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**Emissions from consumer level 3D printers and their potential health impacts**

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Consumer level fused deposition modelling (FDM) 3D printers are widely used in small-scale indoor environments and public spaces. Therefore, concerns over potential health impacts of emissions from 3D printers have been raised, especially for vulnerable populations such as children. This study systematically characterized particle and volatile organic compound (VOC) emissions from multiple 3D printers using a standard test method. Potential health impacts from particles were assessed by multiple *in vivo* and *in vitro* experimental methods; possible exposure levels of VOC emissions were assessed by exposure modeling. We found that 3D printing emits high concentrations of particles (especially ultrafine particles) and numerous VOCs, the levels of which are associated with different print conditions like extrusion temperature, filament material, printer brand, filament brand and color. The particle chemical compositions of 3D printer emitted particles were similar to or different from the bulk filament material depending on the filament type, indicating particle formation may be associated with the bulk material or filament additives. The toxicity analyses showed that 3D printer emitted particles are capable of inducing toxic responses, and that the predicted exposure levels of some VOC species exceed the indoor air criteria. Overall, emissions from 3D printing and exposure to them should be mitigated.

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