dragonfly® crystal: an ideal solution to problematic liquids in screening environments

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introduction

The accurate pipetting of viscous liquids and cross-contamination between wells can be highly problematic when using conventional pipetting technologies, such as air displacement pipetting.

The dragonfly® crystal positive displacement liquid handling instrument eliminates these issues and can be used to optimise assays and formulations in a wide variety of application areas including drug discovery, biotechnology, clinical and food industries.

Very high or very low viscous solutions, such as 100% glycerol, PEGs, alcohols, or detergent solutions, including thixotropic non-Newtonian ones, are easily pipetted with very high accuracy and precision. Liquids are dispensed via a non-contact unique dispensing technology to ensure there is zero cross-contamination between wells and the disposable tips eliminate cross-contamination between samples.

1. dragonfly crystal: digital liquid handler

The novel dispensing technology of the dragonflycrystal digital liquid handler enables dispensing directly into assay plates with a very large dynamic range of 0.5 µL to 4 mL. Independent volume control and simultaneous digital dispensing from up to 10 pipetting tips provide rapid dispensing; less than 5 minutes for dispensing 4 solutions into a 96-well plate and total freedom of plate layout. Suitable applications range from formatting multi-dimensional reagents, optimisation experiments to backfilling of each well with assay buffer or PCR master mix.

2. pipetting technology

A dragonfly crystal is equipped with an array of either 5 or 10 pipetting heads. These utilise positive displacement pipettes providing reliable and accurate dispensing of a broad range of liquids without any classification (Fig 1: A).

The use of disposable syringe and plunger guarantees no cross-contamination. Each pipette works independently to dispense any volume into any well for complete assay flexibility. Each liquid is aspirated from a dedicated easy-to-fill reservoir (Fig 1: B & C).

Unused liquid at the end of a run can thus be recovered resulting in a dead volume of < 0.5 µL. The whole process is achieved without valves, air gaps or system fluid resulting in high reliability.

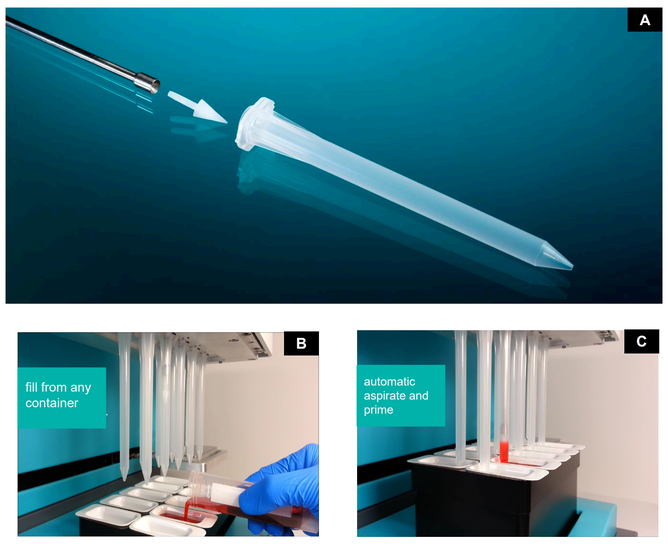

Fig 1: dragonfly crystal's disposable positive displacement pipettes for non-contact dispensing

Independent volumes dispensed simultaneously

3. result of pipetting 100% glycerol: a Newtonian liquid

Fluids may be classified as Newtonian or non-Newtonian. In a Newtonian fluid, there is a linear relation between the magnitude of applied shear stress and the resulting rate of deformation. Newtonian fluids have a constant viscosity (dynamic or absolute viscosity) at a given temperature such as water, ethanol or aqueous solutions of salts and sugar.

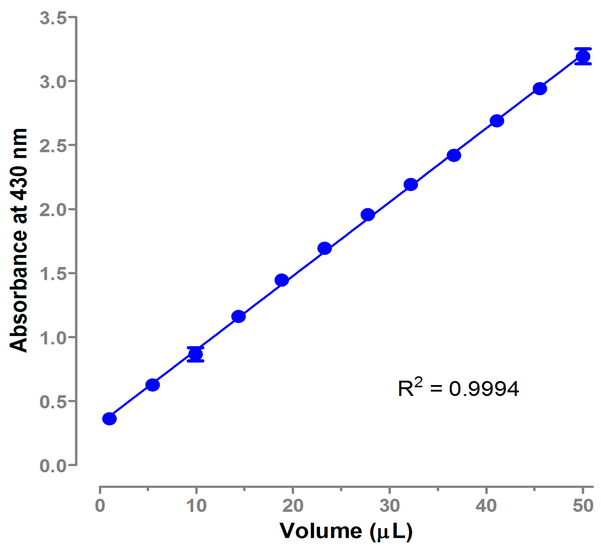

Fig 2: Linearity of dispense for 100% glycerol

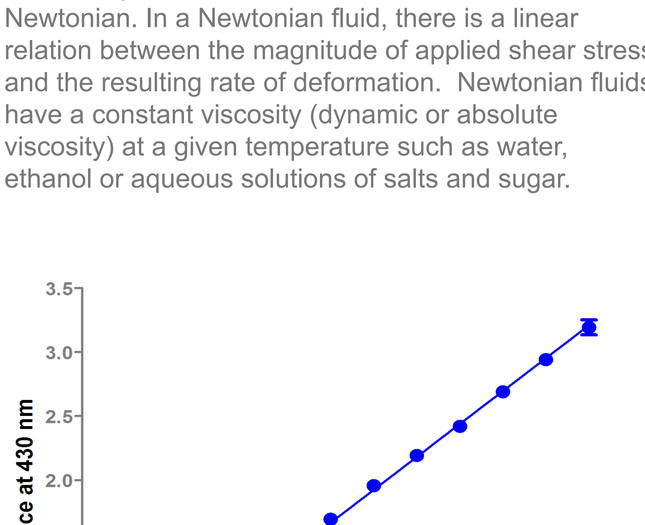

Fig 3: Viscosity vs shear rate of 100% glycerol. The method we used was a rotational rheometer with a cone and plate.

4. result of pipetting a non-Newtonian liquid

A wide range of industrially important liquids, such as solutions of high molecular weight polymers, colloids, suspensions, and emulsions exhibit more complex behaviour, which is termed non-Newtonian. In non-Newtonian fluid, there is a nonlinear relationship between the magnitude of applied shear stress and the rate of angular deformation.

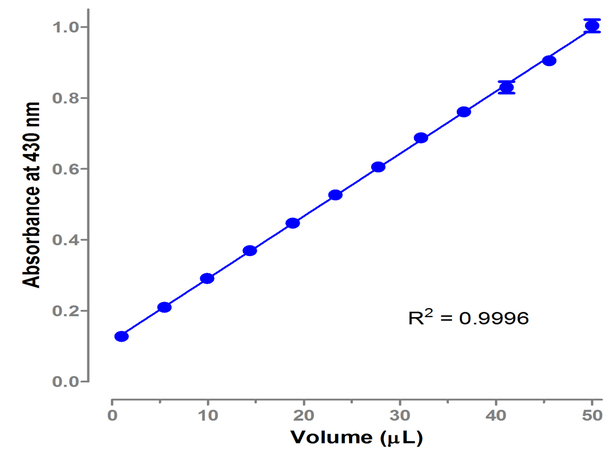

Fig 4: Linearity of dispense of 17.5 mM dyed household detergent using dragonfly crystal

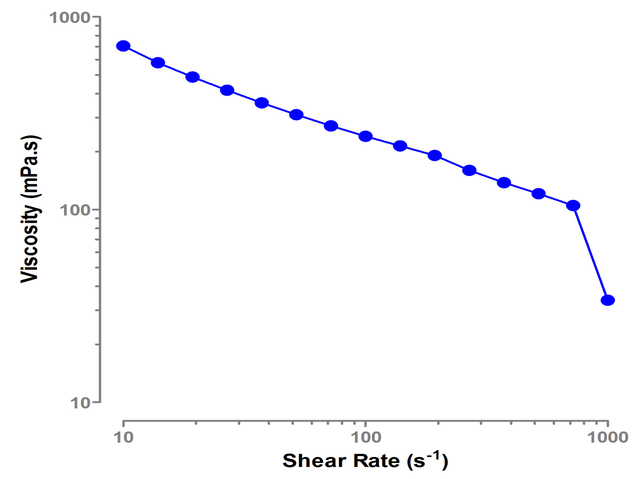

Fig 5: Viscosity vs shear rate. The method we used was a rotational rheometer with a cone and plate

5. pipetting data-accuracy and precision

liquid type	% inaccuracy	% CV
4 µL glycerol	0.18	1.20
4 µL Lutensit	2.50	0.80
4 µL Pluriol P900	2.0	0.73
1 µL Tween 80	1.30	0.91
1 µL Tween 20	1.20	0.89

conclusions

Our work demonstrates:

- dragonfly crystal's ability to pipette difficult liquids that often cause blocking and contamination in an optimisation study
- the dragonfly crystal liquid handler is valuable to the discovery workbench, eliminating the tedium of complicated microplate set-ups while maintaining flexibility