[Interview]

Easy To Use Electronic Pipettes Reduce Burden On Researchers

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The unnecessary burden placed on researchers by difficult to use equipment leads to reduced accuracy in research and experiments. Today's example, the pipette, is a scientific instrument used to extract very tiny amounts of liquid for measurement or transport. They are frequently used in experiments as well as research and require precise operation. About one year has passed since one electronics manufacturer in the measurement and medical equipment fields released electronic micropipettes with the idea of "freeing researchers from fatigue". One researcher began using these electronic micropipettes late last year and saw improved accuracy of his experiments.

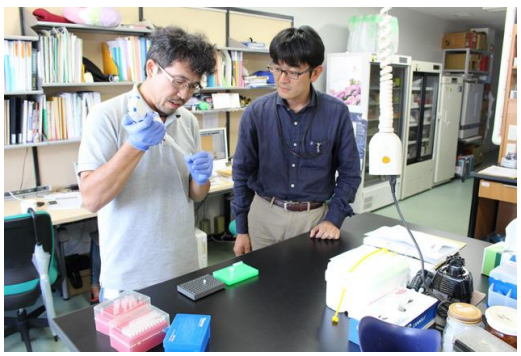
Professor Kanda, an associate professor who researches regenerative medicine at Kansai Medical University's Department of Public Health gave us his thoughts about the pipettes he introduced to his lab.

Laboratory instrument usability influences experiment accuracy

Professor Kanda works in the fields of regenerative medicine and molecular cell biology. For example, he studies the differentiation of pituitary cell lines using mouse stem cells with a goal of future clinical application. Experiments involving cell cultures are essential to make progress with research. DNA expression is analyzed through a process that starts by extracting DNA and RNA from cells, then preparing them with a Polymerase Chain Reaction sample (PCR sample, used to selectively amplify a part of DNA) and finally combining them with a reagent.

"In these experiments, a micropipette is used to measure and dispense a small volume of liquid accurately. In the case of a cell culture, 100 μL suspensions of cells are dispensed 96 times into a microplate. The utmost accuracy is required while handling these extremely small amounts of liquid. Moreover, the cells will gradually sink as time goes on so performing actions quickly is crucial. For dispensing into a 96 well microplate the micropipette must be pressed down 96 times."

Pressing a pipette down only once requires hardly any effort at all. However, pressing a pipette down repeatedly for 96 times over a short duration is a different story. Furthermore the attention to detail that must be paid only adds to the fatigue. Researchers perform hundreds of operations with a pipette everyday and sometimes develop serious inflammation.



Pipette operation under Professor Kanda's instruction

“Rushing an experiment leads to sloppiness and inaccuracy. Research in the laboratory is carried out by the undergraduate and graduate students who I trust and have been instructed in correct operation. That said, unavoidable differences in skill do appear. Additionally, dispensing 96 times in a row again and again causes the fingers to be quite fatigued. Half of the researchers in the laboratory are women and I was concerned about the burden on them.”

When researchers become tired some develop shaking fingers. This can lead to slight deviations in the way the pipette is pressed. Even while using the utmost care fatigue causes deviations that ruin results. Professor Kanda was looking for a way to address this problem.

10 years later, a second take on electronic pipettes

Electronic micropipettes guarantee accuracy of the dispensed amount and allow anyone dispense an accurate volume. Professor Kanda, interested in their usability, got his hands on electronic pipettes when they were first announced 10 years ago.

“They were terrible. I bought 2 devices at about 100,000 yen a piece but now they lie unused in a corner of the lab.”

The increased accuracy gained from using electronic pipettes came at a price; they were difficult to use.


Professor Kanda recalling the release of the first electronic pipettes

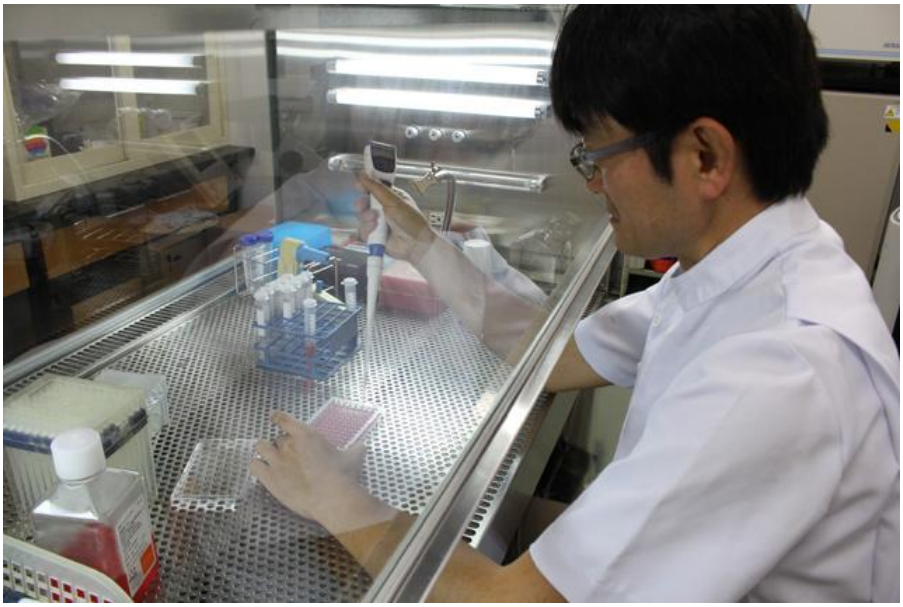
“They were large and heavy, which made them extremely hard to handle. The settings were confusing and operability was poor. The low battery life made things worse and caused batteries to run out quickly. Also they were expensive. I honestly thought they were worthless. My impression of electronic pipettes then was so low that when I heard that a new one was announced I had almost no interest at all.”

However, in the last ten years, the electronic pipette design has made startling technological improvement, and with the lowered price for parts the micropipette price has also fallen to about a third of the previous amount.

“I figured for that price it was worth it to try. When I got a hold of one, the first thing I noticed was the compact size. The design that, according to the manufacturer, thoughtfully positioned the center of gravity indeed made the pipette feel weightless. There were many features such as one that made mixing solid samples and liquids easier. The functions were intuitive and didn’t require following the manual step-by-step. The device was very easy to use. I wanted to purchase several pipettes at once because of the many advantages and the low price.”

Our staff have no trouble using it and excellent results are guaranteed regardless of the skill or experience of the person using it. These are the obvious merits. However, to actually introduce them to his lab he needed to prove their accuracy. Professor Kanda carried out a comparison test between the electronic

micropipettes and the manual micropipettes that he had been using.



Performing an experiment with an electronic pipette

Data to back up the high accuracy of electronic micropipettes

In the comparison test electronic and manual micropipettes were used to prepare two of the same samples each and the results were then compared.

“If you look at this graph the results are obvious. The waves of the electronic micropipette are equally spaced (diagram 1). On the other hand for the manual pipette as the dilution increases the spaces tend to become narrow (diagram 2). If you look at the standard curve, you see the manual pipette has a correlation coefficient of 0.98917 (diagram 3), and the electronic micropipette has a correlation coefficient of 0.99436 (diagram 4). The electronic micropipette does a better job of dispensing accurately.”

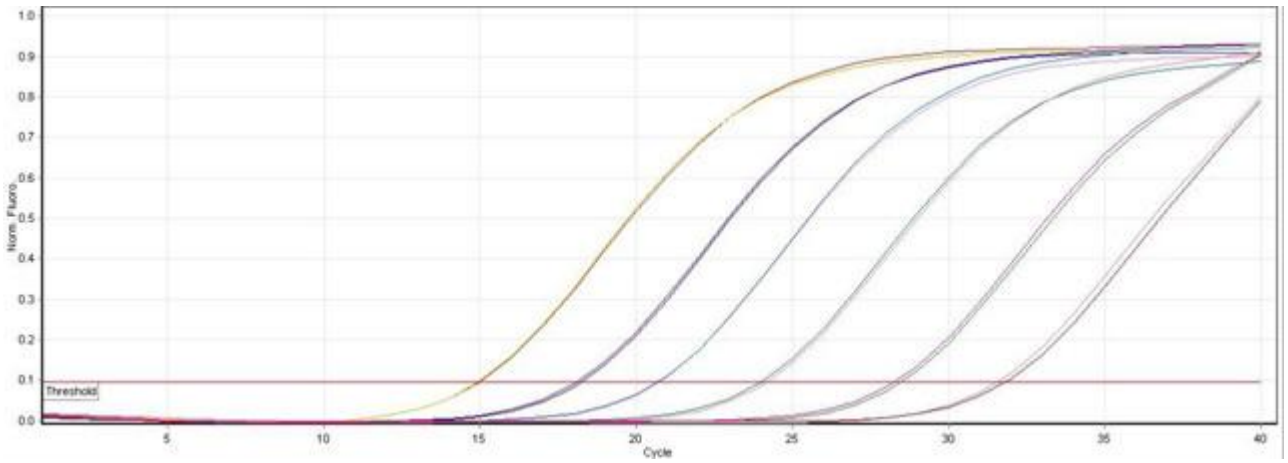


Diagram 1. Results for electronic pipette

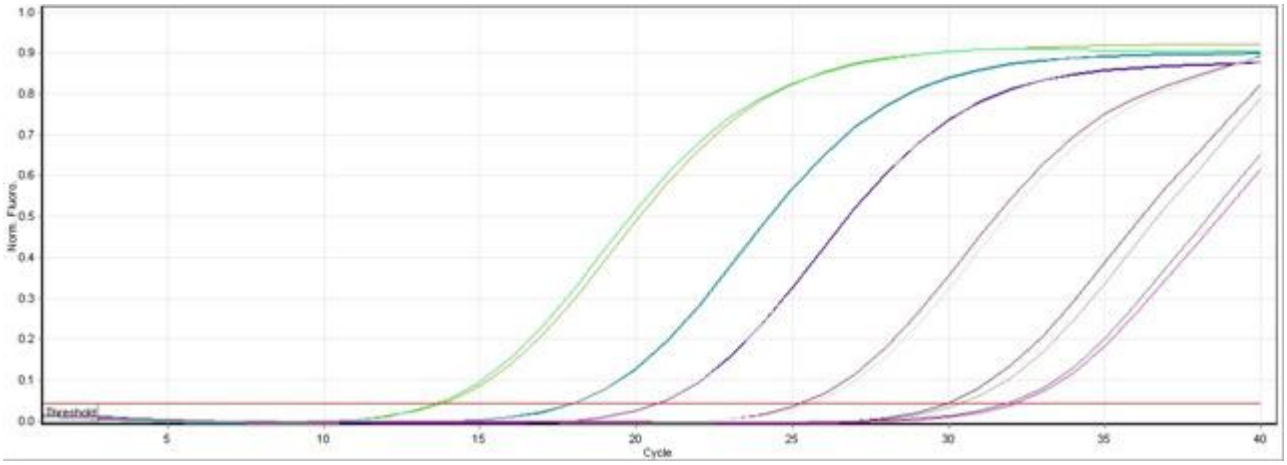


Diagram 2. Results for manual pipette

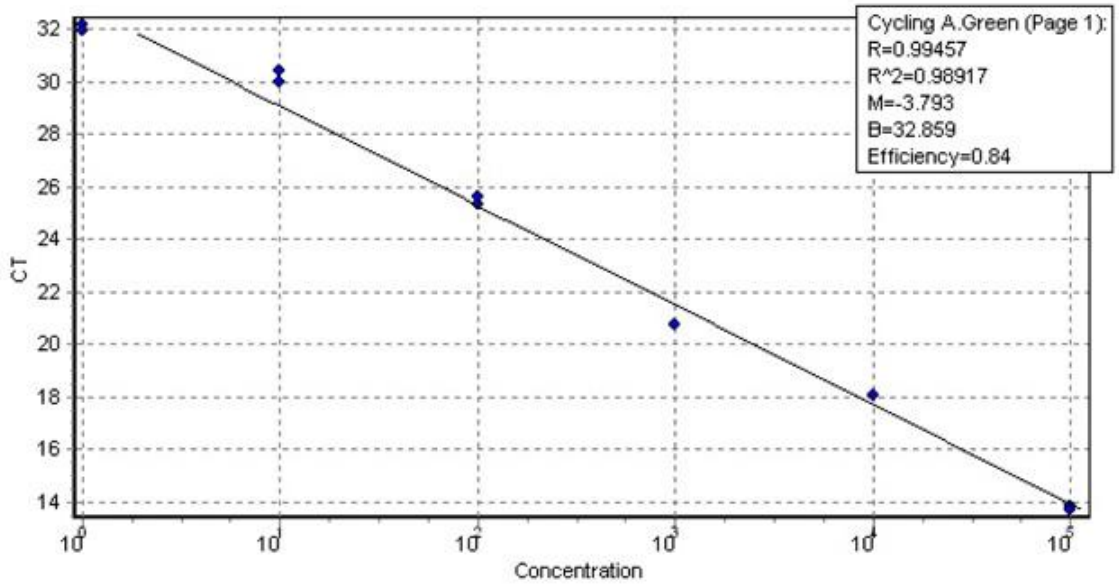


Diagram 3. Standard curve for manual pipette

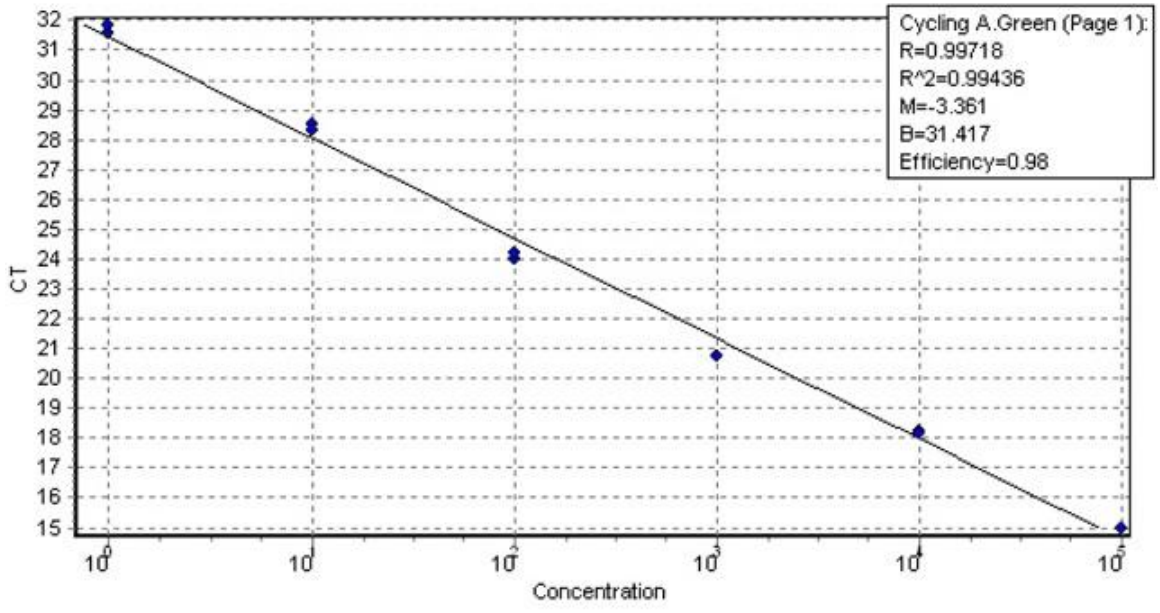


Diagram 4. Standard curve for electronic pipette

There is also the problem of accuracy deterioration over time. With manual pipettes there is a potential for reduced accuracy from dropping or o-rings becoming worn from use. Due to this, regular pipette checks are another difficult problem for researchers on top of their already busy work schedules.

“Occasionally the manufacturer comes to check the pipettes and finds errors that we didn’t know we had. If we used electronic pipettes such errors would be unlikely to occur in the device. Even if there were errors they could be corrected easily with the user calibration function. Also there would be no fatigue after dispensing many times. The reason for this, as I was told beforehand, is the aspirating and dispensing button is activated by the index finger and not the thumb. Researchers used to using their thumbs to press the pipette were a little confused at first but once they became used to it they praised the ease of use of the electronic pipette.”

The benefit of detailed support from a Japanese manufacturer

“If there is anything I don’t understand I can contact a representative immediately for direct consultation. I am grateful that I can get a response when I need it. However, I didn’t have to read the manual at all to use it normally. Such high usability must be the distinctive quality of a Japanese manufacturer. I also feel that the fact that this company had a late start in pipette manufacturing made their devices so detailed and intuitive.”

They are just pipettes, yet they are still pipettes. Experiment instrument usability can affect research results. Presently, Professor Kanda’s lab uses A&D’s MPA series of electronic micropipettes. It has been about half a year since his lab made the switch to electronic micropipettes and so far operability has been excellent and experiments are proceeding superbly.

(Collaboration with A&D Company, Limited)