GRUPO ALIMENTA HAVE A MISSIÓN TO DEVELOP SLOW RELEASE FERTILIZERS FROM PYROLYSIS OFAGRICULTURAL RESIDUES, UTILSATION OF WASTE HEAT AND CO2 TO PRODUCE SPIRULINA

Creating value out of agricultural residues to regenerate soil fertility

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The goal of this project is to contribute to the preservation of the biodiversity that characterizes one of the most privileged places in the world. An important challenge of the 21st century is to maintain sustainable crop yield for an expanding population and reduce greenhouse gas emissions without damaging ecosystems. To acheive this goal we need to build up soil carbon, beneficial micro-organisms and eliminate the loss of macro and micronutrients through the sustainable use of biomass resources. This project is unique as it combines pyrolysis of residues, production of energy with CO2 capture and the production of healthy food (spirulina).

INTEGRATED SYSTEM FOR THE PRODUCTION OF ALGAE:

Figure 1. Peru is listed among the group of the 17 megadiverse countries of the world

Figure 02. Spirulina pond (left) and the CO2 injection system (right).

Two companies have combined resources to develop both an algae technology, pyrolysis technology and a slow release fertilizer. The original design of the pyrolyser was developed by Professor Stephen Joseph and is based on Open Source Technology originally developed in collaboration with Johannes Lehmann' group at Cornell University. The detailed design of this 100kg/hr (dry feed in) design was undertaken by Russell Burnett of BES Ltd in Australia and Stephen Joseph. Modifications to the design and detailed design of the heat exchanger was carried out by Peruvian engineers (Samuel Encarnación and Yngrid Espinoza).

The system has 4 components:

1. Pyrolyser that can use a range of residues that are available throughout Peru
2. A heat exchanger that produces hot air for drying the algae and cools the flue gas that is used to grow the algae
3. Algae ponds
4. Algae drier

The pyrolysis of the biomass is carried out at a temperature of between 400-500^{o}C. The pyrolysis gases are burnt to produce a flue gas consisting mainly of CO2, O2 and N of approximately 800^{o}C. This gas passes through the heat exchanger and then is cleaned and injected into the algae pond. The hot air that is produced in the heat exchanger is used to dry the algae from 90% to 10%. The algae are used for feeding children who may be malnourished or as a feed for animals. The biochar can be used to help extract the algae and can also be added into animal feed of mixed with other nutrients to make a slow release fertilizer.

Figure 03. Dryer for spirulina (left) and spirulina as a supplement for animal feed (right).

SLOW RELEASE FERTILIZERS:

We are working to develop six types of slow release organic and inorganic fertilizers. The biochar is the matrix and other minerals, organic matter such as manure and/or chemicals such as urea, di-ammonium phosphate and KCl with be blended and reacted with their matrix. These products are being developed to regenerate 250,000.00 hectares (10% of the agricultural land) of degraded land. Our goal is not only to restore degraded land but to provide incentives for reforestation in these areas.

Figure 04. Biochar from native bamboo (left) and continuous pyrolyzer (right).

The first trials will take place on the Peruvian coast and central amazon in coffee, cocoa, citrus, grape, potatoes growing areas. Trials will be carried out in collaboration with different national universities, government and non government institutions and farmers that want to promote sustainable development.

Figure 05. Integrated system from a pyrolyser of continuous production of fertilizers and spirulina. In the image the following phases are described (A) Biomass crusher, (B) entry of organic waste, (C) chimney for the conduction of gases, (D) exchanger for the recycling of heat for the drying of the microalgae and (E) use of CO2 for the production of spirulina. Photo: Yngrid Espinoza.