Production of methane and ethylene from plastic in the environment

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Abstract

Mass production of plastics started nearly 70 years ago and the production rate is expected to double over the next two decades. While serving many applications because of their durability, stability and low cost, plastics have deleterious effects on the environment. Plastic is known to release a variety of chemicals during degradation, which has a negative impact on biota. Here, we show that the most commonly used plastics produce two greenhouse gases, methane and ethylene, when exposed to ambient solar radiation. Polyethylene, which is the most produced and discarded synthetic polymer globally, is the most prolific emitter of both gases. We demonstrate that the production of trace gases from virgin low-density polyethylene increase with time, with rates at the end of a 212-day incubation of 5.8 nmol g\(^{-1}\) d\(^{-1}\) of methane, 14.5 nmol g\(^{-1}\) d\(^{-1}\) of ethylene, 3.9 nmol g\(^{-1}\) d\(^{-1}\) of ethane and 9.7 nmol g\(^{-1}\) d\(^{-1}\) of propylene. Environmentally aged plastics incubated in water for at least 152 days also produced hydrocarbon gases. In addition, low-density polyethylene emits these gases when incubated in air at rates ~2 times and ~76 times higher than when incubated in water for methane and ethylene, respectively. Our results show that plastics represent a heretofore unrecognized source of climate-relevant trace gases that are expected to increase as more plastic is produced and accumulated in the environment.
Methane makes up 20% of all greenhouse gases.

Methane is 21 times more potent than CO2.
Synthetic turf:
- LDPE
- High surface area
- Weak polymer – degrade fast
- Expose directly to UV light
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Questions?
Mahalo!