Mixing materials could lead to better biofuels

November 2 2021

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With the world coming to terms with the need to leave fossil fuels in the ground, renewable alternatives have never been more important. One such alternative is bioenergy coming from the burning of biomass. Now a new article to be published in *Carbon Capture Science & Technology* details how to best optimize biomass fuel production: it's all about

mixing materials.

Biomass is any kind of renewable biological material that can be burned as fuel, though it is usually of plant origin, like wood chips or straw. "Biomass energy is one of the most efficient renewable energy sources," says author Cui Xuyang, who works alongside Yang Junhong at the Key Laboratory of Efficient Utilization of Low and Medium Grade Energy at Tianjin University in China. Biomass fuel often comes as pellets, formed under pressure and temperature, and the quality of the pellets can be hugely influenced by additives.

For example, mixing straw or woody biomass with sugar like starch or cellulose improves the strength and durability of the finished pellets. The same can be achieved by combining woody biomass with production waste like sludge—a readily available, often sugar-containing material that can also help lower the economical and environmental cost.

Keeping costs and production energy low is crucial. "The manufacture of high quality pellet fuels with low energy consumption is what we are after," says Cui. The pelletizing step alone contributes to 50 percent of the energy consumption needed to turn the raw biomass into usable pellets. Oily crops, such as castor and rapeseed, can lower energy consumption of wood chip pellets because the oil reduces friction during the processing. Overall, Cui says, "oil and sugar [...] help reduce energy consumption in the preparation of biomass pellet fuel and improve the quality of the pellets."

When looking at the processing, it's also important to consider the components of the main biomass. For example, because wood is rich in an organic polymer called lignin, it requires a higher temperature to turn into pellets. But at the same time, heating promotes the bonding of the raw materials, improving pellet strength. Similarly, microalgae biomass lacks sufficient levels of lignin, cellulose, etc., butthelipidsit contains

reduce the energy consumption of the pelletizing process.This balancing act is another reason why mixing materials is useful.

"It is obvious that mixing different raw materials for co-pelletizing is a promising way to upgrade biomass pellets," says Cui. "In the future, co-combustion and co-gasification of different feedstocks should also be taken into account."

Creating a world powered exclusively by renewable energy will take work. Some of that work will be a process of constantly fine-tuning—like finding the perfect biomass mix. But if it means we can move fully away from fossil fuels, it will be more than worthwhile. "As mankind's interest in biomass energy grows, the question of how to make better use of it is one that needs to be answered," Cui concludes.

More information: Cui, Xuyang, et al. *Carbon Capture Science & Technology* (2021).

Provided by SciencePOD

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