Centrifugal step emulsification for absolute quantification of nucleic acids

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Aqueous microdroplets provide miniaturized compartments for numerous chemical or biochemical reactions, and moreover, it enables single-molecular-level identification with limiting dilution process. Herein, we introduce the lab-on-a-disc based centrifugal step emulsification for the fast, easy and cost-effective production of monodispersed droplets. Homogenous droplets in a range from 90 μm to 320 μm of diameter were generated (volume range from 0.38 nL to 17 nL) within a few minutes. Fluorocarbon carrier oil usage per aqueous phase usage was greatly reduced than the conventional droplet generator by more than a factor of 5. Lab-on-a-disc based emulsification can enable sample-to-answer molecular diagnostic system: proceed the isothermal nucleic acid amplification and absolute quantification of the target nucleic acid after droplet formation with no additional handling steps. Compared to conventional digital droplet polymerase chain reaction (ddPCR), the overall process time and cost of digital analysis could be highly reduced.