Applied Biosystems 3400 DNA Synthesizer

- Stand-alone functionality, fully programmable
- Four-column simultaneous synthesis
- Automatic dilution of bases
- Automatic analysis of synthesis coupling efficiency
- Fast cycle time; online cleavage

Introduction

The Applied Biosystems 3400 DNA Synthesizer is a versatile, four-column, benchtop instrument designed for 40-nmol, 200-nmol, and 1-µmol synthesis scales. Simultaneous synthesis and cleavage of four oligonucleotides (25-mer at 40- or 200-nmol scales) requires approximately four hours.

The instrument is upgradable to accommodate larger phosphoramidite and reagent bottles, which doubles the capacity without requiring additional hands-on intervention. Fast cycle times, automated functions, and multiple bottle positions allow for specialty chemistries and provide flexibility for low-throughput laboratory applications.

Proven Phosphoramidite Chemistry

Applied Biosystems phosphoramidites enable oligonucleotides of the highest purity. User-optimization of cycles makes possible synthesis of high quality RNA* and phosphorothioate DNA. In addition, specialty phosphoramidites are available at all three scales for 5′ fluorescent labeling (6-FAM™, HEX™, and TET™ dyes), biotinylation (Biotin), phosphorylation (Phosphalink® phosphoramidite), amine addition (TFA Aminolink™ reagent), and other applications. Specialty phosphoramidite bottle positions allow you to add labels and linkers automatically during synthesis to produce modified oligonucleotides.

*RNA synthesis is not supported by Applied Biosystems.
Please contact your RNA chemistry provider for application support.

Easy and Reliable

The 3400 DNA synthesizer is designed for application versatility, dependability, and ease-of-use. Automatic phosphoramidite dilution, electronic synthesis monitoring, and automatic cleavage enable a largely hands-free operation. Default synthesis cycles can be easily modified by the user for special synthesis requirements.

Trityl Conductivity Monitoring

The AutoAnalysis trityl monitor is a standard feature of the 3400 DNA synthesizer. It is composed of individual conductivity detectors that measure the trityl cation flowing out of each synthesis column. Trityl conductivity monitoring eliminates the need for a fraction collector and manual handling of potentially hazardous trityl samples. By automatically measuring the amount of trityl cation released during detritylation, the 3400 synthesizer indirectly monitors the quality of the ongoing synthesis and displays the results automatically at the end of the synthesis run.

Trityl conductivity monitoring data are useful for the early detection and diagnosis of instrument- or chemical-related problems. Direct measurement of oligonucleotide quality by confirmatory analytical methods such as reverse-phase or ion-exchange HPLC, capillary electrophoresis, or mass spectrometry is highly recommended. For additional information regarding trityl monitoring data interpretation, please contact your local Applied Biosystems representative.

Compact and Convenient

The 3400 synthesizer is designed to fit on the benchtop. Changing bottles on the instrument is fast and convenient. The synthesizer is equipped with eight phosphoramidite bottle positions, sufficient for two complete sets of DNA monomers, a set of DNA and RNA monomers,* DNA monomers of different molarities, or specialty amidites such at 6-FAM™, HEX™, and TET™ dye monomers, Biotin, Phosphalink®, or TFA Aminolink™. You can choose to cleave your oligonucleotides and dilute phosphoramidites in acetonitrile automatically on the instrument.

Segregation of chlorinated from non-chlorinated waste minimizes hazardous materials disposal. Acetonitrile, TCA, and DCM are manufactured in large bottle sizes to reduce the number of bottle changes required. An optional extended-capacity upgrade is available to accommodate 2-g phosphoramidite bottles and larger volume reagents.

Fully Programmable Cycles

You can choose predefined synthesis cycles or customize the cycles to meet your application needs. Step times, step order, and functions (i.e., the set of valves that opens a reagent flow path) are all programmable. Programming is performed by a touch keypad with a four-line, 40-character LCD display for entering, editing, and selecting sequences and for choosing and modifying standard synthesis cycles.

FastPhoramidite® Reagents

FastPhoramidite® reagents are available for use on the Applied Biosystems 3400 DNA Synthesizer. They offer fast deprotection for primer-length oligonucleotides. Simply substituting Fast G (dG^{dmf}) for the standard dG^{ibu} shortens deprotection at 55°C from 8–12 hours to 1–2 hours at 65°C, significantly reducing the time required for synthesis.

Figure 1 (A and B) shows reverse-phase HPLC confirmatory results for 3400 synthesizer oligonucleotides at 0.2-µmol scale. Polystyrene-based chromatography column, 2.5 µm (4.6 × 50 mm); A=0.1M TEAA, B=1:1 (A:ACN); 5-40% B over 25 min.

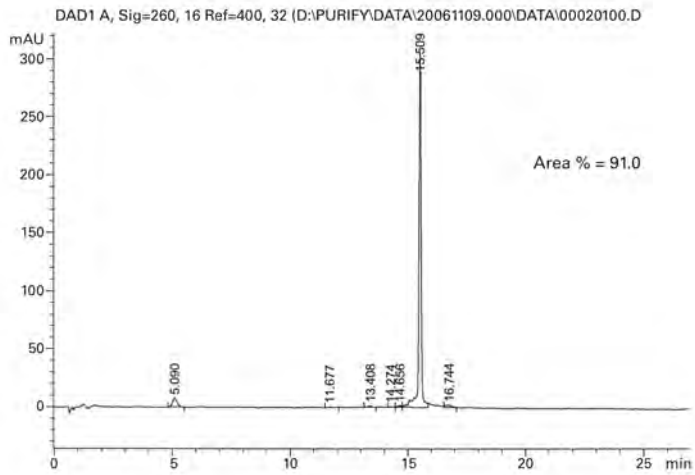

Figure 1 (A). 25-mer: ASWY = 99.6% based on 91.0% area under major peak.

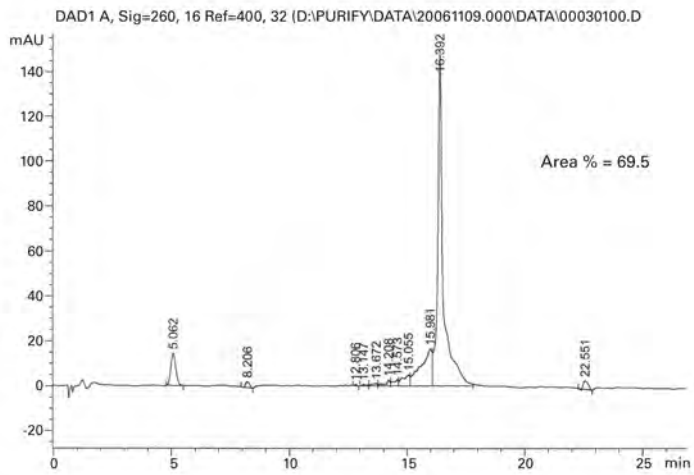

Figure 1 (B). 75-mer: ASWY = 99.5% based on 69.5% area under major peak.

PC Compatibility

The 3400 DNA synthesizer is also networkable. With user-supplied networking support, you can network your 3400 DNA Synthesizer and use a Web browser to download and edit sequences, and create and save user-defined cycle programs from an HTML page. No additional software is necessary, as everything you need to access the sequence- and cycle-editing functions on the HTML page is encoded on the instrument firmware.

DNA Purity and Quality

Established phosphoramidite chemistry produces DNA that is pure and chemically authentic. The instrument routinely synthesizes oligonucleotides with average coupling yields > 98% as measured by HPLC analysis. A simple desalting of crude deprotected oligonucleotides is adequate for most applications. The results from ion-exchange and reverse-phase HPLC, CE, and MS analysis of crude DNA products synthesized on a 3400 instrument reveal highly pure product of the desired sequence.

TABLE 1. AVERAGE YIELDS OF CRUDE PRODUCT

Scale	ODU	Sequence
40 nmol	6.25 (0.25 OD/base)	25-mer
200 nmol	25 (1.0 OD/base)	25-mer
1 µmol	125 (5.0 OD/base)	25-mer

SYSTEM SPECIFICATIONS

Chemistry	
DNA (cyanoethyl phosphoramidite)	40 nmol, 0.2 µmol, 1.0 µmol
Hardware/Electronics	
Reagent delivery	Argon gas pressure
Solvent/reagent bottles	9 (6 standard, plus the following 3 external bottles: acetonitrile, trichloroacetic acid, and dichloromethane)
Display	4-line, 40-character LCD
Programmability	Complete cycles, procedures, and functions
Performance	
Coupling efficiency (DNA—cyanoethyl phosphoramidite)	> 98.0% as determined by full length product peak by reverse-phase HPLC analysis
Cycle time	4-column operation: ~6–7 min/base for 40- and 200-nmol scales, and ~9 min/base for 1.0-µmol scale excluding cleavage (~70 min additional for on-instrument cleavage)
Miscellaneous	
Power	100V (50/60 Hz); 120V (60 Hz); 220V (50 Hz), 240V (50–60 Hz)
Communications port	Ethernet
AutoAnalysis	Conductivity measurement
Computer (not included)	User-networkable (Contact AB sales rep. for information)
Dimensions	
Height	50 cm (19.9 in.)
Width	66 cm (26.0 in.)
Depth	46 cm (18.0 in.)
Weight	43 kg (96 lb)
Regulatory Approval	
UL 3101-1 (for UL mark)	
CSA 1010.1 (for UL or cUL marks)	
EN 61010-1 (for CE mark)	
EN 61326-1 (which includes EC 1000-3-2, 1000-3-3, etc.; and EN 50082-1 and EN 55011 Class B)	

ORDERING INFORMATION

Description	P/N
Applied Biosystems 3400 DNA Synthesizer 4-column independent synthesis, 8 base positions, fully programmable, automatic cleavage, AutoAnalysis.	4334667
3400 Extended-Capacity Upgrade Kit Expands to 4 phosphoramidite positions to accommodate 2-g bottles; expands to 4 reagent positions to accommodate 450-mL bottles.	4343065

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