Preparation of PAAP-Medium Stock Solutions

1. SCOPE AND APPLICATION

1.1. This method is based on EPA-600/9-78-018, *The Selenastrum capricornutum Printz Algal Assay Bottle Test*. (*Selenastrum capricornutum* is now known as *Pseudokirchneriella subcapitata*). It is used to prepare nutrient solutions used in culture media for freshwater test species. Several of the solutions can also be used in the culture media for the marine algal test species.

2. SUMMARY OF METHOD

2.1. Materials are gathered and placed on lab table and cart. Chemicals are weighed for each stock solution. Chemicals are placed in labeled flasks and dissolved in water. Stock solutions are stored for up to one year in walk-in refrigerator. Preparation information is recorded in LIMS Standard Preparation tracker.

2.2. Interferences include, but are not limited to, calibration errors, drafts, moisture and contaminated spatulas and weigh boats.

WARNING: DO NOT USE ALUMINUM WEIGH BOATS – A violent chemical reaction can occur especially when copper chloride is placed in an aluminum weigh boat and then rinsed into a flask.

WARNING: DO NOT USE ALUMINUM FOIL to seal flasks. Glass or rubber stoppers, or ParaFilm® can be used.

2.3. Definitions:

2.3.1. PAAP: Provisional Algal Assay Procedure

2.3.1.1. The procedure to make the synthetic freshwater algal nutrient medium.

3. EQUIPMENT AND SUPPLIES

3.1. Metal spatula

3.2. Magnetic stirrer

3.3. Stir bar, 2.5 cm

3.4. Stir-bar retriever

3.5. Tape (for labels)

3.6. Black permanent marker

3.7. Main salts

3.7.1. Mettler Toledo 403TS/00 balance

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3.7.2. PLASTIC Weigh boats, 10 cm x 10 cm

3.7.3. 500 mL volumetric flasks with stoppers, 4 (No Aluminum Stoppers)

3.7.4. 1 L volumetric flasks with stoppers, 3 (No Aluminum Stoppers)

3.7.5. 500 mL beaker

3.8. Micro salts

3.8.1. Mettler Toledo XA105DU Balance, calibrated per SOP PCR-2.2

3.8.2. PLASTIC Weigh boats, 4 cm x 4 cm

3.8.3. 500 mL volumetric flasks with stoppers, 2 (No Aluminum Stoppers)

3.8.4. 500 mL beaker

3.9. Trace salts

3.9.1. Mettler Toledo XA105DU Balance, calibrated per SOP PCR-2.2

3.9.2. Weigh boats, 4 cm x 4 cm

3.9.3. 1 L volumetric flask with stopper (No Aluminum Stoppers)

3.9.4. 500 mL beaker

3.10. Computer with access to LIMS

4. REAGENTS AND STANDARDS

4.1. Autoclaved Deionized (DI) Water

4.2. Wash bottle of autoclaved DI water

4.3. Main salts (minimum ACS-certified)

4.3.1. Sodium nitrate ($NaNO_3$)

4.3.2. Magnesium chloride ($MgCl_2 \bullet 6H_2O$)

4.3.3. Calcium chloride ($CaCl_2 \bullet 2H_2O$)

4.3.4. Magnesium sulfate ($MgSO_4 \bullet 7H_2O$)

4.3.5. Potassium phosphate (KH_2PO_4)

4.3.6. Sodium bicarbonate ($NaHCO_3$)

4.3.7. Disodium Ethylenediaminetetraacetate (EDTA)

4.4. Micro salts (minimum ACS-certified)

4.4.1. Zinc chloride ($ZnCl_2$)

4.4.2. Cobalt chloride ($CoCl_2 \bullet 6H_2O$)

4.4.3. Sodium molybdate ($Na_2MoO_4 \bullet 2H_2O$)

4.4.4. Cupric chloride ($CuCl_2 \bullet 2H_2O$)

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4.5. Trace salts (minimum ACS-certified)

4.5.1. Micro salts solution (prepared per Section 5.2)

4.5.2. Boric acid (H_3BO_3)

4.5.3. Manganese chloride ($MnCl_2$)

4.5.4. Ferric chloride ($FeCl_3 \bullet 6H_2O$)

5. PREPARATION OF STOCK SOLUTIONS

5.1. Main salt solutions

5.1.1. Label the four 500 mL volumetric flasks with the name and the amount of the single salt they will contain, "For PAAP," the date, batch # (prep date in mm/dd/yy format), your initials, and an expiration date of one year from prep date.

5.1.1.1. Salts:

$MgCl_2 \bullet 6H_2O$	6.082 ± 0.001 g/500 mL
$NaHCO_3$	7.500 ± 0.001 g/500 mL
$CaCl_2 \bullet 2H_2O$	2.205 ± 0.001 g/500 mL
$MgSO_4 \bullet 7H_2O$	7.350 ± 0.001 g/500 mL

5.1.2. Label the three 1 L volumetric flasks with the name and amount of the single salt they will contain, "For PAAP," the date, batch # (prep date in mm/dd/yy format), your initials, and an expiration date of one year from prep date.

5.1.2.1. Salts:

$NaNO_3$	25.500 ± 0.001 g/1000 mL
KH_2PO_4	0.818 ± 0.001 g/1000 mL
EDTA	0.300 ± 0.001 g/1000 mL

5.1.3. Fill all the volumetric flasks approximately half full of autoclaved DI water.

5.1.4. Use the Mettler Toledo 403TS/00 balance to weigh the amount of each salt listed in Step 5.1.1. and 5.1.2. (per SOP TA-06.34).

5.1.4.1. Use a separate weigh boat for each salt and pour into corresponding flask.

5.1.4.2. Use the autoclaved DI wash bottle to rinse clinging salts into the flask.

5.1.5. Clean the spatula with DI water and dry with a Kimwipe before and after each salt.

5.1.6. Swirl each flask several times to help dissolve the salts.

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5.1.7. Fill each volumetric flask to the 500- or 1000-mL mark with autoclaved DI water.

5.1.8. If a flask contains undissolved salt (particles on the inside bottom of the flask):

5.1.8.1. Place a stir bar in the flask.

5.1.8.2. Place the flask on the magnetic stirrer, turn it on and stir until salt is dissolved (cannot be seen).

5.1.8.3. Remove the stir bar with the stir-bar retriever and rinse both thoroughly with DI water.

5.1.9. Record the stock preparation batch information in the LIMS Standard Prep Tracker.

5.1.10. Store the stock solutions in the walk-in refrigerator.

5.2. Micro salts solution

5.2.1. Label one 500 mL volumetric flask with "Micro," the names and the amounts of the four salts it will contain, the date, batch # (prep date in mm/dd/yy format), your initials, "For PAAP," "Caution 100x," and an expiration date of one year from prep date.

5.2.1.1. Salts:

ZnCl2	0.1635 ± 0.001 g
$CoCl_2 \cdot 6H_2O$	0.0714 ± 0.001 g
$Na_2MoO_4 \cdot 2H_2O$	0.3630 ± 0.001 g
$CuCl_2 \cdot 2H_2O$	0.00060 ± 0.00001 g

WARNING: DO NOT USE ALUMINUM WEIGH BOATS – A violent chemical reaction can occur especially when copper chloride is placed into an aluminum weigh boat and then rinsed into a flask

5.2.2. Label the other 500 mL volumetric flask "$CuCl_2$," 0.0060±0.0001 g, the date, batch # (prep date in mm/dd/yy format), your initials, "For PAAP," "Caution for micro," and an expiration date for one year from the preparation date.

5.2.3. Half fill both 500 mL volumetric flasks with autoclaved DI water.

5.2.4. Use the Mettler XA105DU Balance, located in the micro lab, to weigh out the amount of each salt listed in Step 5.2.1.1. (per SOP PCR-2.2),

5.2.4.1. Use a separate weigh boat for each salt.

5.2.4.2. Pour each salt (except the $CuCl_2$) into the "Micro" flask.

5.2.4.3. Use the autoclaved DI wash bottle to rinse clinging salts into the flask.

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5.2.5. Clean the spatula with DI water and dry with a kimwipe before and after each salt.

5.2.6. Use the Mettler XA105DU balance to weigh out 0.0060±0.0001 g $CuCl_2$*$2H_2O$ (per SOP PCR-2.2)

5.2.6.1. Pour the salt into the flask labeled "$CuCl_2$."

5.2.6.2. Use the autoclaved DI wash bottle to rinse any clinging $CuCl_2$ salts from the weigh boat into the flask.

5.2.7. Fill the "$CuCl_2$" flask to the 500 mL mark with autoclaved DI water and swirl to completely dissolve the $CuCl_2$.

5.2.8. Remove 50 mL of salt solution from the "$CuCl_2$" flask and add it to the 500 mL "Micro" flask.

5.2.9. Fill "Micro" flask to the 500 mL mark with autoclaved DI water and swirl to help dissolve the salts.

5.2.10. If a flask contains undissolved salt (particles on the inside bottom of the flask):

5.2.10.1. Place a stir bar in the flask.

5.2.10.2. Place the flask on the magnetic stirrer, turn it on and stir until salt is dissolved (cannot be seen).

5.2.10.3. Remove the stir bar with the stir-bar retriever and rinse both thoroughly with DI water.

5.2.11. Record the stock preparation batch information in the LIMS Standard Prep Tracker.

5.2.12. Store the "Micro" and "$CuCl_2$" solutions in the walk-in refrigerator.

5.3. Trace salts solution

5.3.1. Label a 1 L volumetric flask with "Trace," the names and amounts of the three salts it will contain, the date, batch # (prep date in mm/dd/yy format), your initials, "For PAAP," and an expiration date for one year from the prep date.

5.3.1.1. Salts:

H_3BO_3	0.28552 ± 0.00001 g
$MnCl_2 \cdot 4H_2O$	0.41538 ± 0.00001 g
$FeCl_3 \cdot 6H_2O$	0.15976 ± 0.00001 g

5.3.2. Half fill the 1 L volumetric flask with autoclaved DI water.

5.3.3. Use the Mettler XA105DU balance to weigh the amounts of each of the salts listed in step 5.3.1.1. (per SOP PCR-2.2).

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5.3.3.1. Use a separate weigh boat for each salt.

5.3.3.2. Pour each salt into the flask.

5.3.3.3. Use the autoclaved DI wash bottle to rinse clinging salts into the flask.

5.3.4. Clean the spatula with DI water and dry with a kimwipe before and after each salt.

5.3.5. Swirl the flask several times to help dissolve the salts. These salts are generally easily dissolved.

5.3.6. Transfer 10.0 mL of solution from the "Micro" flask into the "Trace" flask.

5.3.6.1. AFTER the transfer, add "Micro added" to the "Trace" flask label.

5.3.7. Fill the "Trace" flask to the 1 L mark with autoclaved DI water.

5.3.8. If a flask contains undissolved salt (particles on the inside bottom of the flask):

5.3.8.1. Place a stir bar in the flask.

5.3.8.2. Place the flask on the magnetic stirrer, turn it on and stir until salt is dissolved (cannot be seen).

5.3.8.3. Remove the stir bar with the stir-bar retriever and rinse both thoroughly with DI water.

5.3.9. Record the "Trace" preparation batch information in the LIMS Standard Prep Tracker.

5.3.10. Store the "Trace" solution in the walk-in refrigerator.

6. DATA ARCHIVAL

6.1. Use a black, waterproof pen for all bench sheets and logbooks.

6.2. Record the preparation batch information for the main salt's solutions, micro salt's solutions, and trace salt's solutions in the LIMS Standard Prep Tracker.

6.3. To correct raw data entries, place a single line through the incorrect or illegible entry. Write the corrected entry near the error, date and initial the correction. Do not overwrite entries.

6.3.1. The corrected entry is written as near its appropriate space as possible or else in the comment box on the appropriate bench sheet.

6.3.2. If the correction requires an explanation, write a comment and reference the error. Initial and date the explanation. Do not attempt to put all information (correction and comments) into a small space.

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6.3.3. Use sequential alphabetical annotation to identify errors and corresponding comments (use A for first error and use A for corresponding explanatory comment; use B for second error, etc.).

7. QUALITY CONTROL

7.1. Minimum purity of compounds should be ACS-certified reagent grade or equivalent. Purer compounds can be used.

7.2. All salt solutions should be thoroughly mixed to ensure that all salts are dissolved.

7.3. Use separate weigh boats for each salt as they are being weighed.

7.4. The spatula should be cleaned before and after the measuring of each salt.

7.5. Refer to the Laboratory QA Manual

8. SAFETY/HAZARDOUS WASTE MANAGEMENT

8.1. Proper laboratory protection, including lab hood or ventilation system, lab coat, gloves and safety glasses, is required when working with chemicals and unprocessed samples.

8.2. Do not throw away empty containers, purchased prior to July 2006, until the lot analyses label is pulled off, copied and filed. Analyses data for chemicals purchased through Fisher is now available at Fishersci.com.

8.3. Refer to the Laboratory Health and Safety Manual and Hazardous Waste Management manual and Read MSDS information for reagent handling and disposal.

9. REFERENCES

9.1. EPA-600/9-78-018, The *Selenastrum capricornutum* Printz Algal Assay Bottle Test

9.2. DEP SOP TA-06.34, Calibration and Use of the Mettler Toledo 403TS/00 Balance

9.3. DEP SOP PCR-2.2, Calibration, Use and Maintenance of Mettler Toledo XA105DU Balance.

9.4. DEP SOP TA-09.11, Preparation of Nutrient Solutions for Limiting Nutrient Algal Assays

9.5. Laboratory Quality Manual http://www.dep.state.fl.us/labs/library/lab_sops.htm

9.6. Laboratory Health and Safety Manual https://www.fldepnet.org/content/dear/bureau-laboratories-safety-documents

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APPENDIX OF CHANGES

07/30/2008 Added Interferences, References and Appendix of Changes. Moved Scope and Application and Summary of the Method from comment section and placed in body of SOP.

07/13/2009 Updated Quality Manual reference. Added date to previous change (initial change was on 7/30/2008).

07/13/2010 Updated Quality Manual reference. Added 'CAUTION Individuals allergic to latex should not use latex gloves. A suitable substitute should be found and used.' and deleted 'Vinyl gloves can be substituted for individuals allergic to latex.' in Safety Section comments. Completed names in Main Salts Step 1 comment. Replaced '06' with '10' in all batch # examples.

05/18/2011 Updated Quality Manual reference and SOP link. Replaced Mettler PC 440 balance with Mettler Toledo MS 403TS/00 and associated SOP reference. Added "The bath # is the preparation date mm/dd/yy." Deleted "The first batch produced in a calendar year is always numbered 01 followed by the last two digits of the year (example 01-10). Additional batches in a calendar year are sequentially numbered (example the second batch in a calendar year would be 02-10)."

05/18/2013 Updated the SOP format.

02/10/2015 Formatted for 508 compliance.

03/05/2015 Updated links.

08/19/2015 Added warning concerning aluminum weigh boats. Updated links.

09/14/2016 Added Mettler balance. Removed OHAUS balance.

09/20/2017 Moved definition of PAAP to Summary of Method section; added expiration dates where they were missing; included LIMS Standard Prep Tracker in record keeping steps.

08/29/2018 Updated to replace Mettler Toledo PB403PB/FACT balance with the Mettler Toledo 403TS/00 Balance. Updated links and changed font to Calibri.

09/13/2018 Updated SOP reference for Mettler Toledo 403TS/00 balance (M. Faircloth 09/13/2018).

09/03/2020 Removed references to out of date logbooks. Updated with universal language.

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