

## ABSTRACT

### Background

Mainstream cigarette smoke contains a complex array of toxic chemicals which can cause irreparable harm to the lungs and most organs in the biological landscape. Attempts to reduce harmful by-products in mainstream cigarette smoke have received little attention although various researchers have proposed the use of catalysts, zeolites and filter modifications. In this study, the bio-degradation of selected tobacco chemicals in a commercial cigarette (MM-R) and a local cigarette (RR-M) is investigated.

### Methodology

*Croton megalocarpus* (*C. megalocarpus*) seed husk was ground into powder before pyrolysis at 550 °C to form biochar. The cigarette filter was treated with *C. megalocarpus* seed husk biochar as an adsorbent in order to degrade tobacco chemicals such as benzene and phenol. Specially designed smoking apparatus consistent with standard procedures for cigarette smoking was used to simulate cigarette smoking. Model tobacco chemicals—benzene and phenol—were characterized using low-resolution electron impact mass spectra on a liquid chromatograph hyphenated to a mass spectrometer. The overall concentration of tobacco chemicals with puff time was screened using a UV–visible spectrometer.

### Results

The rate constants for the removal of benzene from treated MM-R and RR-M cigarettes were  $0.123\text{s}^{-1}$  and  $0.0759\text{s}^{-1}$ , respectively, while the rate constants for the removal of phenol from the model cigarettes were  $0.125\text{s}^{-1}$  and  $0.163\text{s}^{-1}$ , respectively. For MM-R and RR-M cigarettes, the per cent reduction for benzene was 14.79 and 19.88 while that of phenol was 10.62 and 25.80, respectively. The reduction of benzene at 15s puff time for MM-R cigarette was 55.91% while the reduction of phenol at the same puff time is 37.25%. Also, the reduction in the concentration of benzene and phenol for RR-M model cigarettes was 22.89% and 66.19%, respectively, at the same puff time. The UV–Vis data show overall reduction in tobacco chemicals with increase in residence time.

### Conclusion

The results reported in this study showed that *C. megalocarpus* seed husk biochar is a promising biocatalyst that can be incorporated into the cigarette filter in order to degrade tobacco chemicals in mainstream cigarette smoke. This is a very important finding towards harm reduction and tobacco reform policy.