

Matie microbiology students KICK BUTTS

It's been estimated that 5.6 trillion cigarette butts are discarded worldwide every year. In South Africa, cigarette butts were the most abundant litter item collected during the 2020 International Coastal Clean-up event, having been washed down rivers and stormwater canals but also simply tossed on the sand by beachgoers.

Apart from being unsightly, this type of litter is a significant environmental pollutant anywhere that it occurs. Discarded cigarette butts exposed to the elements leach nicotine, metals and other chemicals – many of them toxic – into the surroundings. The filters, introduced in the 1950s in an attempt to reduce the health hazard of smoking, are made of cellulose acetate. This is essentially plant-derived cellulose that has undergone a chemical process known as acetylation, and may have had plasticisers added for bonding. As a result, cigarette butts also release microplastics as they break down, typically over a period of a few years.

Several companies are now marketing 'biodegradable' cigarettes, which they claim are more environmentally friendly because they break down over a matter of months and have filters made of 'plastic-free' hemp, cotton or wood pulp. But a group of third-year microbiology students from Stellenbosch University (SU) questioned whether such cigarettes would simply leach their pollutants into the environment faster, and hence have greater impact.

They tested their hypothesis in a research project conducted as part of the third-year Microbial Ecology module in the Molecular Biology and Biotechnology programme at SU, and presented their findings at a mock-up academic conference. Their method involved using inductively coupled plasma mass spectrometry (ICP-MS) to analyse leachate from both biodegradable and non-biodegradable butts, and testing the effect of the two types of leachate on bacterial communities in soil through a DNA-fingerprinting technique.

Aluminium, iron and zinc were found to be the dominant elements in both leachate types, but arsenic, boron, barium, cadmium, cobalt, chromium, copper, mercury, manganese,



Wilda Fourie-Basson

These Stellenbosch University students published a peer-reviewed paper from their third-year microbiology project, which showed that even biodegradable cigarette butts have a negative impact on the environment. They are (from left to right) Aza Mqulwa, Sidney Reed, Elizaveta (Lisa) Koroleva, Zahraa Tambe and Scott Norris-Jones. All are currently pursuing postgraduate degrees in microbiology or biochemistry at the university.

molybdenum, nickel, lead, antimony, selenium, tin, strontium and vanadium were also detected.

The leachate from the biodegradable butts had a significant impact on the composition of the microbial community of the soil sample, while the leachate of non-biodegradable butts did not. This could be attributed to the much higher concentrations of metals and metalloids in the biodegradable butt leachate.

The group published their findings in the journal *Environmental Science and Pollution Research*. Prof. Karin Jacobs, their lecturer and a co-author of the paper, says of particular concern is the fact that bacteria exposed to heavy metal contamination are known to develop metal resistance, which has been found to correlate with the development of antibiotic resistance.

"We are, of course, very proud of this group of students with their first paper," she adds. "This is certainly a first for our Faculty of Science."

Based on a press release issued by Stellenbosch University. Read the paper at <https://doi.org/10.1007/s11356-021-13152-w>

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2021

Quest Volume 17 Number 2 2021

Academy of Science of South Africa (ASSAf)

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Cite: Academy of Science of South Africa (ASSAf), (2021). Quest: Science for South Africa, 17(2). [Online] Available at: <http://hdl.handle.net/20.500.11911/191>

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