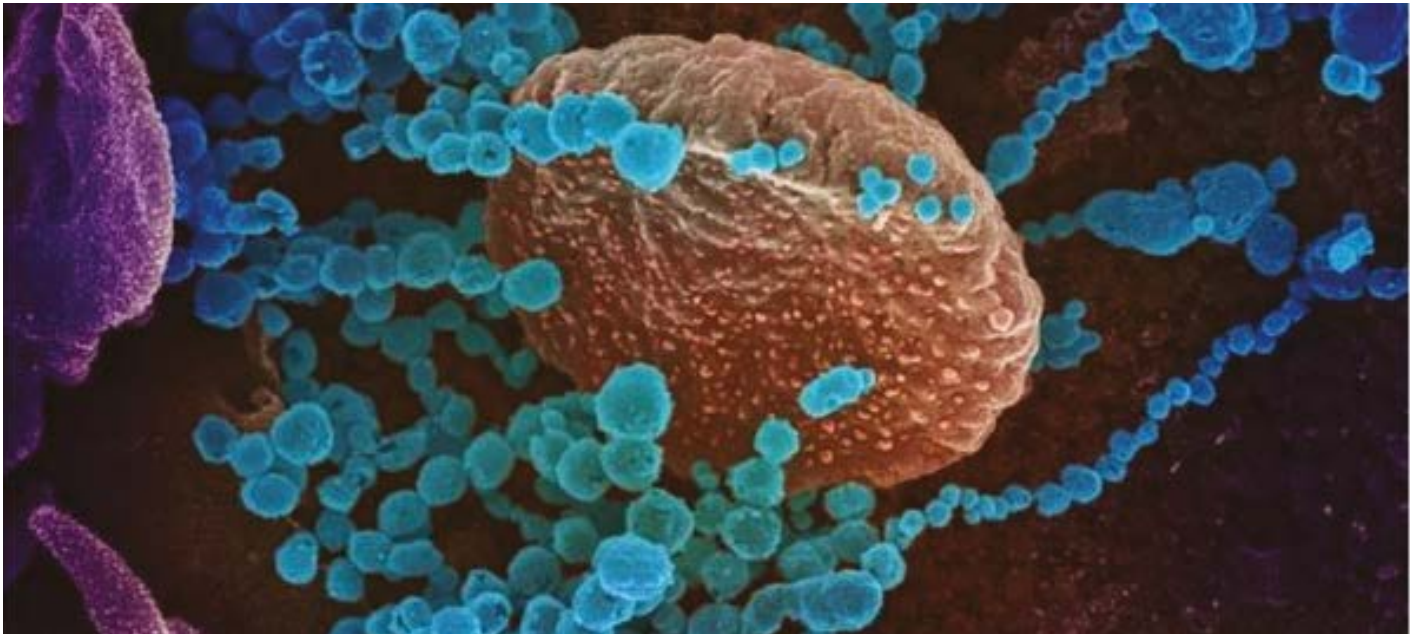


LGC, Biosearch Technologies Accelerate Probe and Primer Production to Enable COVID-19 Testing with the SP Genevac HT Series 3i Evaporator

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As the novel coronavirus (COVID-19) pandemic is progressing throughout 2020, it has become evident that millions of testing kits are needed internationally every single day. This article explores how a leading provider of tools and technologies for genetic analysis, LGC, Biosearch Technologies, is aiding in the fulfilment of this demand, assisted by evaporation technology from SP Genevac.

How the scientific community has responded to the COVID-19 pandemic

Previous pandemics did not see the rapid, global development of testing kits from labs in their hundreds. However, the emergence of the novel coronavirus, caused by the SARS-CoV-2 viral strain, saw this swift production of testing kits.

In February 2020, the US Food and Drug Administration (FDA) relieved restrictions on laboratories and companies developing their own tests for the SARS-CoV-2 virus. This lift on restrictions led to a quick increase in testing numbers. This increase has proven necessary because in the USA, it could be that between 5 and 20 million tests per day are required in order to achieve effective widespread population testing. While the world works towards developing an effective vaccine for COVID-19, the power to contain the virus remains in testing for infections.

How can we test for COVID-19?

There are two main types of test for COVID-19: a viral test and an antibody test. The most widely used type of test is a viral test, which employs Reverse Transcription Polymerase Chain Reaction (RT-PCR) to look for active infection with SARS-CoV-2.

This viral test usually includes collecting a sample from the back of the nose and throat. Contrasting this is the antibody test, which uses a blood sample, and is able to pick up current or past infections by detecting a person's immune response to the coronavirus. Antibody tests take longer to develop than PCR tests, which became available very rapidly after the genetic sequence of SARS-CoV-2 was published.

Genetic analysis has used PCR as an approach for a long time, and it has become long established and widely used. With an RNA virus such as SARS-CoV-2, a DNA copy of the genetic material is produced. This copy is then greatly amplified by adding enzymes, master mix, probes, and primers. An explanation of probes and primers is detailed below.

Primers are oligonucleotide sequences that hybridize in order to target sequences on the single-stranded DNA during amplification. This initiates copying and facilitates the probe's ability to couple, clear and release the reporting fluorophore. N, E, and RdRP genes are the viral genes that have been targeted so far.

Probes are fluorescently labeled oligonucleotide sequences. They hybridize with DNA target sequences as the copies are taking place. While this happens, light is emitted. As more of the target sequence is copied, the more hybridization will take place, and the amount of light emission will increase as a result. This increase in light emission can be detected, and measuring this will be used to determine if SARS-CoV-2 is present in the sample.

How LGC, Biosearch Technologies is responding to testing demands

LGC, Biosearch Technologies is one key company that has been responding to demands for test kits. This brand offers tools and technology for genetic testing applications, and regularly caters to agrigenomic and molecular diagnostics customers.

LGC, Biosearch Technologies has a very wide portfolio of products, and the areas of application for their products cover:

- Sample preparation
- Amplification
- Cloning and expression
- Next generation sequencing
- Custom oligonucleotide synthesis
- Nucleic acid chemistry reagents

LGC, Biosearch Technologies is experienced in pandemics and previously scaled up their oligonucleotide manufacturing during the 2009 swine flu (H1N1) outbreak.



Image credit: LGC, Biosearch Technologies

During COVID-19, LGC, Biosearch Technologies has been accelerating their production of oligonucleotides, along with other ranges of critical components, from RNA viral purification kits and master mix, to enzymes for one-step RT-qPCR.

LGC, Biosearch Technologies are an acceptable commercial supplier of 2019-nCoV probe and primer kits qualified by the Centers for Disease Control and Prevention (CDC) and in accordance with the CDC's Emergency Use Authorization (EUA).

These probe and primer kits comprise of FAM-BHQ probes and primers that target N1, N2 and RNase P signatures, which is required by CDC protocols. Oligos are delivered dried and are shipped at ambient temperature.

LGC, Biosearch Technologies are also responsible for delivering large-scale probes and primers, created using sequences designated by the Charité protocol, which enables up to 100,000 tests per order. Along with these testing kits, LGC, Biosearch Technologies also provides custom, bulk oligonucleotides based on customer-supplied sequences.

Due to their past experience operating in pandemics, and by prioritizing orders concerned with the current COVID-19 pandemic, LGC, Biosearch Technologies is enabling customers to address the demand for COVID-19 testing goals.

However, there are problems that can slow production workflow. One particular bottleneck for LGC, Biosearch Technologies, in the production of their oligo products from synthesis to customer distribution, is seen in the drying process. The output from the synthesis labs and purification group can far outweigh the aliquoting, loading and drying workflow, which causes workflow to slow down upstream.

The probes and primers being produced to address the testing demands during COVID-19 have to be accurate and reliable. In addition to this, it's essential that the production process is scalable. LGC, Biosearch Technologies is using SP Genevac technology in order to facilitate the rapid production of probes and primers, and creating them to the high standards needed in this extremely challenging situation.

LGC, Biosearch Technologies uses the SP Genevac HT S3i evaporator to dry down the probes and primers for SARS-CoV-2 detection and custom orders. Any water left in the samples from inadequately dried oligos can be detrimental to the probes and primers over time. Due to this risk, it is crucial that the oligos are properly dried before they are shipped. The automatic End-of-Run detection feature is programmed in all pre-set methods to identify when the samples are dried completely and move to the next stage. An alternative drying method is freeze-drying, especially if long-term storage is needed. The SP Genevac HT S3i possesses a range of features that allow this process to be rapid and reliable.

Probes are light sensitive and too much exposure to light could lead to degradation to produce false results. On the HT S3i the lamp positioning, coupled with the aluminium sample holders, will accelerate the drying process without compromising and damaging the probes by light.



SP Genevac HT S3i Evaporator

The capacity of SP Genevac technology is equivalent to 3-4 times that seen with other dryers being utilized within the production workflow. The drying time is also roughly equivalent. Other products are also able to be dried alongside the COVID-19 oligos, which eliminates the risk of backlogs in production lines for oligos not created specifically for COVID-19 customers.

Through parallel capacity, the model facilitates high-throughput evaporation, which avoids the risk of bottlenecks occurring in the production of test kit components. Alongside this benefit, it also carries a number of patented technologies that ensure speed of production does not have harmful effects on accuracy.

This includes SP Genevac's SampleGuard temperature control that preserves the integrity of samples, to Dri-Pure anti-bumping sample protection, which guarantees against contamination and sample loss. This dual functionality enabling the drying and freezing of samples offers a unique feature to this particular oligo synthesis application.

Why is testing so important?

Testing for COVID-19 is essential because it is the only method to confirm a case of the infection. It is not sufficient to diagnose a case of COVID-19 using the symptoms alone. Although this is the chief reason why testing is so crucial, the list expands far beyond this.

For instance, testing is the only way we can adequately understand virus transmission and the pandemic as a whole. When considering research, testing it can also elucidate how the virus affects different populations.

Entire regions and industries are effectively shut down, and this is true on a global scale. As such, it is of paramount importance to know whether shutting down these areas and industries are in fact preventing the transmission of the virus. Once it becomes necessary to re-open sections of society (whether that pertains to geographical restrictions being eased or the reopening of certain industries), it will also be important to carry out increased testing in order to allow uninfected people to work.

When an individual has tested positive for COVID-19, it makes way for quarantining, and contact tracing, especially if the test catches the infection in its early stages. Both quarantining and contact tracing are considered essential measures for containing the virus.

As there is no vaccine available at present, this testing, quarantining, and contact tracing strategy is the only viable option for controlling the epidemic. Testing is also able to reveal the infection in asymptomatic carriers, who make up for approximately 50% of those infected, and are thought to play a significant role in spreading the disease.

Acknowledgments

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