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Haemo-Sol Residue Detection Testing

Brief Introduction

In many industries, precision or critical cleaning processes are employed to ensure that all surface contaminates and soils are properly removed from instruments, devices, and equipment. The presence of any foreign agent can negatively impact the functionality of the item being cleaned, and interfere with the effectiveness of the end product.

Many different precision cleaning substances and processes have been used to remove inorganic and organic soils. Some industries have tried non-aqueous based cleaning systems that rely heavily upon petroleum-based chemicals, volatile solvents, and corrosive substances. Others have turned to aqueous cleaning systems which use specialized detergents and water to clean.

While both systems yield similar results, the chemicals and solvents used in non-aqueous based cleaning systems have proven to be difficult to dispose of; complicated to handle; noxious; toxic; and harsh on the environment. The cost to purchase and dispose of these chemicals and solvents can also be expensive and prohibitive.

Due to the nature of the chemicals and solvents used in non-aqueous based cleaning systems, aqueous based cleaning systems have experienced a resurgence in popularity. Studies of aqueous based cleaning systems, such as those conducted by Du Pont[1], Gavaskar[2], Massachusetts Toxics Use Reduction Institute (TURI)[3], have reported equivalent or even superior cleaning results when compared to non-aqueous based cleaning systems.

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[1] E.I. Du Pont de Nemours, "Case Study 6: Polymer Vessel Washout" in *Du Pont Chambers Works Waste Minimization Project*, Washington, D.C., U.S. EPA, November 1993. (U.S. EPA report number EPA/600/R-93/203).

[2] Gavaskar, Arun, et al., "An Automated Aqueous Rotary Washer for the Metal Finishing Industry," in *Pollution Prevention Possibilities for Small and Medium-Sized Industries – Results of the WRITE Projects*, Washington, D.C. U.S. EPA, May 1995. (U.S. EPA report number EPA/600/R-95/070.)

[3] *Surface Cleaning Laboratory Case Study #1: Market Forge*, Lowell, MA, Toxics Use Reduction Institute (1995).

High-efficiency detergents, such as Haemo-Sol®, are being used by individuals in the electronics, food and beverage, pharmaceutical, medical, dental, veterinary, dairy, and cosmetic industries in

their aqueous cleaning systems to remove wastes and other byproducts from hard surfaces (e.g., metal, glass, rubber, plastic, etc.). The key to using these types of detergents is in the rinse. All surfaces of the item being cleaned should be rinsed according to usage guidelines printed on the detergent's packaging.

Tests recently performed by Intertek (www.intertek.com), an independent laboratory specializing in detergent testing, have shown that items cleaned in Haemo-Sol and rinsed properly no longer show signs of contaminants or soils. The tests also show that Haemo-Sol's line of detergents have high dissolution and rinsability rates.

Complete testing methodologies; reports outlining results of this investigation; and a summary of the findings are attached for further study.

Definitions of Terms

Source Water:	Sample of tap water used as the baseline or control sample. All pHs collected during these tests were compared to the pH of the source water.
pH Meter:	Used to collect the pH of the source water and the test water samples.
Test Water:	Sample of tap water used to test for residue once glassware was washed in Haemo-Sol solution.
Rinsability:	Ability of a detergent to rinse completely away without leaving a residue behind.

Methodology

The following test procedures are suitable for detecting detergent residues resulting from improper rinsing and can be used to meet laboratory accreditation guidelines and questionnaires such as the College of American Pathologist program.

A. pH Meter Method

1. Rinse a small clean beaker by filling and emptying 3 times with source water.
2. Fill a 4th time and measure pH using a pH meter. Record the pH as source water pH.
3. Prepare four different Haemo-Sol solutions based on mixing instructions listed below:

Haemo-Sol Regular (026-050): Dilute ½ ounce of detergent with 1 gallon of warm water (52 °C or 125 °F) in sink, bucket, pail, or other container.

Haemo-Sol Non-Sudsing (026-051): Place 1 ounce of detergent in machine washer (e.g., washer-sanitizers, warewashers, conveyor-washers, or spray and pressure washers).

Haemo-Sol Enzyme Active (026-055): Dilute ½ ounce of detergent with 1 gallon of warm water (52 °C or 125 °F) in sink, bucket, pail, or other container.

Haemo-Sol Non-Phosphate (026-058): Dilute ½ ounce of detergent with 1 gallon of warm water (52 °C or 125 °F) in sink, bucket, pail, or other container.

4. Note the following observations:
   a. How long does it take the Haemo-Sol Regular (026-050), Enzyme Active (025-055), and Non-Phosphate (026-058) to dissolve?
   b. Once the Haemo-Sol detergents listed above are dissolved in water, is the water clear or is it cloudy?
   c. What was the temperature of the water used?

5. Clean glassware and metal instruments in Haemo-Sol baths according to directions listed below:

   Haemo-Sol Regular (026-050): Soak items in Haemo-Sol bath for about 10-15 minutes (or longer if necessary). Remove objects. All surfaces of the item being cleaned should be rinsed thoroughly for at least 10 seconds with either ambient, warm, or hot water. Rinse tanks can also be used in place of running tap water.

   Haemo-Sol Non-Sudsing (026-051): Load objects into racks so that any open ends face towards spray nozzles. Place difficult-to-clean objects with narrow necks and openings near the center of the rack, open-side down, preferably on special racks with spray nozzles pointing directly into them. Minimize touching between objects. Group small objects in baskets to prevent them from being displaced by the spray action of the machine.

   Haemo-Sol Enzyme Active (026-055): Soak items in Haemo-Sol bath for about 10-15 minutes (or longer if necessary). Remove objects. All surfaces of the item being cleaned should be rinsed thoroughly for at least 10 seconds with either ambient, warm, or hot water. Rinse tanks can also be used in place of running tap water.

   Haemo-Sol Non-Phosphate (026-058): Soak items in Haemo-Sol bath for about 10-15 minutes (or longer if necessary). Remove objects. All surfaces of the item being cleaned should be rinsed thoroughly for at least 10 seconds with either ambient, warm, or hot water. Rinse tanks can also be used in place of running tap water.

6. Using a piece of cleaned glassware you wish to test, fill about 10% full with test water (10 ml into 100 ml beaker). Use more water if necessary to get enough water to be able to sufficiently immerse the pH meter electrode in your measuring beaker. For metal

instruments, fill clean container with test water and place metal instrument in water. Use more water if necessary to sufficiently submerge object.

7. Swish water in glassware to extract residues from all possible surfaces.

8. Take pH reading with pH meter and record as glassware pH, or in cases of metal instruments, as instrument pH.

9. Any significant increase in pH indicates possible alkaline detergent residue. A significant change is 0.2 or more pH units on a pH meter measuring to 0.01 pH units of sensitivity. A result of less than 0.2 pH units change indicates properly rinsed glassware.

Experimental

The "pH Meter Method" instructions were followed with slight temperature adaptations. Detergents Haemo-Sol Regular (026-050), Haemo-Sol Enzyme Active (026-055), and Haemo-Sol Non-Phosphate (026-058) were dissolved in water at 41 °C instead of 52 °C. Haemo-Sol Non-Sudsing (026-051) was placed in a commercial dishwasher and ran at 60 °C. Calibration of the pH meter was performed with pH buffers 4.0, 7.0, and 10.0.

Results

Dissolution Rate & Water Clarity Table

Haemo-Sol Detergent Name	Dissolution Time	Clarity	Temperature
Haemo-Sol Regular (026-050)	45 Seconds	Clear	41°C
Haemo-Sol Non-Sudsing (026-051)	Not Applicable	Not Applicable	60°C*
Haemo-Sol Enzyme Active (026-055)	45 Seconds	Clear	41°C
Haemo-Sol Non-Phosphate (026-058)	30 Seconds	Clear	41°C
"Source Water" (Tap Water)	Not Applicable	Clear	24°C

** Dishwasher cycle used.*

Residue Detection Using pH Meter Method

Haemo-Sol Detergent Name	pH Test 1	pH Test 2	<0.2pH Units Change
Haemo-Sol Regular (026-050)	8.41	8.42	Yes
Haemo-Sol Non-Sudsing (026-051)	8.36	8.38	Yes
Haemo-Sol Enzyme Active (026-055)	8.47	8.48	Yes
Haemo-Sol Non-Phosphate (026-058)	8.58	8.51	>/= 0.2 pH units
"Source Water" (Tap Water)	8.31	8.34	

Findings

On November 30, Intertek performed a series of residue detection tests adapted from the College of American Pathologists (CAP) on behalf of Haemo-Sol, Inc. These tests were performed to examine the rinsability of Haemo-Sol's various formulations.

Scientists used a pH meter to determine the pH of the source water. The source water was determined to have a pH of between 8.31-8.34. These readings were used as the baseline for the tests performed with the test water and Haemo-Sol's detergents.

Once the pH levels of the source water were determined, scientists turned their attention to collecting data on the test water. After cleaning each piece of glassware in a Haemo-Sol bath, the beakers were rinsed with ordinary tap water and refilled with the test water. A pH meter was then used to calculate the pH of the test water.

In order to demonstrate that Haemo-Sol rinses completely away, the test water should be within 0.2 pH units of the source water. Any significant increase in pH would indicate possible alkaline detergent residue. A significant change is 0.2 or more pH units on a pH meter measuring to 0.01 pH units of sensitivity. A result of less than 0.2 pH units change indicates residue-free glassware.

As can be seen from Intertek's results, items washed in three of the four detergents, Haemo-Sol Regular (026-050), Haemo-Sol Enzyme Active (026-055), and Haemo-Sol Non-Sudsing (026-051), demonstrated pH averages of 8.42, 8.48, and 8.37, respectively. These averages fall below 0.2 pH units, and indicate that items washed in Haemo-Sol's detergents and rinsed according to the adapted CAP's Residue Testing Methodology did not contain any residue left behind by Haemo-Sol's detergents.

Haemo-Sol Non-Phosphate (026-058), exhibiting a pH average of 8.5, showed a lower rate of rinsability than Haemo-Sol's other detergents.