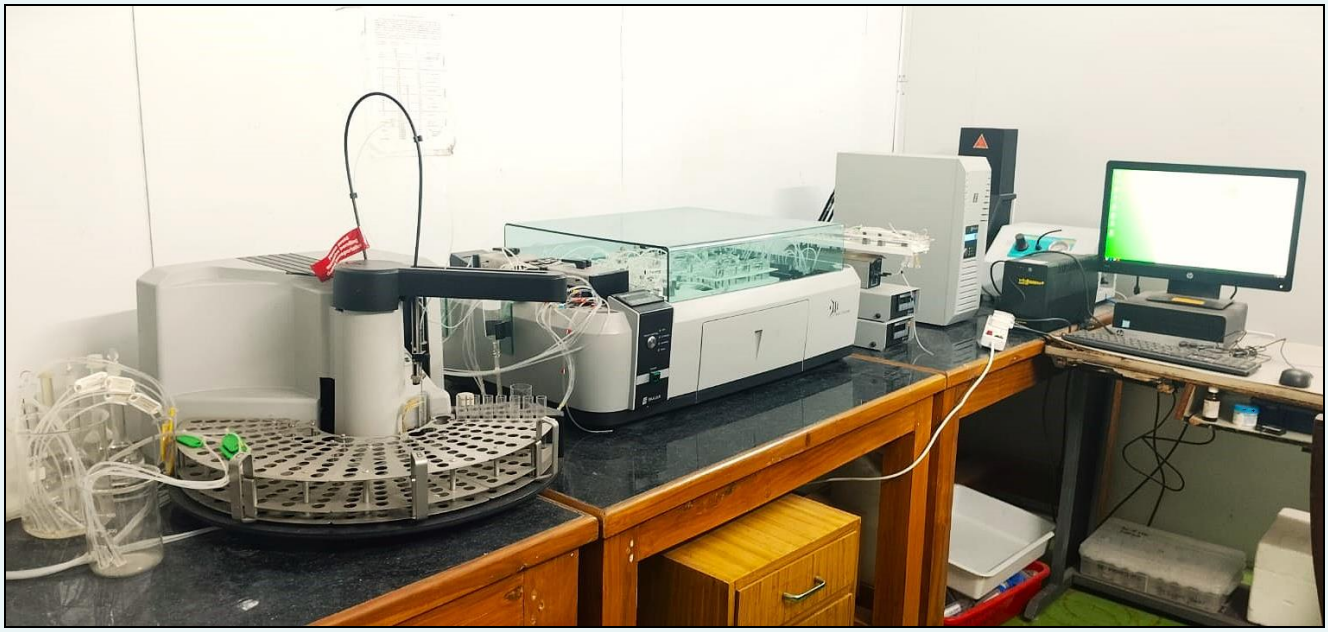
Nutrient Analyzer (Geochemistry Unit)



Name of the Instrument:	Nutrient Analyzer
Instrument BSIP Code:	BSIP/SAIF/0012
Make:	SKYLAR
Model:	San++ continuous flow analyzer (21050900 / 5000 / 28505900)
Year of Installation:	2012

Unit In-charge: Dr Anupam Sharma (anupam.sharma@bsip.res.in, Contact: 0522-2742974)

Scientist In-charge of Instrument: Dr Anurag Kumar (anuragkumar@gmail.com)

Facilities under the lab: FID and wet chemistry laboratory.

Specification: The Skylar Nutrient Analyzer San++ is a highly versatile and efficient system used for the analysis of nutrients in various water samples. The facility is capable of analyzing multiple nutrients including nitrate, nitrite, ammonia, phosphate, silicate etc. The instrument utilizes colorimetric detection techniques for precise measurement of nutrient concentrations. The instrument has fully automated operation with programmable sequences for sample preparation, analysis, and data processing. Features automatic calibration and reagent preparation, enhancing ease of use and accuracy. It is highly sensitivity with low detection limits, suitable for trace level nutrient analysis in various types of water samples.

1. **Ammonia** (Range: 0.02 - 2 mg N/liter)
2. **Nitrate + Nitrite** (Range: 0.1 - 10 mg N/liter)
3. **Potassium** (Range: 0.4 - 40 mg K/liter)

4. Silicate (Range: 0.1 - 10 mg Si/liter)
5. Ortho Phosphate (Range: 0.1 - 10 mg P/liter)
6. **Urea** (Range: 1 - 100 mg N/liter)
7. Boron (Range: 0.02 - 2 mg B/liter)
8. Chloride (Range: 1 - 100 mg Cl/liter)
9. Total Fluoride (Range: 0.1 - 5 mg F/liter)
10. Bicarbonate (Range: 0.07 – 3.3 g CO_2/liter)

Working Principle: The working principle of the Skylar Nutrient Analyzer San++ involves several key steps, primarily based on colorimetric analysis. Here's a detailed overview of how the system operates:

Sample Preparation: The water sample to be analyzed is introduced into the system. This can be done manually or through an automated sample feeder. The sample may undergo pre-treatment to remove interferences or to bring the analytes into a detectable form.

Reagent Addition: Specific reagents are added to the sample to react with the target nutrients. The type of reagent and its addition sequence depend on the nutrient being measured (e.g., nitrate, phosphate, ammonia, etc.). The reaction typically results in the formation of a colored complex whose intensity is proportional to the concentration of the nutrient.

Reaction and Mixing: The sample and reagents are mixed thoroughly in a reaction chamber or flow cell to ensure complete reaction. This mixing can be achieved through mechanical stirring, flow-induced mixing, or other methods depending on the design of the analyzer.

Color Development: The chemical reaction between the nutrient and the reagents produces a color change. The specific wavelength at which this color change is observed depends on the nutrient being analyzed. The color development is time-dependent, and the system allows for sufficient time to ensure the reaction reaches completion.

Detection: The colored solution passes through a photometric detector, typically a spectrophotometer, which measures the absorbance of light at a specific wavelength. The absorbance is directly related to the concentration of the nutrient in the sample, based on Beer-Lambert's law.

Calibration and Quantification: The system uses a calibration curve generated from standard solutions with known nutrient concentrations to convert absorbance values to actual concentrations. Calibration can be automated and verified regularly to ensure accuracy and precision.

Data Processing: The absorbance data is processed by the system's software, which calculates the nutrient concentrations in the sample. The software can handle multiple samples, perform statistical analysis, and generate reports.

Quality Control: The analyzer includes quality control features such as checking calibration standards, running blank samples, and using quality control charts to monitor performance over

time. Automatic recalibration and reagent blank corrections are performed to maintain data integrity.

Output and Reporting: The final nutrient concentrations are displayed on the system's interface and can be exported to various formats (e.g., CSV, Excel) for further analysis or record-keeping.

Application: Currently the instrument is configured to measure Ammonia, Nitrate + Nitrite, Potassium and Urea concentration in liquid samples. Here are some key applications:

Environmental Monitoring:

- **Surface Water Quality**: Monitoring nutrient levels in rivers, lakes, and streams to assess the impact of agricultural runoff, industrial discharges, and urbanization.
- **Groundwater Quality**: Measuring nutrient concentrations in groundwater to detect contamination from fertilizers, septic systems, and other sources.
- **Marine and Coastal Waters**: Assessing nutrient levels in oceans and coastal areas to study eutrophication and its effects on marine ecosystems.

Water Treatment Plants:

- **Drinking Water**: Ensuring that nutrient levels in drinking water sources meet regulatory standards to protect public health.
- **Wastewater Treatment**: Monitoring nutrient removal efficiency in wastewater treatment processes to optimize operations and ensure compliance with discharge regulations.

Agriculture:

- **Soil and Irrigation Water**: Analyzing nutrient content in soil and irrigation water to optimize fertilization practices and improve crop yields while minimizing environmental impact.
- **Runoff Monitoring**: Measuring nutrient levels in agricultural runoff to assess the effectiveness of best management practices (BMPs) in reducing nutrient pollution.

Research and Academia:

- **Hydrology Studies**: Investigating nutrient dynamics in different water bodies to understand biogeochemical cycles and their influence on water quality.
- **Ecological Research**: Studying the impact of nutrient loading on aquatic ecosystems, including algal blooms, fish populations, and overall biodiversity.

Industrial Applications:

- **Process Water**: Monitoring nutrient concentrations in industrial process water to ensure quality control and optimize production processes.
- **Effluent Monitoring**: Assessing nutrient levels in industrial effluents to comply with environmental regulations and minimize the impact on receiving water bodies.

Public Health and Safety:

- **Monitoring Harmful Algal Blooms**: Detecting nutrient levels that may contribute to harmful algal blooms (HABs), which can produce toxins harmful to human and animal health.
- **Recreational Water Quality**: Ensuring that nutrient levels in recreational waters, such as swimming lakes and beaches, are safe for public use.

Regulatory Compliance:

- **Environmental Regulations**: Helping organizations comply with local, national, and international water quality regulations by providing accurate and reliable nutrient data.
- **Permit Requirements**: Assisting in the preparation and submission of monitoring reports required for environmental permits.

Guideline for sample preparation and courier: The samples should be collected in 30-120 ml (depending on analysis) HDPE amber bottle. The samples should be filtered in field with 0.22 micron syringe filter and should be stored at temperature below 4 degree C. Different analysis requires different methodology for sample collection. Users must follow published literature for collection of samples, its storage and transport. The samples should be sent to below mentioned address for analysis.

Address: Dr Anurag Kumar
Scientist
Birbal Sahni Institute of Palaeosciences, Lucknow
53 University Road
City: Lucknow
State: Uttar Pradesh
Pin: 741246

User instructions:

1. The analytical data/spectra provided cannot be used as certificates in legal disputes.
2. Service charges (including GST) will be payable in advance through BSIP online payment portal or through Draft/RTGS/NEFT in favour of "The Director, BSIP, Lucknow", Payable at Lucknow.
3. Separate samples should be sent for different analysis. Samples will not be analysed until payment is received.
4. In case of prepared samples, the user must specify the procedure that how the sample was prepared (complete methodology).
5. In all correspondence related to analysis, our reference number must be mentioned.
6. Interpretation of data/spectra will NOT be done.

7. It is mandatory for users to acknowledge the facility in their research work and inform the respective laboratory and the Director of BSIP, Lucknow. This information will be communicated onward to DST, New Delhi.
8. For Lab visit, it is mandatory to take prior appointment. The application should be sent to the BSIP director and unit in-charge.

Payment Guidelines: Payment should be done through online payment portal of BSIP or through bank draft in favour of "Director, Birbal Sahni Institute of Palaeosciences". Please visit our web-site for updated rate-List. Please mention the instrument code in remarks at the time of payment. The payment confirmation must be sent to concerned scientists along with the copy performa invoice.