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Mike Goosey: Biofuels are a sustainable way of ensuring that we do reduce the CO2 challenge going forward in the future.

Interviewer: You are listening to biochemist Mike Goosey with Shell. And I am Joel Block for *EarthSky's Clear Voices for Science*. Goosey talked about the science behind today's biofuels and the research going into what he calls "the next generation of biofuels".

Dr Goosey, welcome to *EarthSky's Clear Voices for Science*.

Mike Goosey: Thank you.

Interviewer: Now we are here to talk about biofuels. What are biofuels?

Mike Goosey: Well, biofuels derived from biomass. And biomass is an organic raw material of living organisms. And also they are by-products as well. The major form of biofuels derives from plants.

Inteviewer: And what sorts of biofuels do we have today? What is available out there? What's… Yeah, tell us more about that.

Mike Goosey: It is mostly two products: bio-ethanol and biodiesel. Let me talk about bio-ethanol first. Bio-ethanol as a product is used in gasoline. It is made through a traditional fermentation process. So very similar to brewing or winery industry it uses basically the sugar or sucrose from sugar cane. It can take starch from corn or wheat, and it is a very simple process; fermentation through to ethanol.
The second most common biodiesel is probably FAME. It is called FAME. It is an acronym for Fatty Acid Methyl Esters. And again the source, the biomass for that bio fuel is commonly rapeseed, palm oil, soy bean as well, in the States. And again a simple process to convert that vegetable oil, that is derived from that biomass, -

inaudible- to give FAME. And the biodiesel again is used within diesel engines. This is the current generation of biofuels.

Interviewer: What's the challenge? What are some of the scientific challenges facing scientists who are trying to make these fuels even better?

Mike Goosey: One of the challenges that the industry is looking at, is how to improve the yield of the biomass. And also reduce the amount of energy that is put into growing that biomass. For example, how we can reduce the amount of fertiliser, how we can reduce the amount of water that is required to generate the biomass.

Interviewer: Is it easy to take these raw materials, this biomass, and turn it into fuel?

Mike Goosey: For conventional biofuels, which is what we are talking about now, essentially the bio-ethanol and biodiesel from sugar cane, corn and wheat, as I've just described, it is basically a conventional process. It is when we get into the next generation of biofuels, which I am sure we will talk about, that a lot of the recurrent research is focused.

Interviewer: Tell us more about this next generation of biofuels. What do you mean by that?

Mike Goosey: That's a good question. And that's key to a lot of research that is being conducted within the industry. Next-generation biofuels have as their biomass, their raw materials two basic sources. One of these is called lignocellulose. Now lignocellulose is a tough molecule that makes up the stiffness -if you like- of the cell walls of plants. And one can look at energy crops, potentially, energy crops that can be grown to maximise the lignocellulose. These are things like switchgrass miscanthus, poplar, willow. There are other aspects of using lignocellulose and that is also through food crop residues. You can look at sugar cane -inaudible-, for example, or corn -inaudible-, or wheat straw. This is rescue that is either left in the ground or burnt, currently. And there are other sources of lignocellulose such as leftover from timber, wood residue. And also consumer waste, such as waste food, waste wood and even sewage. So that's one of the alternative raw materials. The second is what

we call lipids. Now these lipids are essentially vegetable oils, so they are very similar if not identical to the vegetable oils we've just described. And these are droplets of oil found in many organisms. And the next generation research is looking at sources of these vegetable oils such as algae or algae and other inedible, oily plants such as jatropha and other things like that.

Interviewer: What are the new challenges that scientists face as they are trying to make these… this next generation of biofuels better?

Mike Goosey: The next generation of biofuels will very much have, besides new biomass, will have new processes. And an example of this is something that we are doing with a company called Choren and that is to use far more chemical routes to take the biomass and essentially gassify that to give syngas and then use existing technology that we have -it is called Fischer-Tropsch synthesis- and that can then convert the syngas into hydrocarbons that we can use as biofuels. That contrasts with the biotechnology route, which would be involving living organisms and using enzymes that can convert processes through to the product. And an example of that would be what's called cellulosic ethanol.

Interviewer: When should the public expect to see some of these… this next generation of biofuels? When should we expect to actually see those and be able to use those?

Mike Goosey: The industry is progressing at such a rate, that the expectation of these next generation of biofuels should start to appear on the market in the next five to ten years.

Interviewer: Dr Goosey, thanks again for taking this time out. What is the most important thing that you would like the public to know about biofuels?

Mike Goosey: Biofuels will contribute to the mix that is being used to reduce the CO2 footprint. Biofuels are a sustainable way of ensuring that we do reduce the CO2 challenge going forward in the future. It is not a silver bullet, and there will be other technologies that will contribute to this, but we do see biofuels as a significance

contributor to reducing the CO2 and ultimately climate change that is facing us in the next thirty, forty, fifty years.
Voice over: That was biochemist Mike Goosey with Shell, talking about the challenges of today's biofuels and those of the future. Our thanks today to Shell, encouraging dialogue on the energy challenge.

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