Increasing Your Compounding Speed and Accuracy:

Automated Compounding Devices and Related Software

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AN AUTOMATED COMPOUNDING DEVICE (ACD) ASEPTICALLY transfers one or more sterile component solutions to a sterile final container for a patient preparation, thereby replacing or decreasing the need for drawing up component solutions with syringes, increasing the accuracy of the ingredient delivery, and reducing preparation time. ACDs can also decrease the wear and tear on employees who are manually drawing up the sterile components. Beyond recognizing the potential benefits of using ACDs, it is also important to evaluate the different types of devices available in the market, as well as the additional capabilities device-related software programs can bring to the table to further enhance compounding operations.

Photo courtesy of Baxa Corporation

Baxa's Exacta-Mix 2400 is a 24-source compounder for both macro and micro ingredients.

Assessing Your Need for an ACD

To determine if your pharmacy would benefit from an ACD, the first step is to quantify the scope of your current compounding practices. Create a chart with the following information:

- A list of sterile component products prepared in your pharmacy, including, but not limited to, TPN, cardioplegia, small-volume parenterals (SVPs), large-volume parenterals (LVPs), and hydration solutions
- The quantity of each type of compounded sterile preparation (CSP)
- The minimum, maximum, and average number of component solutions for each type of CSP
- The minimum and maximum volumes of source component solutions needed for each type of CSP
- How each type of CSP is prepared, i.e. the time needed to prepare a single sterile preparation for each type of CSP, including the time required for calculation; label preparation; gathering, drawing up, and injecting component solutions; quality-assurance procedures; final labeling; and clean up
- The resources dedicated to each type of CSP, including FTEs, disposable materials, and overhead

Rule of Thumb #1: An ACD is a justifiable purchase when five or more TPNs are prepared per day, when 50 or more syringes are needed for multi-additive CSPs per day, or when preparing large volume hydrations on a daily basis. Using the information collected in your chart will help you determine the ACD that meets your facility's needs.

Choosing the Appropriate ACD

ACDs are available in many different forms. A macro ACD delivers 1 to 4000 mL in either whole numbers or tenths graduations. A micro ACD delivers from 0.2 mL to the manufacturers' settings in hundredths graduations. A macro/micro ACD will deliver from 0.2 mL to the manufacturers' maximum settings in 0.1-mL graduations. A system with separate macro and micro ACDs will require two steps, whereas a macro/micro ACD requires only one step for compounding. When using a two-step process, chances for an error are increased, as patient orders may become confused from step to step. Furthermore, because the breaks between compounding activities are doubled with a two-step process, the chances for contamination are increased. In addition, the one-step compounding process is faster than the two-step process.

Either device may require that some component solutions be drawn up into syringes and injected into the final container if those component solutions are below the ACD's minimum volume or are not used enough to justify a port on the ACD. In addition, component solutions that are very viscous, prone to bubbling, or not recommended for use with the ACD by the manufacturer will also require manual compounding.

ACDs have a wide range of component ports to meet a variety of needs. Macro ACDs are available with one to nine ports, and micro ACDs are available with 10 ports. Macro/micro ACDs are available with 12 to 24 ports. There are pricing differences between these devices, which need to be considered in relationship to your facility's budget. Once your ACD needs have been determined, the choice of compounding methods will be easy to make. The biggest difference between a macro and a micro method and a macro/micro ACD is the macro and micro ACDs are gravimetric, and the macro/micro ACD is volumetric. The method used—

either gravimetric or volumetric—is a preference of the user.

Delivery Methods: Gravimetric vs. Volumetric

Gravimetric ACDs multiply the specific gravity (SPG) and the volume to determine the weight to be transferred into the final container, which is positioned on the load cell. The ACD monitors the weight being delivered to the final container. Gravimetric systems are inherently accurate as long as the manufacturer's calibration and warm-up instructions are followed. Set wear does not affect gravimetric systems. A gravimetric ACD can utilize the entire contents of a source-ingredient solution without affecting accuracy.

Volumetric ACDs determine the amount of solution transferred to the final container by the amount of rotor rotation, the tubing diameter, and the tubing length. Volumetric systems can be affected by solution viscosity, tubing diameters and length, the height at which a source ingredient or final container is hung, tube or distal restrictions, and room temperature. Because improper spiking or venting can affect the accuracy of volumetric ACDs, careful attention must be paid to these processes. Volumetric ACD sets are rated with a manufacturer-recommended volume that they can deliver before replacement is necessary. Also keep in mind that preventing the source containers from running dry will result in some source ingredient loss. As stated previously, the choice between the gravimetric or volumetric method is up to the user's preference and the number of component solutions that are needed to complete compounding. Your decision to use a gravimetric or volumetric device will depend on the volumes and number of ports needed to minimize the manual addition of component solutions.

Photo courtesy of B. Braun Medical Inc.

The Pinnacle TPN Management System from B. Braun is accurate within 2.5% for volumes above 20 mL.

Accuracy vs. Speed

Each individual ACD has an accuracy statement associated with various delivery volumes. As a general rule, the higher the delivery volume the more accurate the delivery device. Manufacturers may make tradeoffs between speed and accuracy when developing their ACDs. It is important to understand that any device, whether a syringe or an ACD, will not be as accurate when measuring small volumes as it will be when measuring large volumes. Each ACD has its limitations. One needs to decide if a device's accuracy serves the needs of the patients, and whether or not the accuracy can affect patient safety and care. Every facility has different degrees of acceptable accuracy. Examine the manufacturers' literature for their accuracy statements, and determine if their accuracy is acceptable to your facility.

Assessing ACD Software

Connecting your ACD to a software package can increase the value of your automation program. ACD software aids in assuring the accuracy of source component solutions being utilized, decreases pharmacy calculations, performs calculations in a consistent manner, prepares patient specific labels, uses label information to confirm that the appropriate patient's preparation has been selected, documents the order-entry and compounding processes, and provides reports on the entire process.

Software is also a necessary element of an enhanced QA system, as it allows you to document what your ACD has delivered. ACD software can also communicate patient-order information with your pharmacy information system (PIS).

Rule of Thumb #2: You will generally need software to run your ACD if you prepare 10 or more multi-additive CSPs on a daily basis.

When assessing ACD software, ask the following questions:

- Does the software provide enhanced labels?
- Does the software enhance your QA process?
- Does the software provide documentation of the compounding process?
- Does the software provide warnings and error alerts?
- Does the software document errors and warnings for later review?
- Does the software meet your sterile-preparation labeling needs?
- Does the software make use of bar code technology?

Software Interfaces

As with every automation system in the pharmacy, interfacing between systems can be a stumbling block to success. It is important to determine up front whether the compounding software will interface with your PIS, and if so, what type of interface is provided. For instance, can the interface send data from the compounding software or receive data from the pharmacy system, or does it do both? Is the interface a batch process or does it occur online? Be aware that an interface is an add-on that both the PIS vendor and the automated compounding software vendor normally charge for.

Conclusion

Every institution is unique, so a careful analysis must be carried out to determine which ACD and software best meet your needs. Choose carefully to reap the maximum benefits for your facility. P&P

Currently the director of information technology operations for SoluNet LLC, David L. Thomas, RPh, MBA, previously served as the manager of implementation and technology development for Baxter Healthcare and as the technology systems manager for Baxter's COMPASS IV admixture service. Before his 15-year tenure with Baxter, Thomas held hospital pharmacy practice and management positions for five years.

Where to find it:

VENDOR	WEBSITE	READER SERVICE #
B. Braun Medical Inc.	www.bbraunusa.com	61
Baxa Corporation	www.baxa.com	64
Baxter Healthcare	www.baxter.com	16
Grifols	www.grifolsusa.com/gri-fill.htm	4
Hospira, Inc.	www.hospira.com	65
Secure/The Metrix Company	www.metrixco.com	19