Risk mitigation in the process of using Sorghum as Biofuel and soil cleaner by means of pyrolysis gasification technology

The background:

Sorghum is on its way to become the main competitor to the corn as a raw material for biofuels, both in the form of biomass-based energy production, and as a precursor for ethanol. It offers a number of additional advantages. The plant is not only highly drought resistant, but also makes the soil looser, thus improving the drainage. Another added value is the Sorghum's ability to extract heavy metals from the soil and retaining them in its roots and stems, thus a): cleaning the soil and b): preventing them into getting in the food chain or in the biofuels. The plant does absorb a number of heavy metals naturally. Using *Phytoremediation* could significantly strhegthen this ability further.

It means that use of Sorghum is only going to increase as food, fourage and biomass-based energy product.

The problem:

As the heavy metals and other pollutants as a rule are retained in the roots and the stems, their use for farming or bio-fuel production becomes problematic from environmental and health protection and security point of view (especially if used in heavily polluted areas or for soil cleaning specific purposes). While the grain, which is not a heavy metal absorbent, could be used directly for biomass and ethanol production, the proper disposal of the intoxicated roots and stems is indeed an issue. Using the usual techniques, like special depot disposal or incineration are either non-efficient, safe or are costly.

The Solution:

The pyrolysis gasification technology could help by environmentally friendly utilizing the polluted biomass, generating in addition energy and derivative fuels, and moreover, allowing easy recovering and reuse of the heavy metals absorbed by the Sorghum.

Pyrolysis is a thermal cracking process for any organic material that occurs at high temperature without oxygen. During this process gas, oil and a type of coal-char or ash residue is produced. By applying various thermo-chemical regimes, the energy carrier output could be either aimed at conversion to prevailingly flammable gas or pyrolisis oil.

Both products are valuable goods for energy production or further refining.

The resultant gas is a mixture closed by its characteristics to the bio-gas and consisting mainly of methane, propane and butane and their derivatives. The gas can be directly burned in internal combustion engines or used to fire a gas turbine, or alternatively be separated into main components and compressed (methane) or liquefied (propane and butane) for further transportation, storage and use.

The pyrolisis oil, while being quite toxic by itself is a very good precursor for some refined hydrocarbon-based products, including diesel. It can also safely be used to run slow two-stroke internal combustion engines alone or mixed with some other fuels. It can also be returned back/recycled to pyrolisis reactor.

The heavy metals during the process are separated and deposited with the resulting ash and can easily be extracted for reuse or targeted utilization in concentrated clean form. The remaining ash is an inert mass, suitable for use as insulation filler in the construction and building works. For actual installation using such technology and used to test Sorghum waste safe conversion, please see www.quantumsolutions.bg/QS-W2ES-Presentation%20v.3.01ENG.pdf .

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