Electronic Supplementary Material (ESI) for RSC Advances.

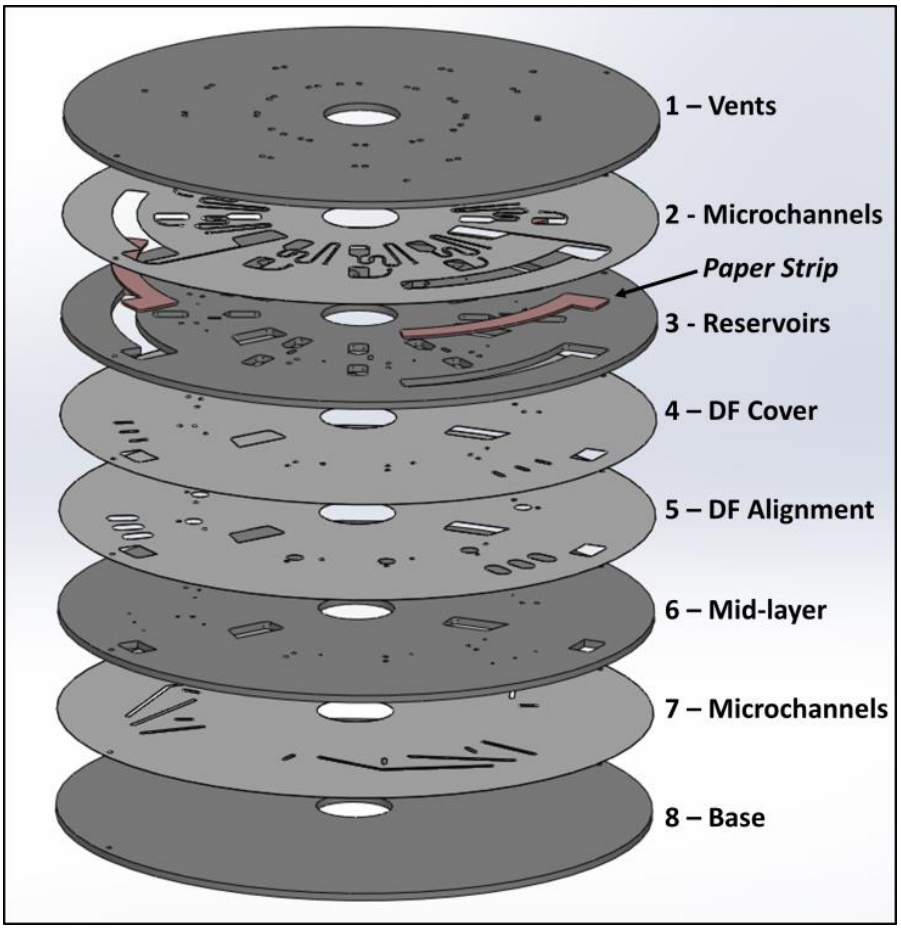

Fig. S1 Schematic of multi-layer disc. Of note, the upper microchannels and lower microchannels are isolated from each other and can thus cross paths. In addition, the paper strips are placed within reservoirs in Layer 3, and, through gentle pressure, adhered to PSA Layer 4. During assembly the dissolvable film, mounted on PSA tabs, are placed within large voids in Layer 5 and then covered by Layer 4.

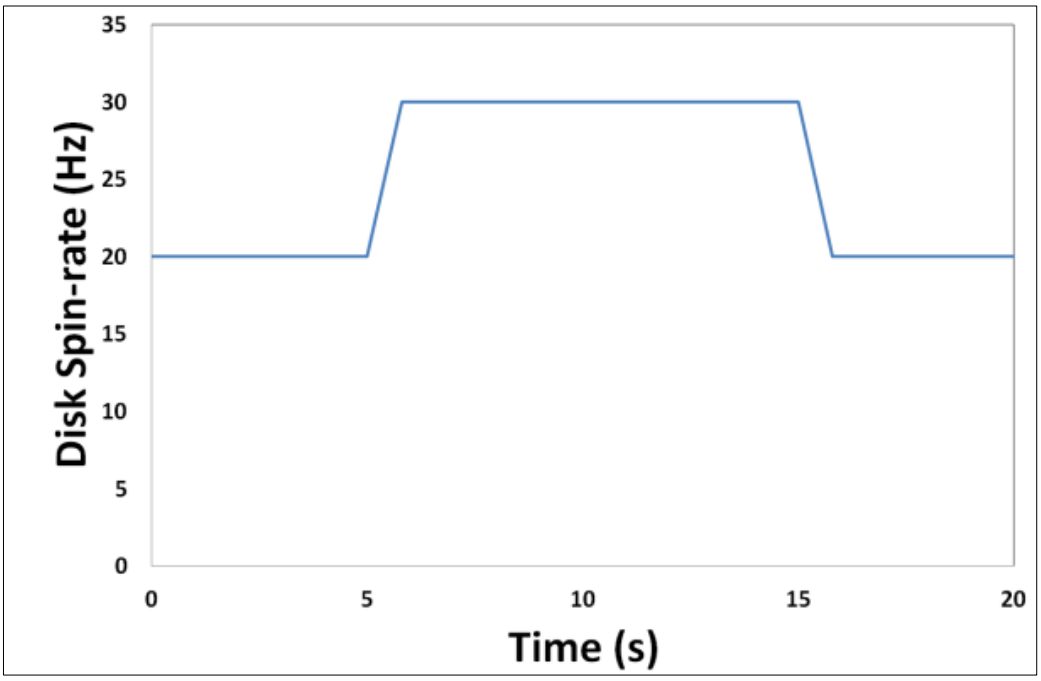

Fig. S2 Spin rate profile of the serial dilution disc which was consecutively repeated throughout the experiments.

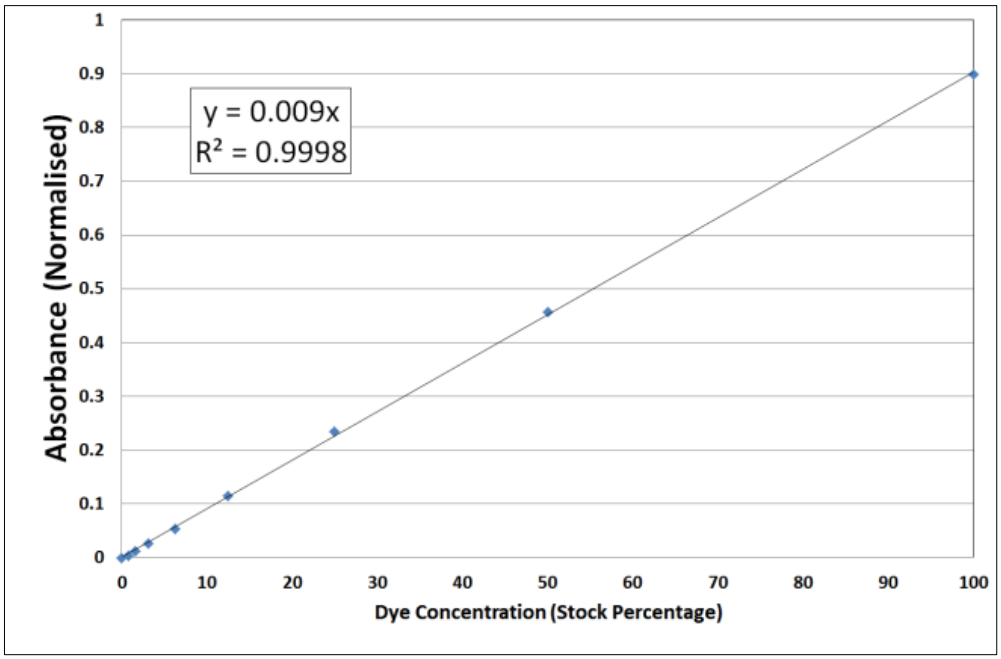

Fig. S3 Initial test to ensure linear relationship between absorbance of Red Food Colour versus concentrations of stock. Absorbance was measured at 505 nm. Note 100% 'Stock dyed water' equates to 1% dilution of food colouring in DI water (data not shown). Concentration of 'Stock' was adjusted to ensure the concentration was within the dynamic range of the spectrograph sensor.

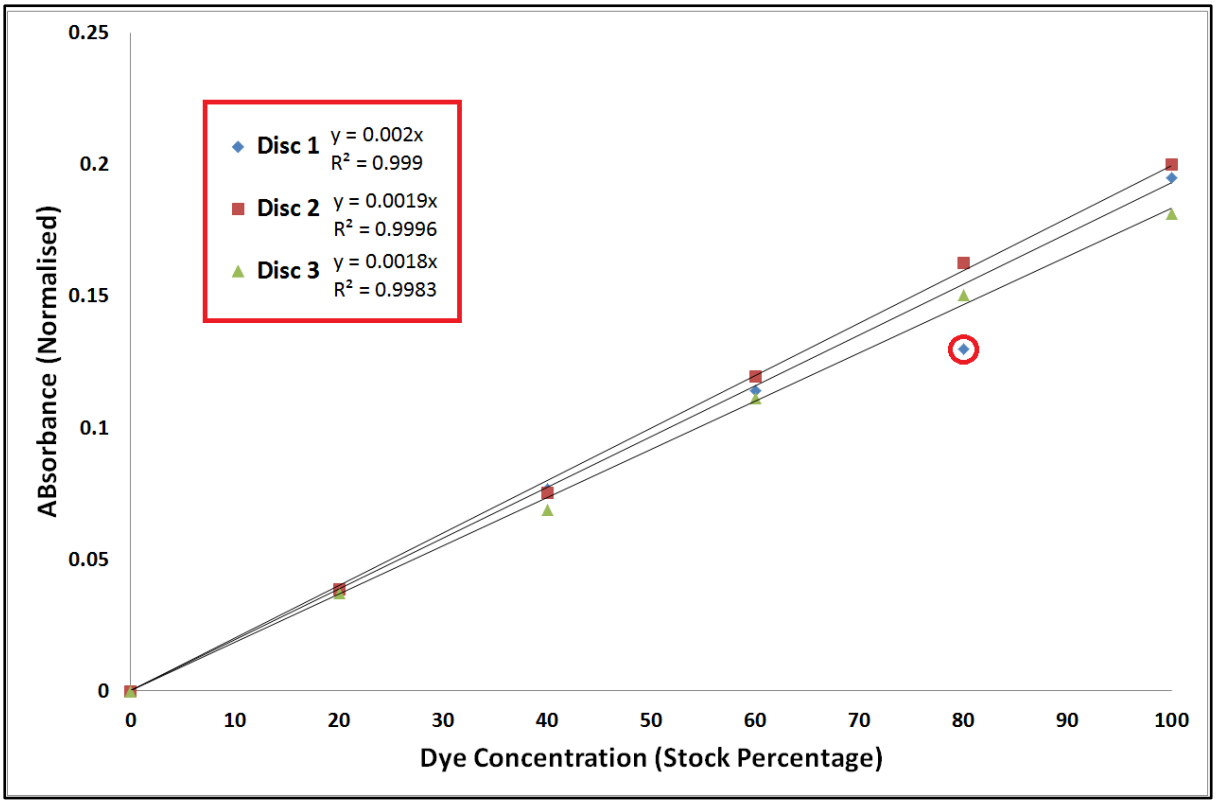

Fig. S4 Standard curves generated from liquid recovered from test discs and measured using photo-spectrometer. Line of best fits and r^2 values for obtained for each disc is also shown. Note that one outlier (circled, for Disc 1) was disregarded during analysis (cause identified as mechanical leakage). These curves were used to estimate the dye concentration generated at each stage in the on-disc serial dilutions.

Method for Analysing Serial Dilution Data

Initially a stock solution of red food dye was created. First, the peak absorbance of this dye was measured (505 nm; data not shown). Next, the stock dilution was selected so that, at volumes measured, the concentrations from 0-100% concentrations were within the dynamic range of the photo-spectrometer.

Following completion of a disc, sample was promptly removed from Read Chambers and Reference Chambers and pipetted (in duplicate 40 µl volumes) into a micro-titre plate. Absorbance was measured at 505 nm. Next, a serial dilution curve was created based on the samples recovered from the Reference Chambers (Fig. S4). Linear relationships ($r^2 > 0.99$) were established. The relationship between absorbance and concentration was then used to calculate the dye concentration present in each of the RC chambers.

Theoretical Model

	Pre-loaded Volume (ul)	Pre-loaded Concentration (%)	Transferred Volume	Moved Concentration	Concentration After Mixing	Volume Moved to Read Chamber	Estimaged Read Concentration
Mix Chamber 1	35	100	35	100	100	30	***85.7***
Mix Chamber 2	35	0	35	100	50	30	***42.9***
Mix Chamber 3	35	0	35	50	25	30	***21.4***
Mix Chamber 4	35	0	35	25	12.5	30	***10.7***
Mix Chamber 5	35	0	35	12.5	6.25	30	***5.4***

Table. S1 Theoretical model assumes that 35 µl of liquid is transferred to the next mixing chamber and mixes perfectly. However it assumes that 5 µl is lost between the mixing chamber (MC) and the read chamber (RC).