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Improving biofuel combustion for the rural South

One glass (20 cl)! That's how much diesel or biofuel, on average, a rural family in the South (Africa, Pacific, Amazon…) needs to have electricity for 4 to 8 hours a day. But the primary need is to have a little power, occasionally or intermittently, for energy services. In Africa, this takes the form of grain milling, water pumping and handicrafts using powered hand tools. Throughout the rural developing world, the requisite power is obtained from small gasoline—or most often diesel—engines. Lister type diesel engines have been widespread on all continents for decades.

In Africa, the development of multifunctional platforms (United Nations Development Programme/MFP) has encouraged their commercialization. These 5- to 15-hp engines are found under various names in the various countries and regions (Peter Lister, Rhino, Fieldmarshal, Imex, Elephant, Jumbo, Goldstar…). They are manufactured in India from a model that has long been obsolete in England. They are hardy, undemanding engines and, especially, cost much less than newer diesels of equivalent power. They are widespread among millers and for water pumping, and attempts to adapt them to use local biofuels were made in the early 80s.

But problems of combustion chamber fouling arose right from initial testing, discouraging any decision to use local pure vegetable oils in rural areas. CIRAD's objective is to provide an appropriate technology solution to allow the use of alternative fuels from local oilseeds. The study and recent development of a very inexpensive part—€50—that is easy to fabricate and install locally will enable hundreds of thousands of these engines to use biofuel in place of diesel. As of today palm, cottonseed or jatropha oil are the favoured types.

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▲ *An example of an 8-hp Lister Rhino diesel engine installed on a multifunctional platform, here coupled to a power generator and a husker. 2IE, Burkina Faso, 2011.*

The DANAC project

activated anaerobic digestion—biomimicry for anaerobic digestion

Today, industrial technologies are being used to produce the various biochemical processes of anaerobic digestion within a single reactor. Over this past decade, pre-processing or co-processing anaerobic digestion methods have appeared whose purpose was to make the matter to be digested more readily available. To date, however, none of these technologies has been able to exceed the threshold of 60% degradation of the organic matter, and so biogas production has been limited. It should be noted that anaerobic digestion is a very common process, especially in living beings' gastrointestinal tract. In these ecosystems, its may digest 61 to 76% of the organic matter.

These results suggest that the living world has developed systems that overcome the obstacle of organic matter availability and so optimize the transformation of matter into energetic compounds. The objective of the DANAC project is to thoroughly analyse living beings' digestion processes and, by mimicry, to develop new processes for producing biogas from waste, with a better than 70% rate of organic matter degradation. LBE is coordinating this project in partnership with the UR "Hydrosystems and Bioprocesses" (IRSTEA), the Paris Sud-Ouest proteomic analysis platform (INRA), the UMR "Biogeochemistry and Ecology of Continental Environments" (AgroParisTech, CNRS, ENS, IRD, *Universités Paris 6* and *Paris 12*) and Suez Environnement.

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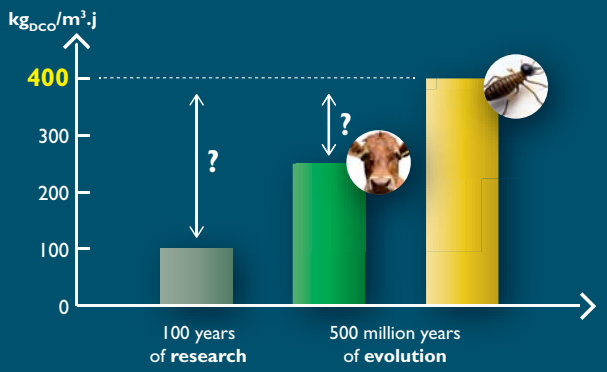

▲ *The DANAC project's objectives: through biomimicry, to seek novel technological solutions for the optimization of solid waste treatment.*