HOW TO USE PHOTOPETTE'S DISPOSABLE CUVETIP CORRECTLY

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- *Photopette is the ideal tool for fast on-spot photometric measurements at the lab bench, in the cell culture hood or outdoors. This application note provides tips and recommendations for the correct use of the device and its disposable CuveTip*

OBJECTIVE

The application note provides additional tips and tricks on how to use the Photopette's CuveTip correctly. It teaches the recommended workflow to perform a measurement and provides information on limitations of the CuveTip. A general introduction to Photopette can be found in the "Photopette User Manual" and "Quick Start Guide" available at the Tip Biosystems webpage. [1,2]

INTRODUCTION

Photopette is a revolutionary first-of-its-kind handheld photometer manufactured by Tip Biosystems Pte Ltd, Singapore. The Photopette device is used with the disposable CuveTip that replaces the classical cuvettes workflow. The system is easy to use by both technical and non-technical users for photometric measurements, and can boost productivity in laboratories or for field measurements. Users are advised to follow the following guidelines for the CuveTip to achieve higher measurement accuracy with the Photopette.

MATERIALS AND APPARATUS

Instruments

- Photopette® device
- CuveTips

Reagents

- As per the requirements of the users applications.

METHOD

In the following section we want to introduce different methods and give some tips on how to work with the Photopette's CuveTip efficiently and to avoid errors.

WHICH CUVETIP SHALL I USE?

Two different CuveTip are available, the "CuveTip Standard" and the "CuveTip Standard Sterile". Both tips can be used for UV and visible wavelength; the only difference between the tips is that CuveTip Standard Sterile is sterilized in a process using ethylene oxide (ETO). For most applications the non-sterile tips are fine. For cell culture work and any work where microbial contamination must be avoided, we recommend the use of sterile tips. Although, CuveTips are manufactured with high standards and in clean environment, however the current tips cannot be ascertain to be DNAse/RNAse free. The user is advised to evaluate contamination risk before performing the measurement.

HOW TO USE THE CUVETIP CORRECTLY?

There are four steps towards proper use of CuveTip: 1) Attach the tip, 2) immerse the tip into the sample and measure, 3) retract the tip from the sample, and 4) eject the tip from the device. Its use is simple and convenient, however some recommendations need to be followed.

Attach

Take the Photopette device, open the tip box and pick up a new CuveTip from the box. Ensure that the CuveTip is adjusted and there is no gap between the tip and the device. Close the tip box to avoid contamination.

Immersion and measurement

Hold the Photopette device at an angle of 20-30 degree with the CuveTip cavity pointing upwards. Then immerse the tip slowly into the sample. Immerse the tip at least 3 mm and maximal 15 mm. Check that no air bubble was formed. In case an air bubble is formed, gently tap the CuveTip onto the wall of the sample container. Proceed with your measurement once the bubble is removed.

Retract

Retract the CuveTip in the same way it was immersed at a 20-30 degree angle and observe if the liquid flows out from the CuveTip cavity. In case the liquid does not flow out, tap the CuveTip gentle onto the wall of the sample container. Repeat if necessary. Alternatively, please use a 5 µl micropipette to pull-in the sample.

Eject

Insert the CuveTip into the ejector box opening. Turn the device at least 60 degree to eject the tip from the stem of the device. The device is now ready for the next measurement.

WHAT IS THE MINIMAL SAMPLE VOLUME AND SAMPLE CONSUMPTION?

Contrary to other spectrophotometers, Photopette needs an immersion depth and not a minimum sample volume. CuveTip is a substitute for the classical cuvette and has to be immersed into the sample liquid sample for at least 3 mm. Depending on the container holding the sample, different minimal volumes are required as given in Table 1.

Container	96-well plate	500 µL reaction tube	1.5 mL reaction tube
Minimum volume (µL)	~120	~120	~150

Table 1: Minimum required sample volumes in different sample containers.

The liquid sample will flow into the cavity of the CuveTip when immersed at a minimum of 3 mm. The maximum immersion depth is about 15 mm. The CuveTip cavity is holding about 40 µL of sample. Due to the adhesion of the sample onto the hydrophilic CuveTip a volume of ~12 µL remains on the tip and is consumed in every measurement.

A TRICK TO REDUCE SAMPLE VOLUME TO 40 MICROLITER

It is possible to reduce the sample volume to ~40 µL by using the following trick. Attach the CuveTip and perform auto-zero. By using the same tip or after changing the tip, place the Photopette device in the stand and pipette-out about ~40 µL sample directly into the cavity of the CuveTip. Check that no bubble was formed and perform the measurement as usual. Use the pipette to retrieve the sample from the CuveTip for reuse.

HOW TO PERFORM AUTO-ZERO MEASUREMENT?

The auto-zero is performed before measuring the sample. It is the same procedure as used in any other spectrophotometer.

Blank sample

The auto-zero is performed in a sample that does not contain the analyte to be measured, this is called a “blank”. The error can be further reduced if the same sample matrix is used for the auto-zero, e.g. sterile media without cells for a cell count measurement. Often, the sample matrix is not available. A media close to the sample should be used in such cases, e.g., buffer or DI water can be used as blank for the auto-zero.

Auto-zero and sample measurement with the same CuveTip

The smallest error is achieved when the same CuveTip is used for auto-zero and the measurement. However, this is only possible if cross-contamination between the blank and the sample is not an issue—and for consecutive measurements between different samples is not critical. For example, in environmental measurements, the auto-zero is performed in DI water and measurements are performed directly in a lake water. Another example is the establishment of a calibration curve where the calibration samples are measured from low concentrations to large concentrations using the same tip. If the same tip is used, the user must make sure that no blank or sample remains in the CuveTip cavity. Residues can be removed by cleaning the CuveTip cavity with a *clean-wipe*. This way only a minuscule volume of the old sample is transferred into the new sample. In most cases such small volumes are negligible.

Auto-zero and sample measurement with different CuveTips

If sample contamination is critical, a new CuveTip has to be used after auto-zero and for any consecutive measurement. This is usually the case for cell culture and microbial work. Due to the unique design of the CuveTip, the sample never comes in contact with the Photopette device. Therefore, contamination and cross-contamination between samples can be totally eliminated by using a new CuveTip for every measurement.

HOW MANY TIMES CAN I REUSE THE CUVETIP?

CuveTip is a disposable and is recommended for single use. If sample cross-contamination must be avoided we strictly recommend to use a new CuveTip after every measurement. The same applies for sterile tasks where the CuveTip Standard Sterile should be used and changed for each new sample measurement.

CAN I USE THE CUVETIP IN SOLVENTS OTHER THAN WATER?

Yes, the CuveTip can be use in certain organic solvents such as methanol, ethanol and their mixtures with water. The compatibility for solvents is given in the Photopette user manual. [1]

AT WHAT TEMPERATURES CAN I USE THE CUVETIP?

The CuveTip is designed to be used at around room temperature; it can be safely used from 10 to 40 °C. The material of the CuveTip is a thermoplastic which deforms at higher temperatures. We have performed measurements successfully at higher temperature of up to ~70 °C for a measurement lasting less than five seconds. A user shall

perform control experiments to ensure error-free measurements for measuring at high-temperature.

CAN I CLEAN THE CUVETIP?

The CuveTip is a high precision optical product with polished windows and mirrors. We do not recommend to clean the CuveTip. Cleaning may scratch or otherwise damage the optical surfaces of the CuveTip and make it unusable for error free measurements.

DISCUSSIONS

ADVANTAGES

If used correctly, the Photopette provides ultra-fast, accurate and reliable measurements at the lab-bench or in the field. Due to its simple workflow and intuitive iOS and Android app, a non-expert user can perform error-free photometric measurement. The disposable CuveTips are available as non-sterile and sterile tips to eliminate any chemical and microbial cross contamination of samples.

LIMITATIONS

A minimal sample volume of ~120 µL is required for measurements. With a simple trick highlighted in this application note, the volume can be reduced to 40 µL. A measurement consumes about 12 microliter sample due to its adhesion on the hydrophilic CuveTip. Unless specified, the Cuvetips should not be considered as Nuclease-free.

SUMMARY

This application note outlines several tips to make working of Photopette and CuveTips easy and convenient. More application specific Application Notes are available on the company's webpage. [3]

REFERENCES

[1] "Photopette User Manual V1.0.0" Tip Biosystems Pte Ltd, Singapore, 2016.

{2} Quick Start Guide, Tip Biosystems webpage at URL www.tipbiosystems.com

[3] Application Notes, Tip Biosystems webpage at URL www.tipbiosystems.com