ITU ROVER TEAM
SCIENCE TEAM
SAFETY INSTRUCTIONS

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1. Procedure

Total Organic Carbon Experiment

Wayne-Blank TOC method

It aims to oxidation of carbon with chromic acid and reduction of chromate with iron solution by redox reactions respectively. Before analyzing the soil sample, a calibration solution set is analyzed which consist of glucose solutions.

However to be ensure of the results of Wayne-Blank TOC experiment, and to eliminate error in TOC experiment, permanganate oxidizable carbon experiment is also conducted which has less complex procedure to apply and gives chance to comparison of results.

PMOX method:

It aims to measure oxidized carbon amount by observing reduction color change on manganate solution.

Before Science Task mission starts;

Wayne-Blank TOC preparation:

Preparation of solutions: Potassium dichromate solution is prepared by mixture of 1 N potassium dichromate salt with 500 ml distillated water. Iron (II) ammonium sulfate solution is prepared 0.4 N with 400 ml distillated water and 7 ml sulfuric acid is added after. Diphenylamine indicator is prepared with 0.25 g diphenylamine, 10 ml distillated water and 50 ml sulfuric acid.

Potassium permanganate preparation:

Preparation of solutions: Firstly, solutions are prepared. Calcium chloride solution is prepared as 11.09 g $CaCl_2$ is dissolved in 750 ml distilled water. Permanganate solution, that is 0.2 M, is prepared as 31.61 g $KMnO_4$ salt is dissolved in 200 ml of distilled water and these two solutions are mixed together. pH value is being checked for mixture, and it must be 7.2 strictly if not, by addition of potassium hydroxide or hydrochloric acid, pH is fixed to 7.2.

Before analyzing soil sample, calibration tests must be run. Colorimeter, which used during experiment ALTA II, is manipulated as colorimeter, is set to 550 nm. In three tubes, 3.75 ml, 2.50 ml and 0.99 ml distillated water is added respectively. 0.2 M permanganate solution is added 1.25 ml, 2.50 ml and 5.00 ml respectively in each tubes which are standard solutions.

In nine different falcon tube 20 ml distillated water is added and 0.2 ml of standard solutions in each three tube distinctively. Absorbance is recorded to use in final calculations.

After soil sample enters the lab;
Soil sample is air dried and grounded in a porcelain mortar.

Wayne-Blank Method:
0.5 g soil sample is taken in an erlenmayer flask and 10 ml 1N dichromate solution, 20 ml concentrated sulfuric acid, 200 ml distillated water, 20 ml concentrated phosphoric acid, 0.2 g sodium fluoride and 1 ml diphenylamine indicator is added respectively and at each addition well-mixed solution is achieved. Solution is titrated with 0.4 g iron (II) ammonium sulphate. Titration is ended when color is turned to lighter green.

POXC Method:
Soil sample is dried and the sample is experimented in duplicate. 2 tubes are filled with 18 ml distillated water and 2 tubes are filled 20 ml distillated water. Soil samples are added 2.5 g by each. 0.2 M, 2 ml permanganate solution is added in 18 ml distillated water soil sampled tubes. Tubes are cap and shacked 2 minutes. After 2 minutes, solution is sloshed. By adding 20 ml water in tube, reaction is ended and data is recorded from colorimeter.

HCL Test:
In order to understand carbonate composition of the sample, HCl solution with 10% concentration will be used to observe bubbling on the fresh surface of the rock sample. Carbonate minerals forms at low temperature and in the presence of water. Therefore, this observation gives the team idea about the site's habitability for organisms.

2. Chemicals Used

-Diphenylamine
-Sulfuric acid
-Phosphoric acid
-Sodium fluoride
-Potassium dichromate
-Iron II ammonium sulphate
-Potassium permanganate
-Calcium chloride
-Potassium hydroxide
-Hydrochloric acid

Note: Chemicals will be supplied by local laboratory and hardware stores in Utah. During the transportation, the chemicals will be handled only by our trained Science Team members to minimize the potential hazards.

3. Pre-Cautions

In order to do not allow any type of accidents, laboratory experiments will be taken with precautions that are listed below:
- Non-nylon and covered clothes are worn.
- For any split of chemicals and for exothermic reactions' temperature reduction water stock

is handed.
- Plastic goggles and nitrate gloves are worn to protect eyes and skin.
- In order to eliminate slipping accidents covered, plastic shoes are worn.
- While working concentrated acids, to eliminate skin damages acid resistant gloves are worn.
- When acid is diluted, acid always added to water. NEVER reverse.
- Experiments are held on well-ventilated bench by adding a fan on bench.
- In order to put out any flame or fire, sand-free, carbon dioxide based fire extinguisher is ready near working bench.
- Acid disposal and organic compounds disposal are kept distinctively not to harm competition area.
- Disposal of chemicals are taken by chemical disposal facilities around Utah, primarily Enviro Chemicals (505 North Main North Salt Lake, Utah 84054505)

4. Accident Plan

Even all precautions are ruled, in any case of emergency, listed procedure will be applied.
-Science sub team leader Bahadır Onur Güdürü is responsible to evacuation of all team members, will be in touch with police and health services.
- Do not let any participants get panic,
- First head is protected and people around tent is evacuated.
- URC services are informed about accident.
- Chemicals are used during experiments not in moderate or large scale, for any split of chemicals diluting with water and drying are enough to eliminate risk.
- For any fire or flame, fire extinguisher is used firstly and authorized people are informed immediately.
- P-A-S-S procedure is applied during using fire extinguisher.
- For any chemical spill on skin or eyes, spitted area is washed minimum 20 minutes.

5. Attaches of related MSDS documents

A1: Dispenser solution
A2: Calcium Chloride
A3: Diphenylamine
A4: Phosphoric Acid
A5: Hydrochloric Acid
A6: Ferrous ammonium sulfate hexahydrate
A7: Isopropyl Alcohol
A8: Potassium hydroxide
A9: Sulphuric Acid
A10: pH 4.01 Buffer Solution
A11: pH 7.00 Buffer Solution
A12: pH 10.01 Buffer Solution
A13: Potassium Dichromate
A14: Potassium permanganate
A15: Sodium Fluoride