

# Application Note - Digestion of Trace Metals in Wastewater Using DEENA, an Automated Sample Digestion System



DEENA, an automated sample digestion system, alleviates most of the manual sample preparation and produces consistent and accurate analytical results. Manual sample preparation often consists of many steps that are both labor intensive and time consuming. There is often a clear desire and justification to automate. When deciding to implement automation in the laboratory, it is important to know ahead of time what the impact will be, if any, to analytical results.

The purpose of the application note is to demonstrate that DEENA automates and produces reliable and consistent results for EPA methods 200.7 and 200.8.



EPA Methods 200.7 and 200.8 are common methods for determining trace metals in water and waste-water. They involve multiple acid digestion and heating steps followed by a dilution to final volume.

## EXPERIMENT

Laboratory Control Samples (LCS), Blanks, Spikes, and Spike Duplicates for commercial waste-water samples were studied for three months prior to and after implementing DEENA. Samples were measured and transferred to 50ml disposable digestion vials. Samples were spiked at 2.0mg/L for EPA 200.7, and at 0.10mg/L for EPA 200.8. The samples were placed in the rack on DEENA. A method was created in the software (Figure 1) with all the steps corresponding to EPA Method 200.7 (aqueous). The timer in the software pre-heats the block to 110°C, prior to executing the method. The reagents were DI water, 1:1 nitric acid (HNO<sub>3</sub>), and 25% hydrochloric acid (HCl). The block temperature was set to high values in the method so that the sample achieved the desired temperature (95°C) in the allotted time. The final sample volume was 50 mL. The final step was repeated three times to achieve the best possible precision and accuracy.

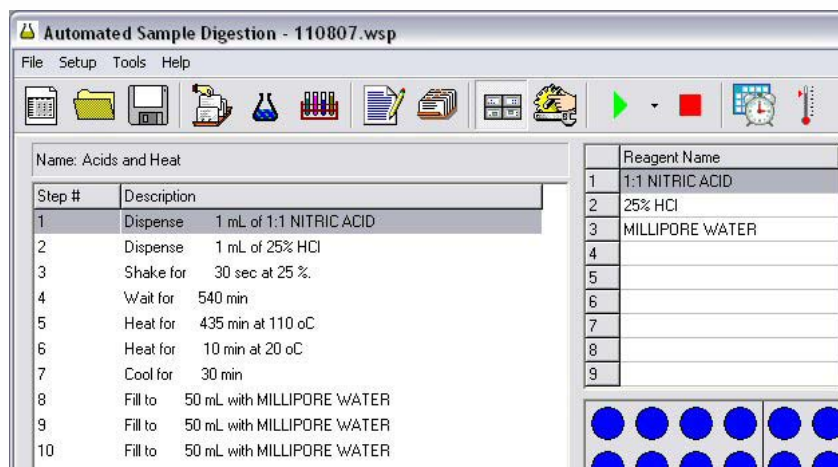


Figure 1 – Method in automated sample digestion software

## RESULTS AND DISCUSSION

For samples prepared manually and automatically with DEENA, concentrations were determined for 27 elements. Recoveries (%) were calculated for LCS, Spike and Spike Duplicates. Relative Percent Difference (RPD) was also calculated for the Spike and Spike Duplicate data. Concentrations for Blank samples were also determined.

Figures 2 and 3 show LCS data resulting from manual, and automated sample preparation. No anomalous trends are present in the DEENA data, indicating DEENA had no problematic effect on the preparation of these check standards.

(continued)

Figure 2: 200.7 LCS Data using manual prep (left) and DEENA (right)

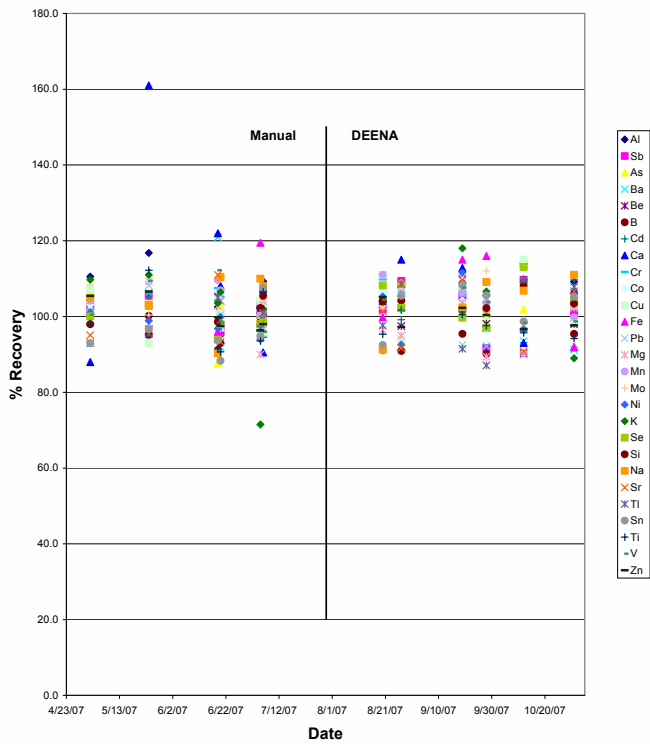


Figure 3: 200.8 LCS Data using manual prep (left) and DEENA (right)

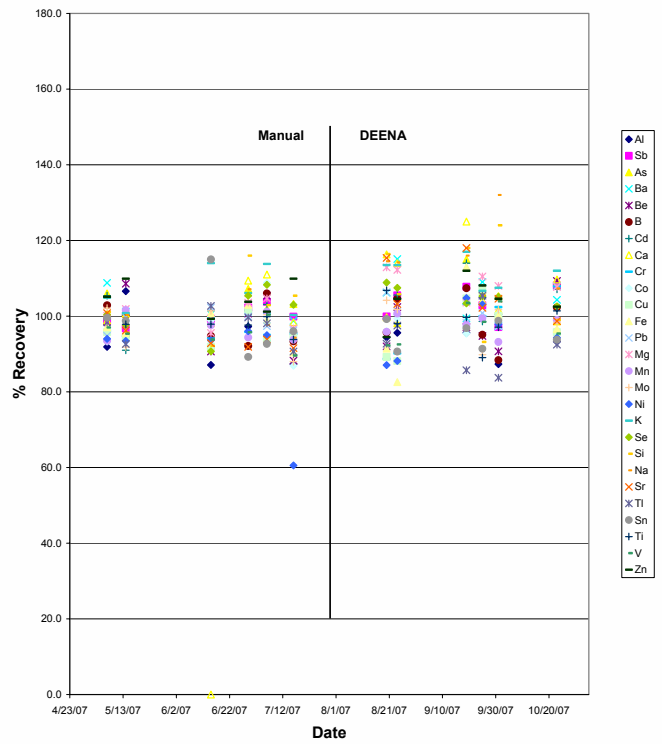


Figure 4 : 200.7 Blank Data using manual prep (left) and DEENA (right)

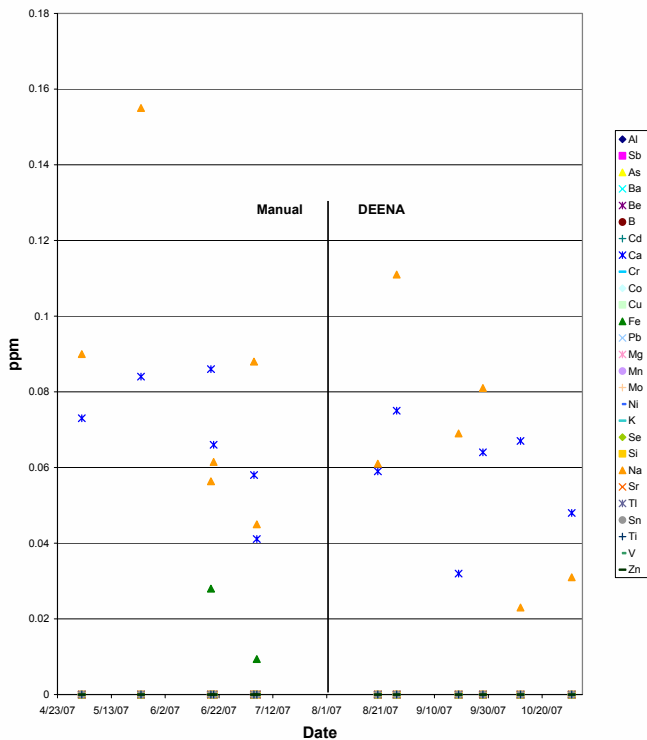


Figure 5: 200.8 Blank Data using manual prep (left) and DEENA (right)

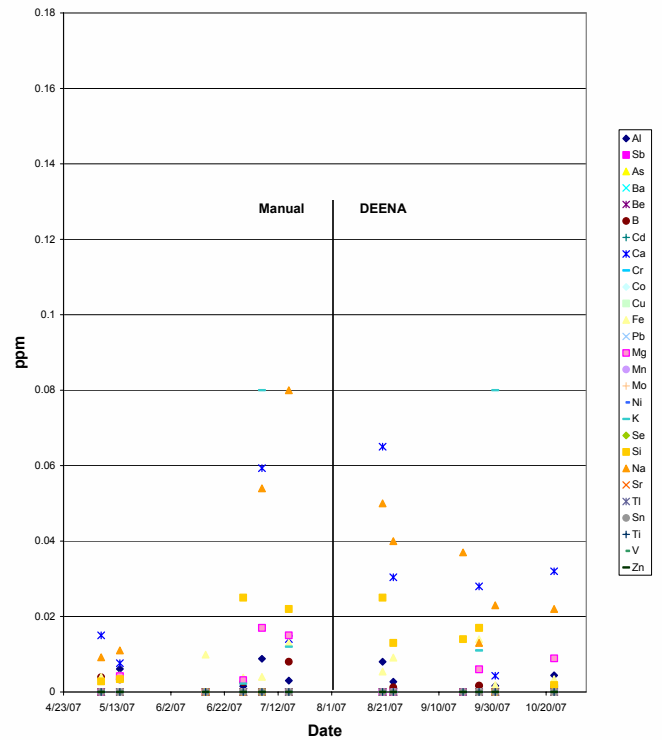


Figure 6: 200.7 Spike Data using manual prep (left) and DEENA (right)

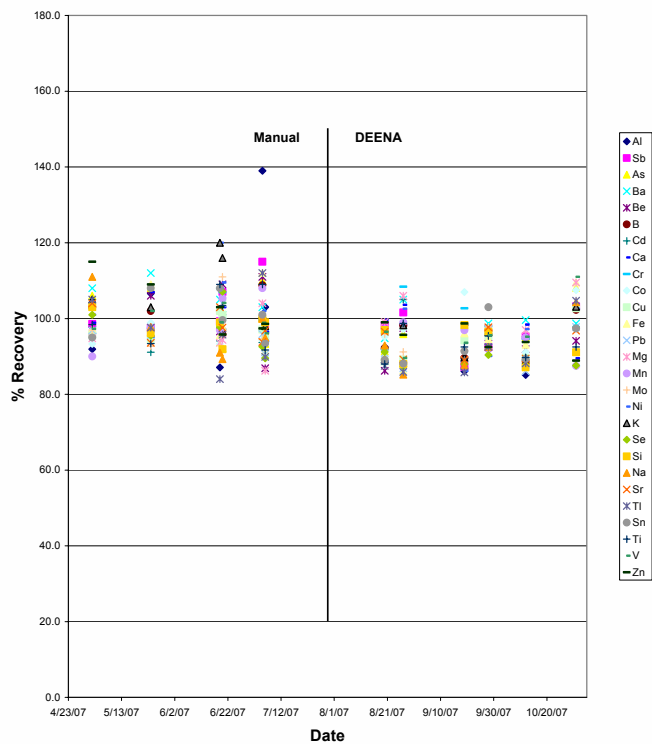


Figure 7: 200.7 Spike Duplicate Data using manual prep (left) and DEENA (right)

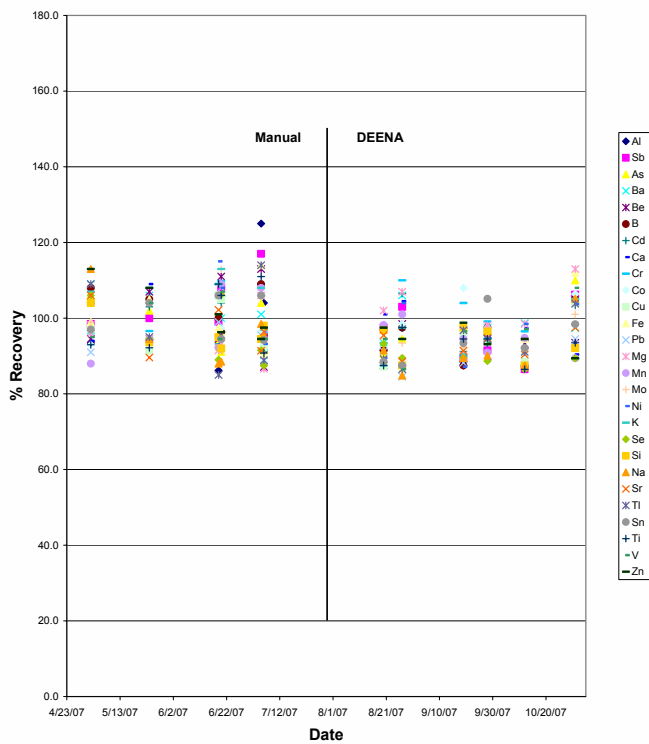


Figure 8: 200.8 Spike Data using manual prep (left) and DEENA (right)

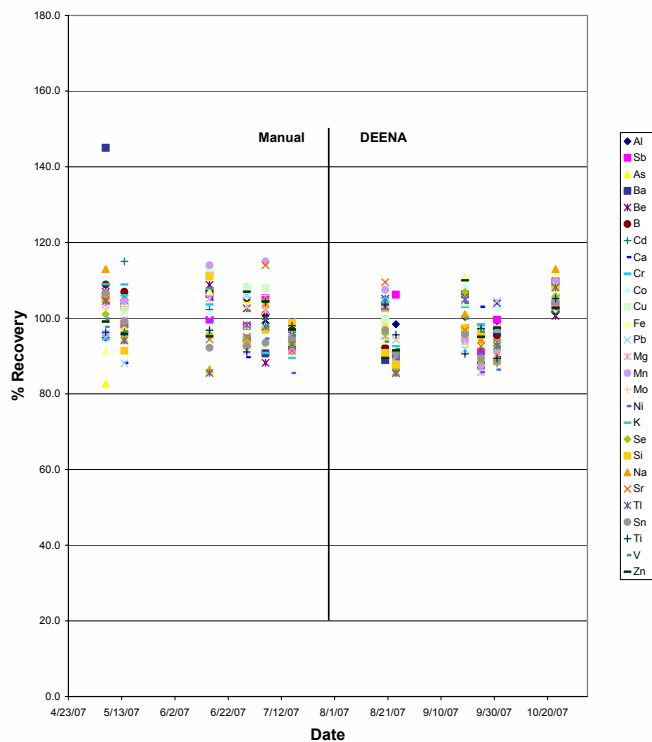


Figure 9: 200.8 Spike Duplicate Data using manual prep (left) and DEENA (right)

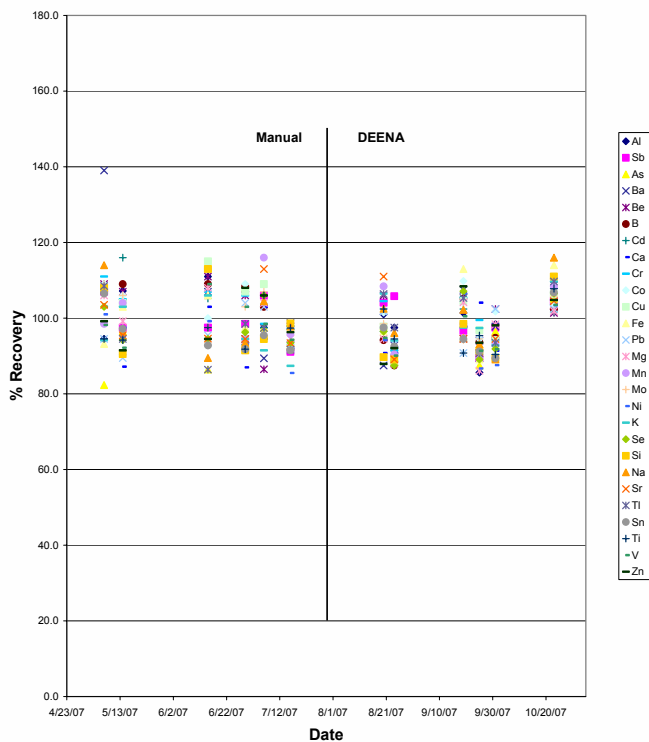


Figure 10: 200.7 Spike/Spike Duplicate RPD Data using manual prep (left) and DEENA (right)

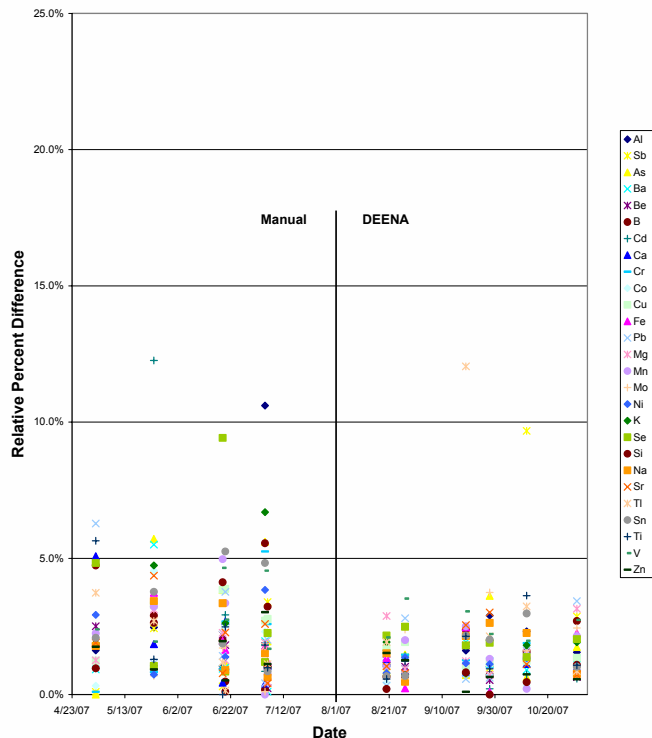
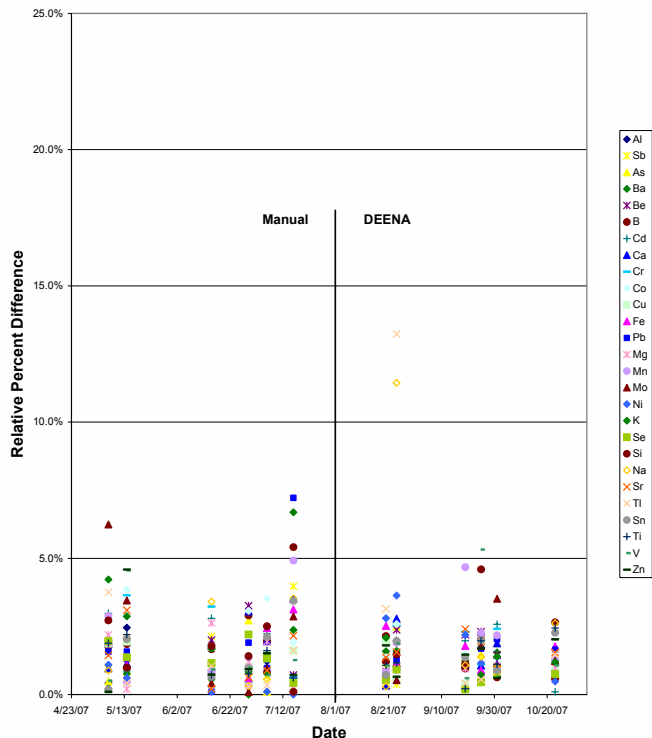


Figure 11: 200.8 Spike/Spike Duplicate RPD Data using manual prep (left) and DEENA (right)



## RESULTS AND DISCUSSION (continued)

Figures 4 and 5 show Blank sample data resulting from manual and automated sample preparation. If DEENA were contributing to sample contamination, it would be revealed in these charts. DEENA is contamination-free, because the manual and automated data are comparable.

Spike and Spike Duplicate recovery (%) data from manual and automated sample preparation are shown in Figures 6 through 9. Again, the DEENA data is statistically equivalent to the manual data. This shows that DEENA properly and consistently prepares these spiked samples.

A comparison of the effect of manual and automated preparation on Relative Percent Difference of Spikes is shown in Figures 10 and 11. Evaluating the manual versus automated data shows DEENA does well on this measure of preparation consistency.

## CONCLUSION

DEENA produces consistent results for EPA methods 200.7 and 200.8. These results confirm that DEENA is at least as precise and accurate as a technician with a manual block digestion system.

## ACKNOWLEDGEMENTS

We would like to thank Owen H. Byfield at Accurate Environmental Labs (Stillwater, OK) for providing the experimental data.

## About Thomas Cain, Inc.

Thomas Cain, Inc. is dedicated and committed to helping laboratories improve their efficiency and simplify their processes by automating their manually repetitive and time consuming tasks.

Thomas Cain's mission is to provide products and services which save their customers time. By listening and identifying true needs, they innovate and provide solutions that have measurable value to their customers.

With DEENA, a fully automated sample digestion system, it is possible to alleviate most of the manual sample preparation and reduce the errors associated from sample handling. With less time devoted to sample preparation, laboratory personnel are free to perform other duties. DEENA will provide consistent data in a clean, safe and timely fashion.

To learn more about Thomas Cain, Inc. please visit [www.ThomasCainInc.com](http://www.ThomasCainInc.com).

## THOMAS CAIN, INC.

PO Box 390781  
Omaha, NE, 68139, USA

Phone: (402) 981-3544  
Fax: (866) 305-2704

Email: [jdivis@ThomasCainInc.com](mailto:jdivis@ThomasCainInc.com)  
[www.ThomasCainInc.com](http://www.ThomasCainInc.com)

