

FROM WASTE TO WORTH

As the irreversible decline of oil availability looms in the not-so distant future, Naoko Ellis is using a grassroots UBC research project to promote the widespread environmental and economic benefits of biodiesel





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It has the power to transform formerly nomadic cultures into major power players of the world economy. It has been the cause of bloodshed, strife and war. To the average individual, its impact has been even more immediate, as modern conveniences once thought of as luxuries have been changed into everyday necessities.

In the 21st century, no other commodity has arguably had as much positive and negative influence on the fabric of society as oil. It is estimated that more than 600 million vehicles around the world are fueled by petroleum-based oil. While 26 billion barrels per year are required to fuel society's insatiable thirst for oil, only about six billion barrels are being uncovered annually and these numbers are rapidly dropping.

As anxiety over dwindling supply and the ramifications of increased fuel consumption continue to reach unprecedented heights, a grassroots research project originating at UBC is helping the case for alternative sources of energy tentatively find its footing. Known as the Biodiesel Project, it has proven that biodiesel can potentially be a viable option to petroleum, if given the support to grow.

The idea for the Biodiesel Project began to germinate in 2002 as a what-if inquiry into the possibility of producing a clean fuel by Dr. Naoko Ellis, Assistant Professor of Chemical Engineering at UBC Vancouver.

Her initial call for a thesis project to carry out research in this endeavour was met with no response but when UBC science students Peter Doig and Geoff Hill approached Ellis to supervise the development of a methodology to produce biodiesel using waste cooking oil, the initiative really took shape.

Transforming vegetable oil into a useable fuel is not a novel concept. Taking a new spin on an established theory, the Biodiesel Project team began investigating ways to utilize the seemingly unlimited supply of used oil produced by UBC cafeterias as a way to efficiently eliminate this waste. The conversion process starts with a filtering system that eliminates any solids and water in

In its pure form, biodiesel is 10 times less toxic than table salt and as biodegradable as sugar

the used oil. The filtered oil is then mixed with methanol through a catalyst, which is subsequently purified and evaporated.

Ellis explains: "Once pretreatment is done with filtering, we mix the oil with methanol and a catalyst, which in our case is potassium hydroxide. After about two

hours, the conversion happens, resulting in a two-phase product: one is biodiesel and the other is glycerol. By density difference, we are able to extract the glycerol from the bottom, leaving biodiesel. This substance is then purified further. The process is quite simple actually."

Once the methodology was mastered, Ellis teamed up with two students from the Environmental Youth Alliance (EYA) who not only began securing the funding needed to expand the operation but also became key players in "closing the loop" on utilizing the waste on campus. Shortly afterwards, the team was producing 100 litres of clean fuel per week at a cost of approximately \$0.20 per litre. During the last five years, the Biodiesel Project trained over 30 students and had even secured a cooperative venture with UBC Plant Operations, which agreed to run its campus lawn equipment with a 20 per cent biodiesel blend in order to determine the feasibility of long-term usage.

But in 2006, the Biodiesel Project quietly dismantled its operations due to losing the space for production: "Economically, the project just does not make sense at this point. At UBC, we could make ends meet with subsidy because the waste oil comes to us for free but to have somebody trained to produce the reaction was the significant cost to the operation, not the chemicals. The EYA helped us tackle this by training young

people but without more large-scale subsidy for biodiesel production, we couldn't move forward."

Despite the fact the Biodiesel Project has been suspended for more than a year, interest has yet to fade. Recently, the city of Quesnel asked the EYA to complete a feasibility study that assesses the possibility of setting up a large-scale biodiesel processing plant in an effort to reap some of biodiesel's economic and environmental benefits.

Aside from being a cost-effective alternative to petroleum-based oil production, the environmental benefits of biodiesel are staggering. According to a study by the U.S. Department of Agriculture and the U.S. Department of Energy, biodiesel reduces net carbon dioxide emissions by 78 per cent, carbon monoxide by 48 per cent and particular matter (linked to asthma) by 47 per cent. Biodiesel is also 10 times less toxic than table salt, which means a major spill would be messy but substantially less damaging than a major spill of petroleum.

Statistics like these have fueled Ellis to centre her latest research on improving the methodology developed by the Biodiesel Project. Through an NSERC strategic grant, Ellis is researching new catalysts for reaction: "Technically speaking, it makes a lot of sense to have a catalyst that is solid not liquid because of separation. Also, I am pursuing a supercritical methanol reaction system to

produce biodiesel and for this, we don't need any catalyst at all."

Ellis' hope is to take her research from small-scale operations like the Biodiesel Project and apply that knowledge on a larger scale. Since Canada is currently importing most of its biodiesel (made from soya bean oil) from the US, Ellis sees the need for government subsidy to make the production of renewable sources of energy more competitive locally: "Politically, Canada is catching on and provincial governments are saying they will contribute \$3 million to promote biodiesel. By the year 2016, they have expressed a commitment to employ five per cent blends of renewable resources. But so far, the link between research and implementation has been very disconnected."

While she is reluctant to predict any drastic action in biodiesel implementation by the Canadian government any time soon, Ellis will continue to adamantly promote a future where a diversity of strategies for fuel sourcing is integral to fostering a cleaner, more livable world. ■

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