

From Waste to Value

Achieving usable biochar from gasification processes

By Jeff Snyder

Josh Frey is a chicken hatchling farmer in West Virginia and a proponent of poultry litter gasification. He takes very young chicks and raises them to a certain size for market. In order to do this, he has to maintain a steady temperature of 90°F. And with raising up to 800,000 chickens a year, he has had a propane bill of \$30,000 per year.

As he was investigating cheaper and more efficient ways to provide heat, he decided on gasification because he could use the chicken litter as feedstock. He has been using gasification since 2008, and he has found a market that will purchase the biochar that comes from his process. When gasification is used to convert biomass materials (wood trimmings, discarded tires, sewer sludge, etc.) into a power source, biochar is made as a byproduct of the thermochemical process.

Frey, who prefers to call his biochar “poultry carbon,” said the product has nutrient trading value. He said the product is a “clean carbon,” and it does not contain metals.

He can generate as much as 9,000 lb of poultry carbon per day when running at full capacity. Frey can sell his biochar for \$1 per pound. The company that purchases his poultry carbon is using it to create an organic blend soil amendment product.

The Intersection of Gasification & Biochar

Although gasification is widely used in Europe, it is just now growing in popularity in the U.S. As it becomes more popular, so do the issues associated with it—both positive and negative.

Gasification reduces a carbon footprint and provides for new sources of power generation. Still, in today’s efficient gasification systems, for every 100 lb of biomass, 5 lb of biochar are left behind. This product is no longer a waste product, however, as it has been proven to have positive properties in it. It does have some BTU value in it, but in exploring the challenge of what to do with the biochar, constituents are finding that it can be a new revenue stream as well.

Evidence of biochar’s use in agriculture has been linked to Amazon tribes several centuries ago. It can be produced from various sources including wood and switchgrass. Johannes Lehmann, a soil scientist at Cornell University, said only recently have scientists fully appreciated its impact on the environment. It is the high level of carbon found in biochar that helps it amend soil. Lehmann said that this in turn will help grow healthier crops, which, through photosynthesis, takes more carbon dioxide out of the atmosphere.

Lehmann said that what has become clear is that the environmental benefits can only be achieved in systems where organic waste management, the production of biofuels and the agronomic use of the biochar product are considered simultaneously. Biochar systems are likely

to be successful in places where soils would benefit from biochar additions to improve water and nutrient retention, organic wastes are easily accessible (and not diverted to other forms of waste utilization), and economic conditions are favorable.

He also cautioned that biochar should not be a one-size-fits-all soil amendment. Soil type, climate and social setting should be considered to develop a tailor-made biochar system for each individual application.

Hopes for Filtration

“Where markets will merge one day is where a manufacturing company uses a gasification plant to produce power and takes it a step further with the reclamation of the biochar,” said Harvey Abouelata, president of Aries Energy. He said Aries is

Biochar reclamation has proven beneficial.



testing the quality and possibilities of gasification biochar being used for a distilling process. "It's not ready now, but it's certainly in the chemistry. We will get there," he added.

Abouelata gave an example of a company that generates a woody waste stream, needs power, and also creates a liquid waste stream as part of its process. Gasification can take care of the biomass waste and generate power. Abouelata's testing includes the same company using the biochar as a type of charcoal filtration system, with heat from the gasification plant to clean up the liquid waste before it is released back into the water purification process. In essence, this company is eliminating solid waste streams from the landfill and ensuring that liquid waste is cleaned up before discharge.

After this type of process, the biochar may still have some intrinsic values. More testing needs to be done, but it is hoped that the processed biochar could be used by the cement industry and never reach any landfill.

A New Study Via Synthetic Biology

Rice University scientists have used synthetic biology to study biochar. Specifically, the Rice researchers are learning how, as a soil amendment, biochar can interrupt chemical signals that some microbes use to communicate. In the soil, biochar has been known to bolster both the water- and nutrient-holding properties of soil. The Rice study cites that in recent years, biochar owes its growth in popularity due to its ability to reduce greenhouse gases by storing carbon in the soil.

Rice cited the study as the first to examine how biochar

affects chemical signals routinely used by soil microorganisms that interact with plants.

Values Found in Biochar

Research being conducted by Aries Energy includes identification of what exactly is still inside the biochar, Abouelata said. In addition to traditional uses for biochar, Aries is looking at other avenues for the product, including:

- **Coal supplement.** Testing has shown that there are still 12,000 BTUs in biochar. When the biochar is made from woody biomass only, harmful sulfur and mercury components are eliminated. Abouelata described this as a "clean coal process."
- **Alternative fuels.** Research is ongoing at Aries to see how biochar can be used to create alternative fuels.
- **Land enrichment.** Biochar, when mixed with compost and used on a golf course, can be beneficial. Abouelata explained that, when the sand turf base of a golf course drains, many nutrients are lost when the draining water takes the nutrients with it. The addition of a biochar mixture still allows for draining, but the carbon entities in it keep the moisture without the harmful effects of too much moisture. Early studies indicated that soil treated with the mixture displayed advanced root structures when compared with non-treated plants. **IWWD**

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