cassava Gel Fuel theory

Mr Aigbogun Ralphael Efosa, born on the 11th day of febuary 1980 in Benin city,Edo states in Nigeria has developed a cassava gel which can be used in cooking stoves, Lamps, Fire places, etc. The technology is said to reduce carbon dioxide emissions by up to 50 per cent when compared to firewood and charcoal.

Cassava gel fuel is a renewable form of energy made by mixing ethanol with a thickening agent and water. The ethanol is extracted through the fermentation and distillation of sugars from the cassava .

Cassava gel Fuel is cheaper compared to other fuel, smokeless, less toxic, easy to handle and store. Cassava Gel fuel burns with a carbon-free flame, so it does not cause respiratory problems such as asthma, which can be caused by emissions from paraffin, coal and wood fuel. The gel also does not produce any smoke or smell.

The Gel fuel will not ignite if spilt like gas or paraffin. The gel is non-toxic and thus is not poisonous.

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The Cassava gel Fuel products and appliances for GreenHeat, would be sold at cheap prices according to the quantities and brands.

TELL US MORE ABOUT YOU

I was born in Benin city, a Nigerian and an undergraduate of Mechanical engineering department , university of Benin, Benin city, Nigeria. University of Benin, engineering Research and Development is a government owned institution mandated to support the industrial sector through research, technology development and transfer.

TELL US MORE ABOUT CASSAVA

Cassava (Manihot esculenta) is the third most important food source in the tropics after rice and maize.

Cassava is one of the richest fermentable substances for the production of alcohol. The fresh roots contain about 30 percent starch and 5 percent sugars, and the dried roots contain about 80 percent fermentable substances which are equivalent to rice as a source of alcohol.

Cassava is the staple food for about half a billion people in the World. It is a tropical crop grown mainly in Africa, Asia and South America. It can be cultivated on arid and semi-arid land where other crops do not thrive.

During processing of cassava into chips, flour or starch enormous amount of wastes are generated ca. 0.47 tonnes for each ton of fresh tubers processed. This waste consists of peels, waste water and pulp that contains from 36 to 45% of starch and from 55 to 64% of lignocellulosic biomass. Processing of cassava peels into value added products will raise the value of the cassava tubers earning more income to small scale farmers and processors.

Therefore an innovative processing system is proposed in which during processing of cassava into flour or starch the peels and other wastes which constitute about 47% w/w of the total tuber are sequentially converted to ethanol, biogas and biofertiliser. Both ethanol and biogas are intended to be used for domestic cooking to replace firewood and charcoal which at present constitutes 90% of total domestic energy requirement. This should improve human health especially of children and women and reduce the rate of deforestation. The biofertiliser will be used to improve productivity in cassava fields, thus increased yield and more income to farmers.

Cassava processing waste is not only an environmental problem but also a loss of great resource since it contains up to 45% starch and up to 20% cellulose and hemicellulose which are readily degradable components. The idea is to integrate cassava processing into flour (human food) and starch (industrial raw material) with energy and biofertiliser production thus ending up with zero waste making the whole value chain more profitable at the same time mitigating environmental pollution

Tapioca Starch, It is a starch extracted from cassava root (Manihot esculenta). This species is native to the North Region of Brazil, but spread throughout the South American continent. The plant was carried by Portuguese and Spanish explorers to most of the West Indies, and continents of Africa and Asia, including the

Philippines and Taiwan. It is now cultivated worldwide. A staple food in many world regions, tapioca is used as a thickening agent in various foods.
The cassava tuber is peeled and then after grated and pressed and pulverized. This results into loose grits which are dried in a solar dryer and are used for flour or starch production. The pressed serum rich in starch is combined with the starch component of the peels for bioethanol production. Consequently biogas is produced from the fermentation residue (stillage) which contains cellulose, hemicellulose, lignin, protein, lipids and biomass (yeast cells) and metabolites e.g. volatile acids. The biogas residue is an excellent biofertiliser.
Biogas is easily upgrade by introducing a scrubbing system between the AD and collection bags. The scrubbing system consists of KOH and silica gel and or zeolite to remove CO2, H2S and moisture, thus the methane content is up to 97% and this can easily be compressed and can be used as LPG. In this way biogas can be transported and used in places far away from the where digesters are located.
By employing Pose FB-SSF of partially liquefied starch (cassava peels powered) a very high ethanol title (up to 20% w/v) can be obtained Thus, minimal energy is used in the downstream recovery to achieve 50-60% and can be used in special low concentration ethanol cooking stoves. This ethanol is cheaper than kerosene.
Beneficiaries include farmers who get better price of their cassava crop, cheap fertiliser to improve productivity, cheap cooking fuel and protection of their health. Secondly, processors who produce more value added products (ethanol, biogas, and biofertiliser) in addition to saving cost from waste management (because now it is zero waste). Thirdly, it is a spillover effect to special ethanol cooking stove fabricator and suppliers, as well as suppliers of bioethanol, biogas and biofertiliser.
We are starting with cassava processors who are having facility already. We convince and support them to make small additional investment in the bioethanol-biogas production system. Since they have running business it is easy for them to obtain credit from the landing institutions. Thus, it is an expansion of their business; they will own and maintain the facilities.

EXPLAINATION OF THE IDEA
The proposed innovation adds a simple anaerobic digester (AD) and a fermenter coupled with a distillation system. Ethanol is produced from the starch component of the peels through pose fed batch (FB) simultaneous scarification and fermentation (FB- SSF) using partially liquefied cassava powder to attain to very high concentration (about 200g/L i.e. 20%) then distilled to 75-80% and bottled to be used as cooking fuel in specially designed cooking stoves. The fermentation residue which contain cellulose, hemicellulose, fermentation metabolites (e.g. volatile acids) and large number of yeast cells save as substrate for biogas production The biogas produced is divided into 3 portions using control valves in which 20% is recycled to heat the AD so that temperature in the AD is maintained at 50°C for higher reaction rate hence higher yield and productivity, 20% fuels the ethanol distiller and 60% goes to low pressure cylinders to be sold at a price lower than natural gas for domestic cooking. The biogas manure is dried and packed in bags and sold at very low price to improve soil fertility. This will also save farmers from having to purchase the expensive artificial fertilizers. This innovation solves multiple problems including reduced post-harvest losses, increased yield and productivity, improved health and reduced environmental degradation (through the use of safer and clean cooking energy) and increased employment (through new production lines in processing factories)

WHO BENEFITS?

Beneficiaries of this innovation are small $ large scale farmers, processors and Consumers through increased cassava yield and productivity, increased price of cassava tubers, increased profit in cassava processing. General public (especially rural) through clean cooking energy, usage of the Gel products, reduced environmental degradation, increased employment opportunity.

WHERE WILL YOUR IDEA BE IMPLEMENTED?

This innovation is to be implemented in the Entire continent of the world, North

America, South America
,Asia, Antarctica, Australia ,Europe, Africa especially in the West African region as well as the eastern, southern and coastal region areas leading in cassava production

ARE YOU IMPLEMENTING IN AN ELIGIBLE COUNTRY?

Yes

EXPERTISE IN SECTOR

I've experimented and worked out the principles of this project in a renouned institution for over a year

EXPERIENCE IN IMPLEMENTATION COUNTRY(IES)

Yes, for more than one year.

SEQUENTIAL PROCESSING OF CASSAVA PEELS INTO BIOETHANOL AND BIOGAS PRODUCTION

FERMENTATION
Crop products with high sugar content – sugar cane, sugar beet and fruits – can easily be fermented into ethanol. But starches such as grains, potatoes, root crops like cassava, the fermentation process is complex because they must be converted into sugar first, before fermentation.
Some agricultural crops such as potatoes can be uneconomical, in the long run, due to low ethanol yield and high transportation costs, unless used locally.

PRODUCTION
The Cassava gel Fuel can also be used with chaffing dishes in hotels to keep the food warm, but using a different burner specifically designed for the dishes.
According to Mr Ralphael, the production process is simple and involves fermentation of the raw materials using chemicals, including the ordinary yeast for at least a week.
The second process is distillation into ethanol, which is then denatured to make it unfit for human consumption. Denaturing is a process of adding some chemicals.
The liquid ethanol is mixed with a thickening element such as cellulose and water to produce a combustible gel. The jellification of the output is necessary to make it economical to use and also to reduce evaporation.
The value of cassava tuber as well as products and marketability has been greatly improved from the conversion of cassava peels and other wastes into value added products

Lamps

Simple and elegant table lamps can provide that extra touch of ambience to your restaurant, café, bar or outdoor area. The Pure Light range comes in sleek and simple designs using polished stainless steel and plastic with opaque and clear glass tops. Our oil cartridges are clean burning, non sooting, and come in a non flammable plastic recyclable container.
They are odourless and tang safe, making them efficient and economical and ideal for providing atmosphere at your table. The extensive range of oil cartridges will also suit most existing table lamps. And do away with messy wax tea lights with our new range of tea light size oil cartridges that burn for 8-12 hrs which are suitable for most of the existing tea light holders. Pure Light, the only name you need to remember in table lighting.

Ethanol Chafing Fuel Gel
Our Ethanol gel is a cassava based formulation from a renewable resource and is non toxic.
sealed in recycled cans and cartons
All cans can be recycled
Available in 2hr / 2.5hr / 3hr / 4KG

Table Lamps
Create Illuminating Tables

The Illuminations range comes in sleek and sophisticated designs using polished stainless steel and plastic with opaque and clear glass tops.

The extensive range of oil cartridges will also suit most existing table lamps.

Illuminations – the only name you need to remember in table lighting.

Cookers
"This stove is number one," it is easy to use and, while paraffin is cheaper than the gel, the gel is more cost-efficient in the long run. "Gel lasts. If you don't use it too much, five litres of gel takes you a month to use, but five litres of paraffin lasts only three days."
an added attraction of ethanol is that the paraffin price fluctuates. "The price of paraffin is going up and down, up and down with the petrol price, "So now I'm forgetting about paraffin."
What I like about the stove is that it will conquer our unreliable electricity
Safety is also a big selling point in favour of ethanol products, particularly for those who use coal or paraffin for heat and cooking. Paraffin stoves, which explode or are easily knocked over, cause fires, and poor ventilation can lead to asphyxiation.
Gel fuel burns with a carbon-free flame, so it does not cause respiratory problems such as asthma, which can be caused by emissions from paraffin, coal and wood fuel. The gel also does not produce any smoke or smell.
Gel fuel will not ignite if spilt like gas or paraffin. The gel is non-toxic and thus is not poisonous if swallowed by children. The stoves are designed so they will not fall over if bumped and the stove's legs allow it to slide when pushed instead of toppling over. Even if an ethanol lamp is overturned, the gel will extinguish the wick.

Composed and Written by
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