

Research Application Summary

Analysis of oil quality and content from different Kenyan land races of *Croton megalocarpus*

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Abstract

The increasing industrialization and motorization of the world has led to a steep rise in demand of petroleum-based fuels. Today, fossil fuels constitute 80% of the primary energy consumed in the world, of which 58% alone is consumed by the transport sector. The sources of these fossil fuels are becoming exhausted, but in addition they are contributing to greenhouse gas (GHG) emissions. These factors have prompted a move towards alternative, renewable, sustainable, efficient and cost-effective energy sources with lesser emissions. Biofuels have been identified as being environmentally friendly in that they are renewable, biodegradable and generate acceptable quality of exhaust gases. In this study, we will characterize biodiesel quality from different *Croton* landraces in Kenya.

Key words: Biodiesel, *Croton*, fossil fuel, greenhouse gas, renewable energy

Résumé

L'industrialisation et la motorisation croissantes du monde ont mené à une forte élévation de la demande des carburants basés essentiellement sur le pétrole. Aujourd'hui, les combustibles fossiles constituent 80% de l'énergie primaire consommée dans le monde, dont 58% seuls sont consommés par le secteur de transport. Les sources de ces combustibles fossiles sont entrain de s'épuiser, mais en plus elles contribuent aux émissions de gaz à effet de serre (GHG). Ces facteurs ont incité un mouvement vers les sources d'énergie alternative, renouvelables, durables, efficaces et rentables avec peu d'émissions. Les biofuels ont été identifiés en tant que non nuisible à l'environnement du fait qu'ils sont renouvelables, biodégradable et produisent de la qualité acceptable des gaz d'échappement. Dans cette étude, nous caractériserons la qualité de biodiesel de différents cochons de *Croton* au Kenya.

Mots clés: Biodiesel, *Croton*, combustible fossile, gaz à effet de serre, énergie renouvelable

Background

Skyrocketing oil prices over the past few years have led to a global boon of investment and enthusiasm for liquid biofuels. Fossil fuel also have detrimental environmental impacts including raising carbon in the atmosphere and global warming. In Kenya much excitement has revolved around the shrubby tree named *Jatropha curcas*. However due to the low yield of less than 1kg per tree other feedstocks including *Croton megalocarpus* is now being investigated. The annual seed yield per tree is of the order of 25–40 kg for *C. megalocarpus*. Analysis of the seeds at the East Africa Tanning Extract Company (EATEC) laboratory in Eldoret and elsewhere shows an average composition of 30%–32% oil and 18%–50% protein from seed of this tree (Thijssen, 1996). The tree has been a subject of recent interest as a source of animal feed. However, there is a big variation in the frequency of flowering, number of seeds per fruit and weight of seeds among populations of this tree. This indicates that through selection and breeding yields could be considerably increased.

Literature Summary

Over recent decades, climate change and its impacts have become one of the main global concerns. The intergovernmental panel on climate change (IPCC) indicated the continuous increase in greenhouse gas (GHG) emissions from the use of fossil fuel to be the main cause of the problem. In Europe, human activities in the energy sector cause approximately 78% of the total GHG emissions. In the European fuel consumption, fossil fuel represents the most exploited source half of which is imported. It has been estimated that if no steps are taken to reduce consumption and promote the production of energy by local sources and short supply chains, dependency on foreign countries is destined to rise to over 80%. Brazil, which directly invested the total of US\$ 4.92 billion in the agricultural and industrial sectors for the production of ethanol for vehicle use during the period 1975-1989, reduced the imports by a total of US\$ 52.1 billion during the period of 1975-2002 (Coelho, 2005). In Africa, South Africa has been most active in promoting biofuels through their biodiesel support program.

As a country without proven petroleum resources, Kenya's economy is vulnerable to increases in the prices of petroleum products. The total imports value of crude petroleum and petroleum products in 2005 was US\$ 1,288,933,291 (Ksh. 97,598,000,000), which accounted for 23% of the country's total import expenditure (Kenya, 2006a). By supporting the biodiesel industry, governments of oil-importing countries will accrue

benefits such as increased energy self-sufficiency, foreign exchange savings and income from the agricultural sectors and new biodiesel industries.

Biofuels are a wide range of fuels which are in some way derived from biomass. The term covers solid biomass, liquid fuels and various biogasses (Dermirbas, 2009). Biofuels are gaining increased public and scientific attention driven by factors such as oil price spikes, the need for increased energy security and concern over greenhouse gas emissions from fossil fuels.

Croton is indigenous to East Africa and has been widely grown in its mountainous regions as an ornamental for generations. It is therefore inconceivable that an ecological catastrophe can be triggered by large scale cultivation of *Croton* (Milich, 2009). When mature the tree has a relatively open architecture, allowing a significant amount of sunlight to penetrate the canopy and reach the ground. Other crops can therefore in principle be grown under the trees in a two-tiered agro-forestry system. Maize, a crop which requires relatively high solar intensities, grows effectively beneath croton (Maundu and Tengnas, 2008). *Croton* grows and produces well at rainfall accumulations of 800mm/year without the need for irrigation. Because of its tap roots, it can access sufficient soil nutrients so that fertilization is not required. The root exudates enrich the soil with minerals and the leaf litter with organic carbon (Milich, 2009).

Study Description

Mature *Croton* seeds will be collected from Kakamega, Bondo, Kisii, Nguruman, Nyeri and Embu. These are regions that lie between the altitudes of 1300 m and 2200 m with annual rainfall ranging from 800 to 1600 mm. The seeds will be transported to the Kenya Forest Research Institute (KEFRI) in Nairobi where analytical tests will be carried out. First, the seeds will be pressed to extract oil. The percentage oil content per dry weight will be determined for the different land races. The straight vegetable oil (SVO) will then be transesterified to produce biodiesel. Biodiesel yield will be determined and the standard quality tests including density, moisture content, viscosity and flash point done. The data obtained will be analysed using the Statistical Package for Social Sciences (SPSS).

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