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Primary emissions and secondary organic aerosol formation from the exhaust of a flex-fuel (ethanol) vehicle

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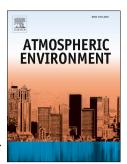
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2	exhaust of a flex-fuel (ethanol) vehicle
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14 15	Abstract
16	Incentives to use biofuels may result in increasing vehicular emissions of compounds detrimental to
17	air quality. Therefore, regulated and unregulated emissions from a Euro 5a flex-fuel vehicle, tested
18	using E85 and E75 blends (gasoline containing 85% and 75% of ethanol (vol/vol), respectively), were
19	investigated at 22 and -7 °C over the New European Driving Cycle, at the Vehicle Emission
20	Laboratory at the European Commission Joint Research Centre Ispra, Italy. Vehicle exhaust was
21	comprehensively analyzed at the tailpipe and in a dilution tunnel. A fraction of the exhaust was
22	injected into a mobile smog chamber to study the photochemical aging of the mixture. We found that
23	emissions from a flex-fuel vehicle, fuelled by E85 and E75, led to secondary organic aerosol (SOA)
24	formation, despite the low aromatic content of these fuel blends. Emissions of regulated and
25	unregulated compounds, as well as emissions of black carbon (BC) and primary organic aerosol
26	(POA) and SOA formation were higher at -7 °C.
27	The flex-fuel unregulated emissions, mainly composed of ethanol and acetaldehyde, resulted in very
28	high ozone formation potential and SOA, especially at low temperature (860 mg $O_3 \ km^{1}$ and up to 38
29	mg C kg $^{\text{-1}}$). After an OH exposure of 10×10^6 cm $^{\text{-3}}$ h, SOA mass was, on average, 3 times larger than
30	total primary particle mass emissions (BC + POA) with a high O:C ratio (up to 0.7 and 0.5 at 22 and -
31	7 °C, respectively) typical of highly oxidized mixtures. Furthermore, high resolution organic mass

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