

GREEN ENERGY OPTION

# Prospect for second generation biofuel crops

*Biofuel from non-food, bioenergy crops Jatropha and Castor can be produced in any land, including soil considered infertile for crop cultivation in Bangladesh. The fuel produced from the two oil bearing crops could be used in lamps, irrigation pump, farming machinery, generators, transports and even as jet fuel with many environmental and socio-economic benefits.*

DR. KAMRUN NAHAR

RENEWABLE energy is now a burning issue in both developed and developing countries vis-a-vis energy security, climate change and emission mitigation as well as sustainable development. Energy demand and environmental concerns have significantly constrained sustainable development. Biofuels in particular, as an energy source have attracted great attention in the USA, European countries, China, Japan and even India for significant advantages over fossil diesel as biofuel consump-

with different breeding technologies (seedling, stem cutting, grafting and tissue culture) of important energy crops to make sustainable biomass feedstock for the production of renewable energy in the form of biofuel. They may be categorized as first generation biofuel (produced from food crops), second generation biofuel (generated from non food crops) or third generation biofuel (algae).

Jatropha curcas and Castor bean are second generation biofuel crops, which are drought resistant, perennial and grow well



Castor plant

food versus fuel. It grows almost everywhere, even on gravelly, sandy and saline soils. The leaves shed during the winter months form mulch around the base of the plant. The organic matter from shed leaves enhance earthworm activity in soil around the root zone of the plants which improves fertility of the soil.

The plants grow wild in forests and fields, and are considered as wild or unwanted. Local people are unaware about their life span, uses and economic values. The plants can live for many years and produce huge amounts of seeds every year, from which biofuel can be easily produced. This will meet the increasing demand for fuel in the country, which is currently not possible from any other renewable energy sources.

To combat our energy depletion, Jatropha or Castor based-biodiesel emits around 80% less CO<sub>2</sub> and 100% SO<sub>2</sub> than the expensive and imported fossil fuel. In addition to global climate change and excess of green-house gases, it addresses deforestation issues as it utilizes infertile, loamy, harsh and fallow lands for production. The seeds contain about 37-50% oil which can be combusted as fuel without being refined. It burns with clear smoke-free flame, tested successfully as fuel in diesel engines. The

by-products are also useful as the press cake or seed cake can be used as good organic fertilizer containing Nitrogen, Potassium, Phosphorus and micronutrients.

These two valuable multipurpose crops also help to alleviate soil degradation, desertification and deforestation. Besides the fuel and fertilizer, biogas can also be produced. From the by-products, ingredients for soap, cosmetics and medicinal uses can be derived and hence, they deserve specific attention. From an economic standpoint, it contributes to rural income generation, thereby reducing poverty. It also helps provide jobs to rural men and women and promotes their financial independence, especially in an agrarian nation like Bangladesh.

The fuel is safe in storage as they have a flash point higher than the fossil diesel fuel. Also their viscosity is slightly lower than the fossil diesel which is a good criterion for smooth flow of the oil through the injector in machines. Converting biomass feedstock to biofuels is an environmentally friendly process. Because of their compatibility with the natural carbon cycle, biofuel offer the most beneficial alternative for reducing greenhouse gases from the transportation sector. When we use biofuel instead of gaso-

line in transportation, we help reduce atmospheric CO<sub>2</sub> in three ways:

- (1) we avoid the emissions associated with gasoline;
- (2) we allow the CO<sub>2</sub> content of the fossil fuels to remain in storage; and
- (3) we provide a mechanism for CO<sub>2</sub> absorption by growing new biomass for fuels.

Aviation fuels are also widely substituted by biofuels produced from jatropha or castor oil. To meet the increasing demand for the jet fuels biodiesel can be blended with the jet fuel since it has lower freezing point than jet fuel. In December 2008, New Zealand tested Jatropha fuels with Houston based air flights and Japan Air also did the same. In 2009, NASA tested and evaluated the potential use of castor oil as a viable and sustainable feedstock for production of bio jet fuel. In 2011, China made similar breakthroughs.

The key to the future of biodiesel is finding inexpensive feedstock that can be grown by farmers of Bangladesh on unused agricultural land and Jatropha and Castor are the two important and promising alternative crops which can certainly reduce our future dependence on oil imports. The country is also faced with severe energy crisis for its growing population. So Jatropha and castor could be introduced as the soils of Bangladesh and its climatic condition are suitable for commercial cultivation. Moreover, second generation plants will not lead to food shortages as they are inedible by both humans and cattle and will be grown on lands which are not suitable for traditional farming.

Since the plants have long lifetime, it is key in producing oils and providing many other beneficial and useful materials over an extended period, all the while sequestering CO<sub>2</sub> from the atmosphere.

The waste lands, and other uplands including the huge area of Chittagong hill tracts, low land, lake and riverside can be easily taken under consideration for biofuel cultivation. The plant-seed oil can be directly used to engines especially farming machinery in villages without any modification of the oil structure. Jatropha cultivation will be more profitable and land productivity can be increased many folds in comparison to other crops cultivation in Bangladesh.

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Jatropha plant

tion generates less environmental pollutants such as SO<sub>x</sub> and NO<sub>x</sub> and mitigates CO<sub>2</sub> emission. Bangladesh, however, has been detached from this issue till recent times.

For many years, I have been researching

in marginal or poor soil. These are easy to establish, grow relatively quickly and produce oil bearing seeds for about 30-50 years. As they are non-food crop and can grow in poor soil, so there is no debate on

# Air pollution continues unabated

*We have high-budget air pollution prevention and mitigation programmes undertaken by the government, and international development agencies and lenders. Hundreds of experts and scientists are working, hundreds of seminars are being organised, thousands of reports are being published, but all these are of no use unless the "polluting machines" are made to behave.*

PROBIR BIDHAN

HIGHLY polluting brickfields are still operating unabated across the country including on the outskirts of Dhaka posing serious health risks in this dry season, harming the nature and damaging arable land. Most of these conventional chimneys are baking bricks round the clock burning wood, tyres and low-quality coal. Replacing the chimneys with improved modern ones can relieve the situation to a considerable extent. But this issue has never been taken seriously by any government in the past two decades of rapid urbanisation.

The present sorry state of Dhaka's west, where around 500 chimneys are polluting nearby households and the city's air, highway-sides and riverbanks shows the apathy of the authorities concerned who are supposed to ensure a site checking before issuing businessmen and influential individuals licence to set up this now-profitable brick-field business. Moreover, tight monitoring is supposed to be carried out by the environment officials and the district administration while law enforcement agency personnel are to inform officials concerned to take measures in case they identify any wrongdoings defying the environmental laws.

The frustration mounts much when the government bodies do not function co-ordinately to act upon for the laws, the court's orders and even the lawmakers' concerns. Very recently, for the first time, MPs of the environment watchdog raised their concerns over Dhaka's air quality, and identifying the brickfields three kilometres

off Dhaka's Gabtoli and Aminbazar areas as major threat, they directed authorities concerned to remove those by June 30.

However, there is minimum possibility this direction might be materialised given the trend of dealing this particular issue by the successive governments. Before the MPs, many High Court judges in different rulings, upon petition or on their own motion, ordered and directed the authorities to ensure that no brickfield is allowed within three kilometres of any arable land, home-steads, municipality, forest or farm; use of standard-grade coal as fuel; and most importantly, no brick kiln is functioning illegally and using conventional technology.

But all these are still happening despite the government's (ineffective) measures; advocacy projects of international bodies like the UNICEF and ADB, and outcry of the green groups and concerned citizens.

The Department of Environment (DoE), the monitoring and enforcement body of the government, is dealing with the whole issue, except for the issuance of licence, done by the district administrations. However, it's not allowed to be issued without the DoE's approval. But due to lack of manpower and unavailability of assistance from law enforcement agencies it draws flack in the monitoring activities and enforcement drives against those violating the rules. Even, the directives given by the DoE to transform the conventional plants into modern technology are ignored by the unscrupulous businessmen. Hence, the deadline has been extended till March this year. But yet in the last week of February, there is no sign of any development activi-



'Polluting machines' vitiating air land and water

ties at the sites across the country, even near the capital Dhaka.

We have high-budget air pollution prevention and mitigation programmes undertaken by the government, and international development agencies and lenders. Hundreds of experts and scientists are working, hundreds of seminars are being organised, thousands of reports are being published, millions of taka are being allocated every year; but all these are of no use unless the "polluting machines" are made to behave.

It is astonishing and unfortunate for the citizens that no administration could remove the illegal brick kilns in Dhaka's Aminbazar, Ashulia and Bosila areas, and compel others to transform technology in the last 20 years when their number has increased rapidly. Many of these kilns are functioning within 50 metres of the highway and river Turag.

According to a World Bank study, the conventional plants contribute up to 20 percent of the total premature mortality caused by urban air pollution in Dhaka (all causes combined). The Bangladesh Country Environmental Analysis reports that poor air quality in Dhaka contributed to an estimated 3,500 premature deaths in 2002 (World Bank 2006). Emissions of particulate matters from this kiln cluster are responsible for 750 premature deaths annually.

Replacing the brickfield cluster north of Dhaka with modern-clean technologies -- suggested by the UNICEF -- would reduce current premature mortality. The new methods that require low coal consumption are so far the cleanest technologies in terms of CO<sub>2</sub> emissions.

**Stricter enforcement of laws needed:**

According to the existing law regarding baking of bricks, the unauthorised kilns

must be removed, while licences of kilns burning wood to be cancelled. Moreover, the violators can be jailed for one year or fined Tk 50,000 or both for similar offences. The officials concerned can also fine those kilns for polluting the air. But there is almost little enforcement.

And the present scenario is that the brickfield owners with profit-making tendencies are running the faulty kilns unabated. The DoE with the help of law enforcing agencies should conduct frequent operations to ensure removal of those operating illegally and using wood and coal as fuel. In this effect, the government should immediately go for increasing the DoE's manpower for the enforcement drives and monitoring.

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