Feature Article

50th Anniversary Product

Development of a Palmtop-type Blood Cell Counter

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Recently, Point of Care Testing (POCT) to perform lab work at clinics or nursing work is gradually showing signs of predominance. HORIBA is developing a palmtop blood cell counter that is a major medical product utilizing its MEMS technology. This report describes the characteristics of the HORIBA palmtop-type blood cell counter and major targets in its development.

Introduction

There is an ever-growing need for Point of Care Testing to perform laboratory tests and on-the-spot of medical checkups. To meet the need, we are now developing a palmtop blood cell counter that is a major medical product. It is a prime requirement to downsize the blood cell counting sensor and preprocessor to perform dilutions, etc. With this in mind, we integrated the sensor into a chip and the preprocessor into a cartridge based on the MEMS (Micro Electro Mechanical Systems)*1 technology owned by HORIBA. We are now in the final experimental stages.

*1: A nano-processing technology for applying semiconductor manufacturing technologies.

Product Characteristics

This product is an innovative small-sized blood cell counter. It is supposed that this palmtop-type (palm-sized) blood cell counter will allow development of new markets such as custom-made therapies and emergency care, etc. Figure 1 shows a prototype small-sized blood cell counter. Figure 2 shows an experiment.

Figure 1 Small-sized Blood Cell Counter Prototype

Figure 2 Experiment

Important Factors in Development

Important factors of the development include miniaturization of the counter, and a sampler and sensor integrated into a cartridge. A disposable cartridge cuts out the need for cleaning and prevents the specimen from being polluted by other specimens. The most important factor in these engineering developments is that electrolytic air bubbles cause obtrusive noise. Conventional electrodes are formed upstream and downstream of the aperture. Air bubbles are generated from each electrode through electrolysis. In conventional devices, most of the air bubbles generated are released into the atmosphere with no problem. However, in our sensor the flow channel is sealed inside the sensor in order to miniaturize it. Therefore, air bubbles generated at the electrodes all pass through the aperture causing noise. In order to solve this problem, we made a three-forked aperture by utilizing MEMS technology and formed an electrode at the two flow channels downstream. As a result, air bubbles generated do not pass through the aperture. We have realized a sensor chip that can count blood cells [1]. We are now considering resin treatment technologies and functional designs, and making trial models to integrate the sensor and diluter into a cartridge. We aim to conceive a sensor cartridge that is both low in cost and high in functionality.

Conclusion

We are developing methods for measuring various items and making an in-situ measuring system that can change its functionality by using interchangeable cartridges. It is also necessary to develop minimally invasive (ultratrace blood drawing, painless needles, etc) or non-invasive (no blood drawing, measurement by ultrasound, infrared, etc) diagnostic units and blood collecting devices for health checkups.

Reference

[1] K. Miyamura, Development of Blood Cell Counter for Point of Care Testing (POCT), *Readout English Edition,* **8**, 56-61 (2004).