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WCI student isolates microbe that lunches on plastic bags


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Getting ordinary plastic bags to rot away like banana peels would be an environmental dream come true.

After all, we produce 500 billion a year worldwide and they take up to 1,000 years to decompose. They take up space in landfills, litter our streets and parks, pollute the oceans and kill the animals that eat them.

Now a Waterloo teenager has found a way to make plastic bags degrade faster -- in three months, he figures.

Daniel Burd's project won the top prize at the Canada-Wide Science Fair in Ottawa. He came back with a long list of awards, including a $10,000 prize, a $20,000 scholarship, and recognition that he has found a practical way to help the environment.

Daniel, a 16-year-old Grade 11 student at Waterloo Collegiate Institute, got the idea for his project from everyday life.

"Almost every week I have to do chores and when I open the closet door, I have this avalanche of plastic bags falling on top of me," he said. "One day, I got tired of it and I wanted to know what other people are doing with these plastic bags."

The answer: not much. So he decided to do something himself.

He knew plastic does eventually degrade, and figured microorganisms must be behind it. His goal was to isolate the microorganisms that can break down plastic -- not an easy task because they don't exist in high numbers in nature.

First, he ground plastic bags into a powder. Next, he used ordinary household chemicals, yeast and tap water to create a solution that would encourage microbe growth. To that, he added the plastic powder and dirt. Then the solution sat in a shaker at 30 degrees.

After three months of upping the concentration of plastic-eating microbes, Burd filtered out the remaining plastic powder and put his bacterial culture into three flasks with strips of plastic cut from grocery bags. As a control, he also added plastic to flasks containing boiled and therefore dead bacterial culture.

Six weeks later, he weighed the strips of plastic. The control strips were the same. But the ones that had been in the live bacterial culture weighed an average of 17 per cent less.

That wasn't good enough for Burd. To identify the bacteria in his culture, he let them grow on agar plates and found he had four types of microbes. He tested those on more plastic strips and found only the second was capable of significant plastic degradation.

Next, Burd tried mixing his most effective strain with the others. He found strains one and two together produced a 32 per cent weight loss in his plastic strips. His theory is strain one helps strain two reproduce.

Tests to identify the strains found strain two was Sphingomonas bacteria and the helper was Pseudomonas.

A researcher in Ireland has found Pseudomonas is capable of degrading polystyrene, but as far as Burd and his teacher Mark Menhennet know -- and they've looked -- Burd's research on polyethelene plastic bags is a first.

Next, Burd tested his strains' effectiveness at different temperatures, concentrations and with the addition of sodium acetate as a ready source of carbon to help bacteria grow.

At 37 degrees and optimal bacterial concentration, with a bit of sodium acetate thrown in, Burd achieved 43 per cent degradation within six weeks.

The plastic he fished out then was visibly clearer and more brittle, and Burd guesses after six more weeks, it would be gone. He hasn't tried that yet.

To see if his process would work on a larger scale, he tried it with five or six whole bags in a bucket with the bacterial culture. That worked too.

Industrial application should be easy, said Burd. "All you need is a fermenter . . . your growth medium, your microbes and your plastic bags."

The inputs are cheap, maintaining the required temperature takes little energy because microbes produce heat as they work, and the only outputs are water and tiny levels of carbon dioxide -- each microbe produces only 0.01 per cent of its own infinitesimal weight in carbon

dioxide, said Burd.

"This is a huge, huge step forward . . . We're using nature to solve a man-made problem."

Burd would like to take his project further and see it be used. He plans to study science at university, but in the meantime he's busy with things such as student council, sports and music.

"Dan is definitely a talented student all around and is poised to be a leading scientist in our community," said Menhennet, who led the school's science fair team but says he only helped Burd with paperwork.

Other local students also did well at the national science fair.

Devin Howard of St. John's Kilmarnock School won a gold medal in life science and several scholarships.

Mackenzie Carter of St. John's Kilmarnock won bronze medals in the automotive and engineering categories.

Engineers Without Borders awarded Jeff Graansma of Forest Heights Collegiate a free trip to their national conference in January.

Zach Elgood of Courtland Avenue Public School got honourable mention in earth and environmental science.

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