEN WASTE TO ENERGY SOLUTIONS

BIOCHAR

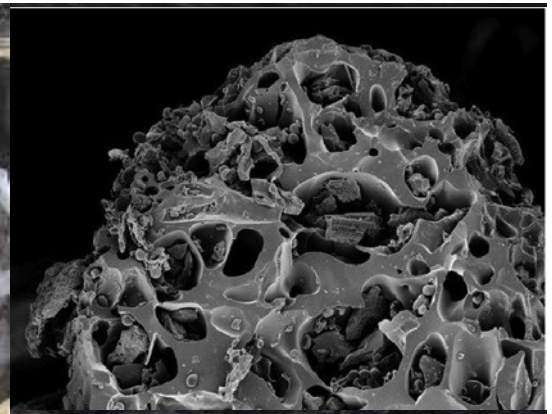
UNIQUE FERTILIZER AND RENEWABLE ENERGY RESOURCE



Biochar - definition and properties

- Biochar is a biomass that is thermally converted in the absence of oxygen, i.e., it is torrefied without burning, with the release of combustible gases (hydrogen, CO).
- Heat turns plant carbon (found in cellulose and lignin) into condensed aromatic carbon rings that are very stable
- A biochar obtained from different types of raw materials at different temperatures can have very different physical and chemical properties.

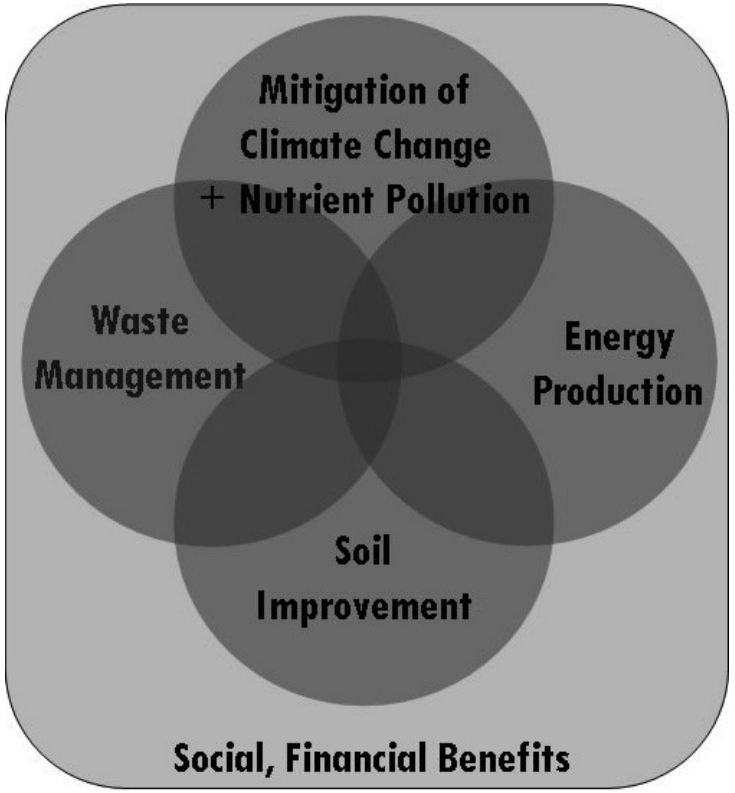
Biochar is a torrefied biomass that can be added to the soilиочар



Biochar: A solid material obtained from thermochemical conversion of biomass in an oxygen-limited environment. (IBI, 2012)

Benefits - Economic and Social

- Soil improvement
- Prevention of climate change and pollution
- Waste management
- Power supply
- Development of bio-charms markets



Soil improvement biochar

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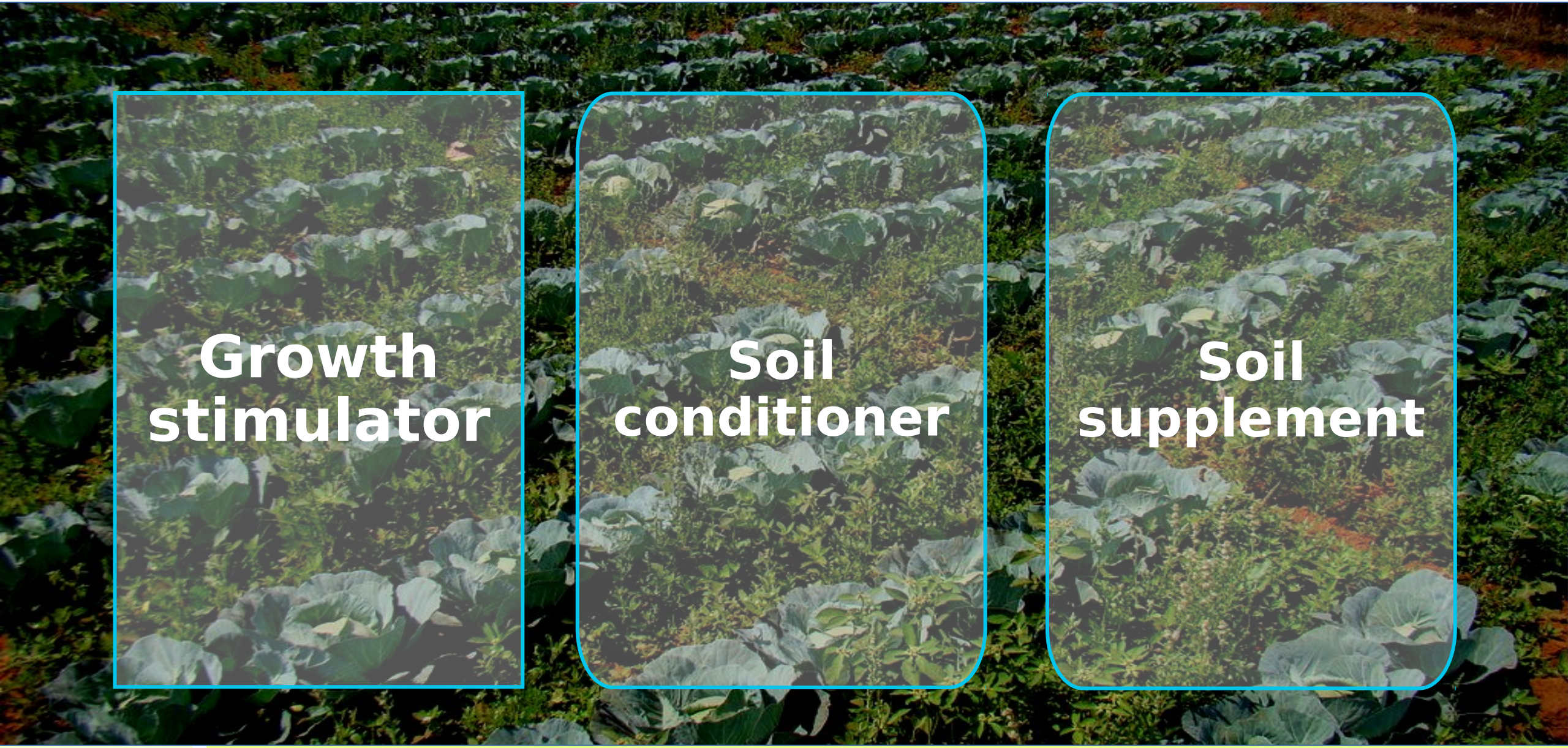

Soil biochar benefits

- provides constant heating of the soil, therefore, accelerates the growth and development of plants;
- removes agricultural chemical residues from the soil (herbicides, pesticides, other chemicals);
- supports the functioning of soil microorganisms (bacteria, fungi, algae and protozoa), which increase soil productivity;
- increases soil porosity and provides air circulation and oxygen access to plant roots;
- improve the content of badlands (alumina, sandy soils);
- neutralizes soils with high acidity;
- protects the soil from certain types of parasites (nematodes, wireworms);
- prevents root rot in the soil;
- accumulates and supports the need for nutrients and microelements in the soil, eliminates the problem of leaching of nutrients.

Terra Preta – artificial soils in the Amazon

Soil without bio-enchantment

Soil with bio-enchantment

Recovery of mine dumps in the USA

Hope Mine near Aspen, Colorado USA

100-year-old dumps contaminated with heavy metals, one year after the biochar is introduced into the soil

The overall effect of biochar on the soil

Factor	Impact	Source
Cation exchange capacity	50% increase	(Glaser et al., 2002)
Fertilizer use efficiency	10-30 % increase	(Gaunt and Cowie, 2009)
Liming agent	1 point pH increase	(Lehman and Rondon, 2006)
Soil moisture retention	Up to 18 % increase	(Tryon, 1948)
Crop productivity	20-120% increase	(Lehman and Rondon, 2006)
Methane emission	100% decrease	(Rondon et al, 2005)
Nitrous oxide emissions	50 % decrease	(Yanai et al., 2007)
Bulk density	Soil dependent	(Laird, 2008)
Mycorrhizal fungi	40 % increase	(Warnock et al., 2007)
Biological nitrogen fixation	50-72% increase	(Lehman and Rondon, 2006)

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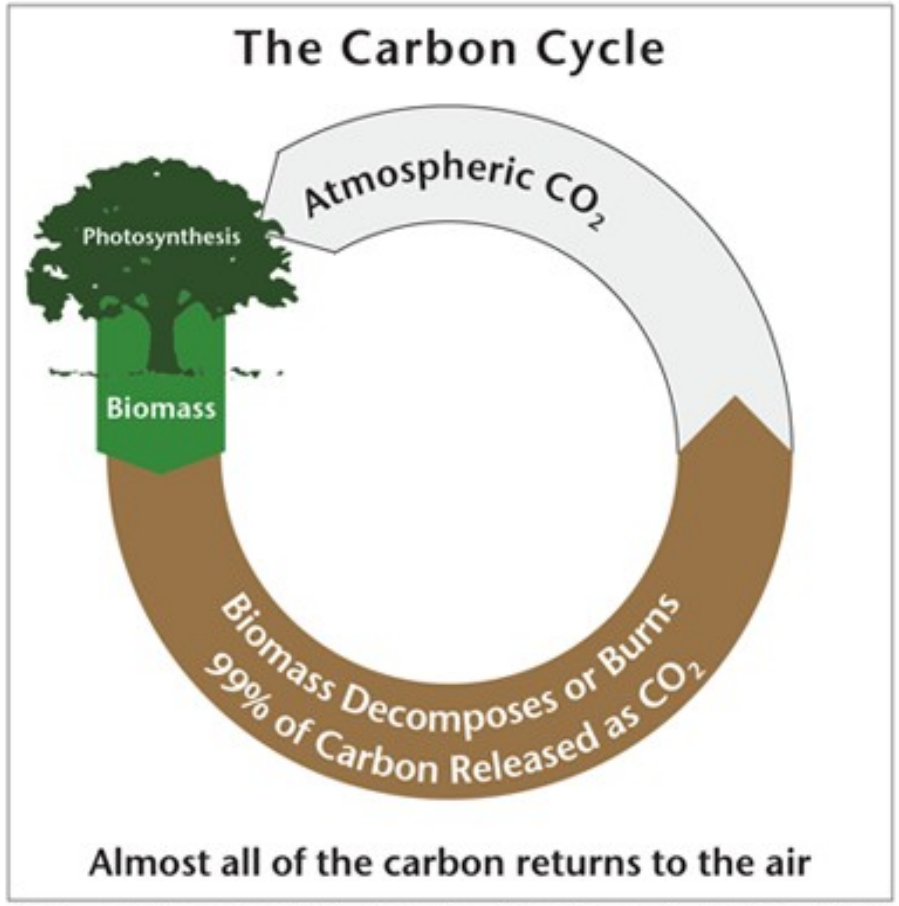
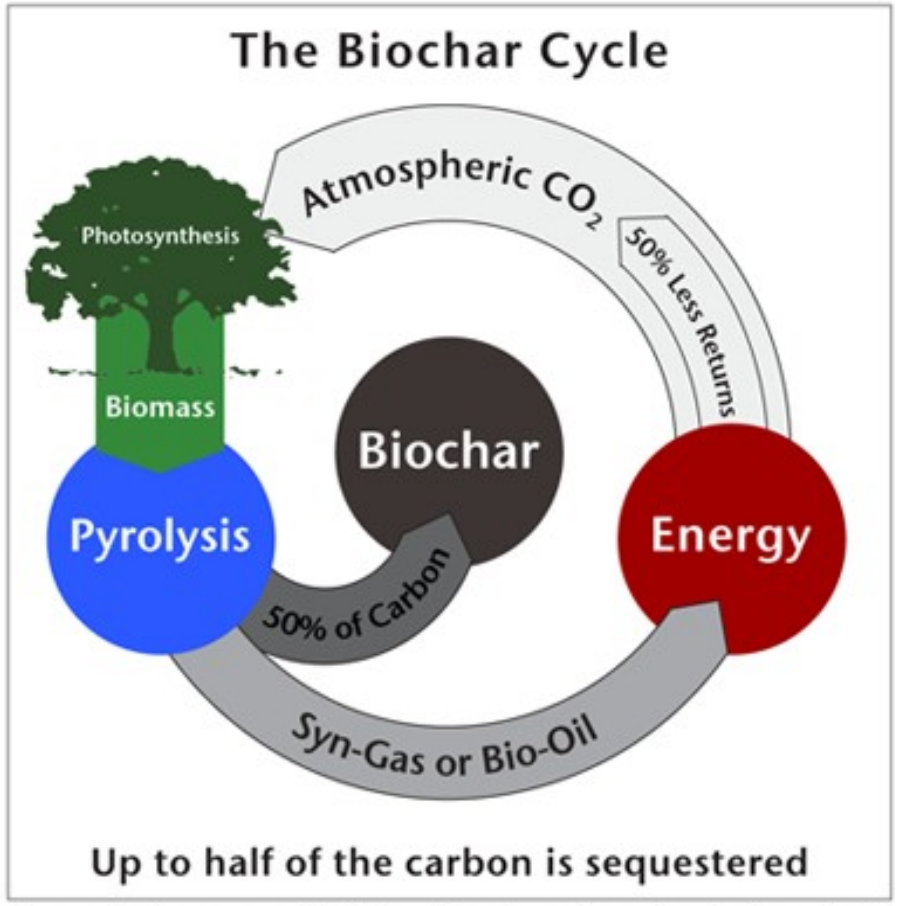
Carbon cycle and biochar



Green plants remove CO_2 from the atmophere via photosynthesis and convert it into biomass. Virtually all of that carbon is returned to the atmosphere when plants die and decay, or immediately if the biomass is burned as a renewable substitute for fossil fuels.



Green plants remove CO_2 from the atmophere via photosynthesis and convert it into biomass. Up to half of that carbon is removed and sequestered as biochar, while the other half is converted to renewable energy co-products before being returned to the atmosphere.

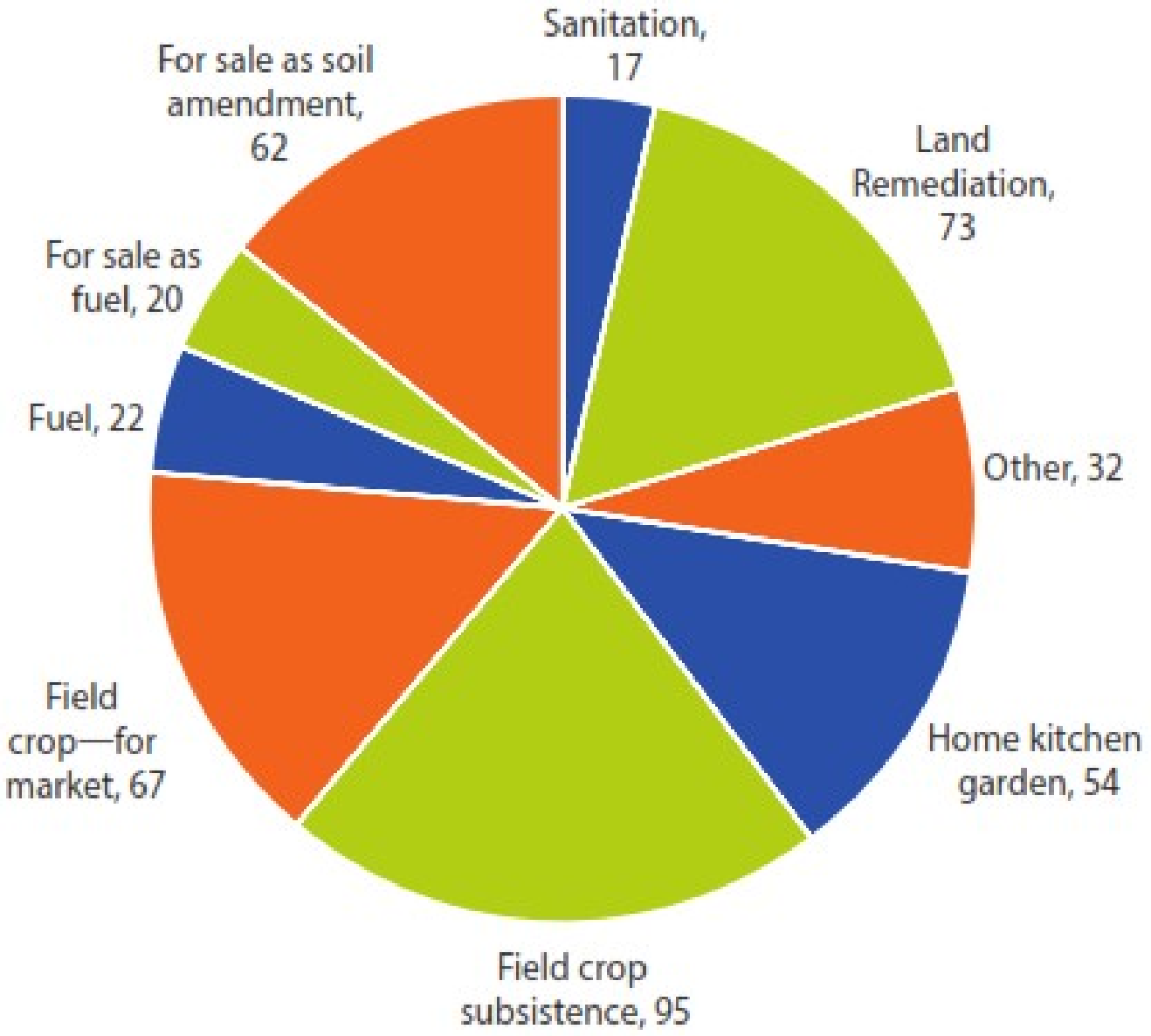
Biochar is a valuable resource for industry

- for the production of bio-coal - a transportable product with high specific energy and the same calorific value as that of coal for small and medium-sized power plants and for personal use for stoves
- for wastewater treatment
- for the production of plastic and plastic dyes
- as a suitable filler for rubber products

CONTENT OF SUBSTANCES IN BIOCHAR (on the dry residue)

Substance	Percent
C	86%
H_2	>0,8%
N_2	>1,1%
O_2	>0,7%

The use of biochara



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Waste that can be processed into biochar

- agricultural waste (waste from livestock farms, husks of sunflower grains, husks of rice, husks of coffee beans, coconut shells, crop residues, grain, feed, fruits, straw, shells, husks and grain dust, etc.);
- biodegradable street and garden waste (leaves, flowers, roots, pruning of trees, vineyards and shrubs, pruning from environmental measures, hay, grass);
- wood production waste (bark and wood chips, sawdust, shavings, wood wool, etc.);
- food waste (materials from washing, cleaning, cleaning, centrifuging and separation processes (pulp, cake or squeezing)).

New biochar markets

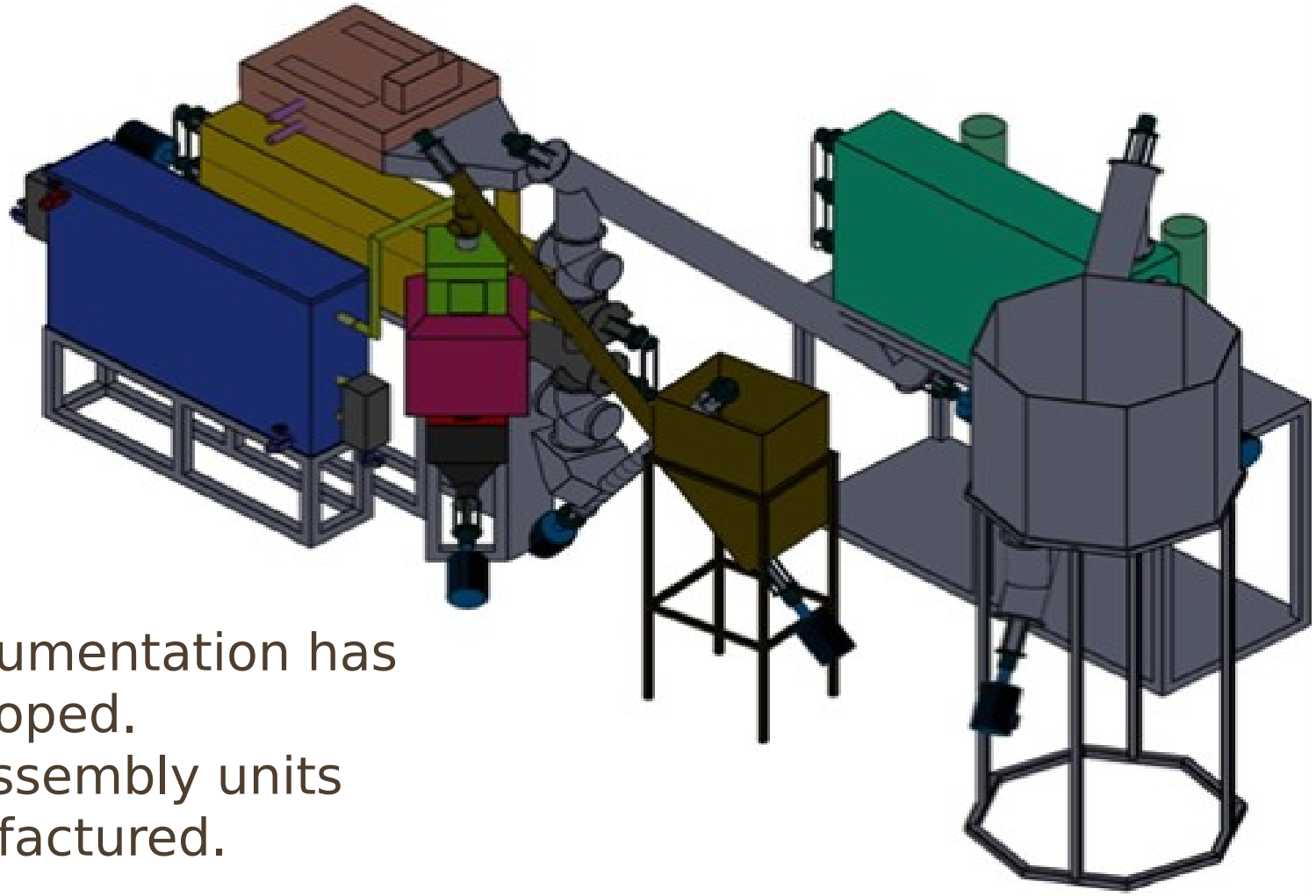
Biochar Production

Technology of continuous low-temperature pyrolysis for converting wet and dry biomass into biochar

The pyrolysis plant works with prepared raw materials (biomass). For plant materials (oilcake, sawdust, wood chips, bark and other plant residues) allowable requirements:

1. maximum permissible humidity - natural wood moisture (up to 60%);
2. maximum allowable particle size of biomass - 30 mm;
3. stones and metal objects larger than 3 mm should not be allowed into pyrolysis plants

Plant for the production of biochar



Design documentation has been developed.
Separate assembly units were manufactured.

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