A Green Solution for the Dissolution Laboratory Which Also Saves Money

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Going "Green" in today's business climate where maximizing shareholder equity and conserving capital is a top priority can be difficult, especially if the project increases the overall cost of doing business. Unfortunately, when business conditions are difficult many environmentally friendly initiatives and other peripheral programs not deemed critical to the performance of the business are some of the first to be put on hold or abandoned altogether. Fortunately, there are several solutions from analytical instrument suppliers which offer cost and time savings as well as being environmentally friendly. Distek, Inc. offers one such solution for the Dissolution lab.

One method of saving money and reducing a company's carbon footprint is by decreasing the amount of electricity that is consumed by a lab in its day-to-day operations. When an instrument with equal or superior performance capabilities requires less electricity than other instruments that perform the same function, serious consideration should be given to using the more energy efficient instrument. With USP 1 and USP 2 dissolution testing, a "traditional" water bath based system is used to heat the vessels and the medium contained within them. Now consider if there was a bathless dissolution unit which eliminates the water bath and consumes less than half of the electricity while still offering similar or superior performance to that of a water bath system. The amount of money that can be saved on electricity in a dissolution lab by simply changing the type of dissolution tester used would be substantial.

Does such a system currently exist? The answer is yes. The Distek Evolution 6100 Bathless Dissolution Test System (EVO 6100), which is the second generation of the patented bathless system first offered by Distek in 1996. In energy consumption tests, the water bath based dissolution systems typically used at least twice the amount of energy of the EVO 6100. In the studies conducted for this article, two typical operating scenarios were considered: the time and power consumed when performing a 24 hour dissolution run, and the power consumed by the equipment between runs.

When a water bath based dissolution tester is not being used to execute a run, the thermocirculator is typically left running to maintain the heat of the water bath, continuing to consume energy. Even if the bath is turned off between tests, it uses comparatively large amounts of electricity to re-heat several gallons of water to 37°C, whereas the EVO 6100 has no such requirement, making it more energy efficient.

Below are the results from two power consumption studies involving typical operating scenarios. The studies were

conducted using an Energy Consumption Monitor/Logger, Model ECM-1220 by Brutech. The baths used in the study were manufactured by various suppliers including Distek, Inc., Varian, Inc., and Hanson Research.

SCENARIO #1
Performing a Dissolution Run

In this scenario, four common brands of bath based dissolution systems were heated up with their vessels in place but without being filled with medium. The thermocirculator temperature was set to 37°C and once the temperature of the bath water reached its set point, 900 ml of room temperature medium was added to the vessels. The time required for the various water bath based systems to reach the set point temperature ranged from 30 to 55 minutes. The temperature of the medium in the vessels was allowed to heat up with the assistance from the paddles stirring at 100 RPM. Once all of the vessel temperatures were at 37°C ± 0.2°C, a 24-hour dissolution run was executed. For the duration of the test, the vessels were kept covered and maintained a temperature of 37°C.

The EVO 6100 was also programmed to run a 24-hour test at 37°C with paddles stirring at 100 RPMs. Because there is no water bath to heat up, the vessels were filled with 900 ml of room temperature medium, covered, and the method program was initiated. For the EVO 6100 there was approximately 10 to 12 minutes of preheat and equilibration time. Upon equilibration, the 24-hour program was started.

Table I below shows the power consumed by four typical baths and the Distek EVO 6100.

SCENARIO #2
Between Dissolution Runs

When water bath based systems are not performing a dissolution run, they are typically left on with the thermocirculator heating and circulating the water in the bath. They can also be turned off when not in use, but would have to go through the process of re-heating the bath when turned on again. The amount of energy required to re-heat the water in the bath is shown in the first row of Table I below. Table II shows the amount of power used to maintain the heat in the bath without any run in progress for a 24-hour period with empty vessels secured into the vessel plate, and a second 24 hour period without any vessels in place.

Some of the variances in power consumption in the different brands of dissolution baths are due to the size of the water bath and the volume of water it holds. The higher the volume of water the greater amount of energy required. Another factor that can have an effect on energy consumption is how well the water is circulated within the water bath. A higher flow rate generally results in a more consistent temperature throughout the bath, but may consume more power for the pumping of the water. Lastly, the temperature in the lab itself will make a difference in the efficiency of the water bath based system. When water bath systems are in a cooler environment, they require more power to maintain the proper temperature.

Table I: Power Consumed by Four Typical Baths and the Distek EVO 6100

	Bath 1	Bath 2	Bath 3	Bath 4	Avg. Bath Energy Used	Distek EVO 6100	% of Bath Energy Used by EVO 6100
Energy consumed heating bath with vessels in place	0.440 KWh	0.353 KWh	0.277 KWh	0.677 KWh		0 KWh	
Energy consumed heating medium in vessels	0.198 KWh	0.162 KWh	0.228 KWh	0.171 KWh		0.281 KWh	
Energy consumed running 24 hours test	2.907 KWh	3.507 KWh	2.377 KWh	3.428 KWh		1.505 KWh	
Total Energy Consumed for Scenario	**3.545 KWh**	**4.022 KWh**	**2.882 KWh**	**4.276 KWh**	**3.681 KWh**	**1.786 KWh**	**48.5**

Table II: Power Consumed to Maintain Bath Heat Without Any Run in Progress							
	Bath 1	Bath 2	Bath 3	Bath 4	Avg. Bath Energy Used	Distek EVO 6100	% of Bath Energy Used by EVO 6100
Energy consumed maintaining heat in bath with empty vessels in place	2.707 KWh	3.220 KWh	2.056 KWh	2.263 KWh	2.562 KWh	0.171 KWh*	6.7
Energy consumed maintaining heat in bath without vessels in place	5.110 KWh	4.630 KWh	3.480 KWh	4.442 KWh	4.416 KWh	0.171 KWh*	3.9

*The EVO 6100 does not require the heaters to remain active since it has no water bath to maintain at a constant temperature. When the EVO 6100 is placed in "Sleep" or standby mode, it continues to use a minimal amount of power as shown in Figure 2 above. Since it requires no water bath re-heat time the unit can be completely turned off between runs consuming zero power with a minimal dissolution medium pre-heat start-up time of 10-12 minutes.

CONCLUSION

It is clear that it requires, on average, twice the power to operate a water bath based dissolution system than it does a bathless dissolution system. Now that the industry and the global community are more cognizant of the need to conserve resources and behave "green", the Distek EVO 6100 bathless dissolution unit is an obvious choice for the planet and for the bottom line