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A

PROJECT REPORT ON

"ANIONIC AND CATIONIC ANALYSIS OF GLACIER WATER BY ION CHROMATOGRAPHY"

(27)

Carried out at

NATIONAL INSTITUTE OF HYDROLOGY (NIH), ROORKE

Submitted in partial fulfilment of the requirements for the award of

The degree of

MASTER OF SCIENCE

IN

CHEMISTRY

(Commercial method of chemical analysis)

Of

GURUKUL KANGRI UNIVERSITY, HARIDWAR

Submitted by

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SESSION:-2015-16

Forwarded to
Head, RMOD.
19/5/16

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2015-2016

DECLERATION

I hereby declare that the work being presented in this project report entitled "**Anionic and cationic analysis of glacier water by ion chromatography**" for the partial fulfilment of the award of degree of master of science in chemistry (commercial methods of chemical analysis) of Gurukul Kangri University, Haridwar under the guidance of **Dr. Manila**, assistant professor, department of chemistry, **Kanya Gurukul Campus Haridwar** is an authentic record of my own work carried out during the period of 18-01-2016 to 31-03-2016 at **national institute of hydrology (NIH), roorkee.**

The matter embodied in this report has not been submitted by me for the award of any other degree.

Date: 27/4/2016

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TO WHOM IT MAY CONCERN

This is certified that Ms. Neha Kushwaha, Student of M. Sc. (Chemistry), IV Semester, Kanya Gurukul Campus., Jwalapur, Haridwar has carried out the project work on the topic titled "Anionic and Cationic Analysis of Glacier Water by Ion Chromatography" for the duration of 3 months (18 January to 31 march 2016) in Water Quality Laboratory, National Institute of Hydrology, Roorkee under the guidance of the undersigned. I wish for her bright future.

8/4/16
(M. K. Sharma)
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CERTIFICATE

This is to certify that the work incorporated in this project entitled "**Anionic and cationic analysis of glacier water by ion chromatography**" has been carried out by **Neha kushwaha** D/o Mr. Somprakash during 18-01-2016 to 31-03-2016 under my supervision at **National institute of hydrology (NIH), Roorkee** for the partial fulfilment of the requirements of the award of the degree of Master of science in chemistry (commercial method of chemical analysis) of Gurukul Kangri University, Haridwar (U.K.).

Date: 14/5/16

Place: Haridwar

Manila

Dr. Manila

(Supervisor)

ABOUT NIH

NATIONAL INSTITUTE OF HYDROLOGY, the premier institute in the area of hydrology and water resources in India. The institute was established in 1978 with the main objective of undertaking, aiding, promoting and coordinating systematic and scientific work in all aspects of hydrology. The institute is well equipped to carry out computer, laboratory and field oriented studies.

The institute is located at roorkee in haridwar district, uttarakhand, india. Roorkee, the historic town, is a well known educational and research centre with the I.I.T., roorkee and a number of R & D organisations viz. central building research institute, irrigation reaearch institute and army's Bengal engineering group. The studies and research activities at the NIH roorkee are carried out under five scientific divisions. As part of the technology transfer program of the institute, various training courses/workshops are also organized by the divisions. The five divisions are as follows:

1. Hydrology division
2. Groundwater hydrology division
3. Hydrological investigations division
4. Surface water hydrology division
5. Resources systems division

ACKNOWLEDGEMENT

I welcome this opportunity to express my deep sense of gratitude to Dr. MANILA, assistant professor for the guidance, intelligence, suggestions and devoting her valuable time for the project work.

I wish to express my sincere thanks to my teacher Dr. ANJALI GOEL head of department, KANYA GURUKUL CAMPUS, HARIDWAR for her valuable suggestions and encouragement.

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I am not getting the suitable words to express my heartfelt gratitude to my venerated and intelligent parents who has not only support me materially but also helped me to maintain my calm all throughout the study.

Finally, I own my sincere thanks to my friends Neha, Khushbu for their constant moral and support during the completion of this project work.

Neha

NEHA KUSHWAHA

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CHAPTER- 1

INTRODUCTION

WATER

Water is our most precious resource. All plant and animals must have water to survive. If there is no water there would be no life on earth.

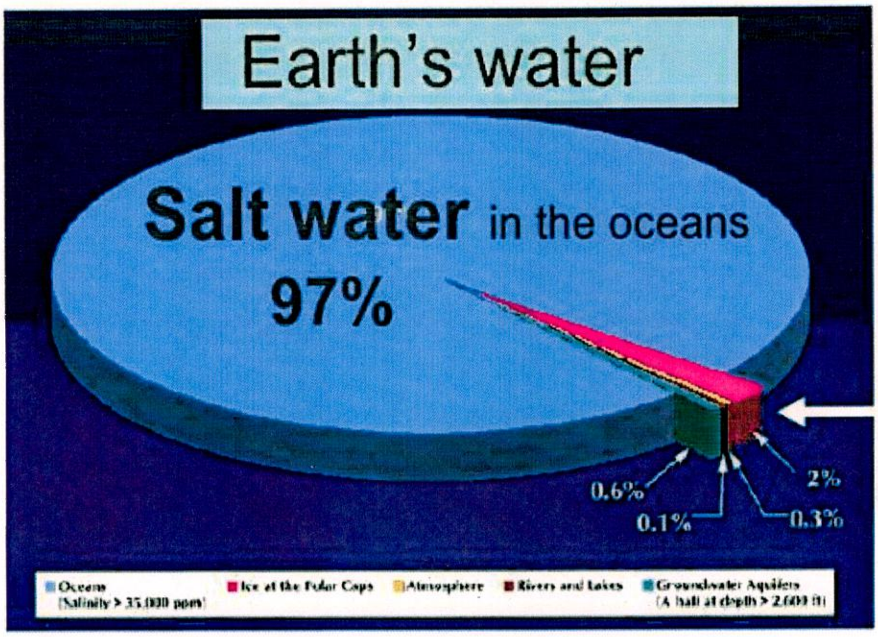
Water is a colourless, transparent liquid, which forms the seas, lakes, rivers and rain and is the basis of fluids of living organisms. Water molecule consists of three atoms, an oxygen atom and two hydrogen atoms that are connected by covalent bonds.

Water is among the most essential requisites that nature provides to sustain life for plants, animals and humans. The earth is sometimes called as a "water planet" because water covers 71% of the earth surface but most of this water is salt water. Freshwater makes up only about 2% of the water on this earth. A large proportion of the world's population depends on melting water from glaciers into lakes and rivers for freshwater supply. With glaciers melting at faster rate than what the rivers can normally hold, the fresh drinking water overflows into the sea and is wasted.

The decreased mass of the shrinking glacier also spells water supply shortage in the near future. In fact, people living in the places near Himalayas are already facing water shortage.

Generally the fresh water on earth is locked up in glaciers, icecaps, lakes, rivers and ponds etc. India is fortunate to have abundant fresh water resource in the form of a number of perennial rivers besides reservoirs, ponds, lakes and swamps etc, but it is unfortunate that today most of our water bodies or fresh water resources are the most polluted and water from many of them is unfit for use.

Most (97%) of the water on Earth is salt water in the oceans.



Only about 3% of Earth's water is fresh water.

Fresh water 3%

We use water for drinking, cooking, washing and growing our food as well as, many other things.

Even water is used by industries to generate electricity, manufacture things, and transport people and goods. Water is also essential in industry. It is heated and the steam is used to run machinery. Water is used to cool hot metal such as the production of steel.

USES OF WATER FOR DIFFERENT PURPOSE-

Water your yard and outdoor plants early or late in the day to reduce evaporation.

Use a shut-off nozzle on your hose.

Use plants that require less water.

Mulch around plants to hold water in the soil.

Get an Energy Star labeled washing machine.

Wash only full loads.

Use a low flow showerhead.

Take shorter showers — five minutes or less is best.

Turn off the water while soaping hands and brushing teeth.

Turn off sink faucet while scrubbing dishes and pots.

Install new toilets that use less than 1.6 gallons per flush.

Put faucet aerators on sink faucets.

Us a broom, not a hose, to clean driveways and walkways.

WATER POLLUTION

But the problem of pollution continues to pose a serious challenge as the threat of nuclear war. It is expected that due to urbanization, population growth, industrial proliferations, increasing living standards and wide spheres of human activities in India or in developing countries, the river get polluted every year. The situation is very much critical due to improper management of water.

The water pollution may be defined as “any change in physical, chemical and biological properties of water or discharge of any sewage as industrial waste into water bodies without enough treatment to remove harmful compounds.

Pollutants get into water mainly by human causes or factors. Water pollution affects the entire biosphere- plants and organisms living in these bodies of water.

Water pollution is a major problem which affects drinking water, rivers, lakes and oceans all over the world. In many developing countries, it is usually a leading cause of death, by people drinking from polluted water sources.

Thus water pollution disturbs the normal uses of water for irrigation, agriculture, industries, public water supply and aquatic life. Actually it represents the state of deviation from the pure conditions, where by its normal functions and properties are affected.

WATER POLLUTION CAUSES BY...

- Industrial waste
- Sewage
- Mainly from household
- Nuclear waste
- Marine dumping
- Oil pollution
- Underground storage leaks

HEALTH EFFECTS OF POLLUTION:

- Diseases like cholera, malaria.
- Typhoid (spread during the rainy season), aquatic life gets destroyed.
- Respiratory illness
- Headache fatigue
- Jaundice
- Gastroenteritis (through bacteria, parasites, chemicals)

WHAT IS WATER QUALITY?

Water quality describes the condition of the water including chemical, physical and biological characteristics, usually with respect to its suitability for a particular purpose such as drinking or cooking.

Water quality is that of a simple property that tells weather water is polluted or not.

Water quality tends to be found focused on water that is treated for human consumption, industrial use, or in the environment.

Water quality is measured by several factors, such as the concentration of dissolved oxygen, bacteria levels the amount of salt or the amount of the material suspended in water (turbid).

The parameters for water quality are determined by intended use. The water quality parameters are roughly divided into three categories. That is.

1. **PHYSICAL ANALYSIS-** including temperature, colour, turbidity and conductivity.
2. **CHEMICAL ANALYSIS-** including alkalinity, acidity, nitrates, chloride, sulphate etc.
3. **BIOLOGICAL ANALYSIS-** including bacteria, algae and viruses.

The concentration of pesticides, herbicides, heavy metals and other contaminants may also be measured to determine water quality.

WHAT IS WATER QUALITY ANALYSIS?

Water quality standards are put in place to ensure the efficient use of water for a designated purpose. Water quality analysis is to measure the required parameters of water, following standard method, to check whether they are in accordance with the standard.

WHY WATER QUALITY ANALYSIS IS REQUIRED?

Water quality analysis is required mainly for monitoring purpose. Some importance of such assessment includes:

1. To check whether the water quality is in compliance with the standards, and hence, suitable or not for the designated use.
2. To monitor the efficiency of a system, working for water quality maintenance.
3. To check whether water quality is in compliance with rules and regulation.

Water quality analysis is of extremely necessary in the sectors of:

- Public health (especially for drinking water)
- Industrial use

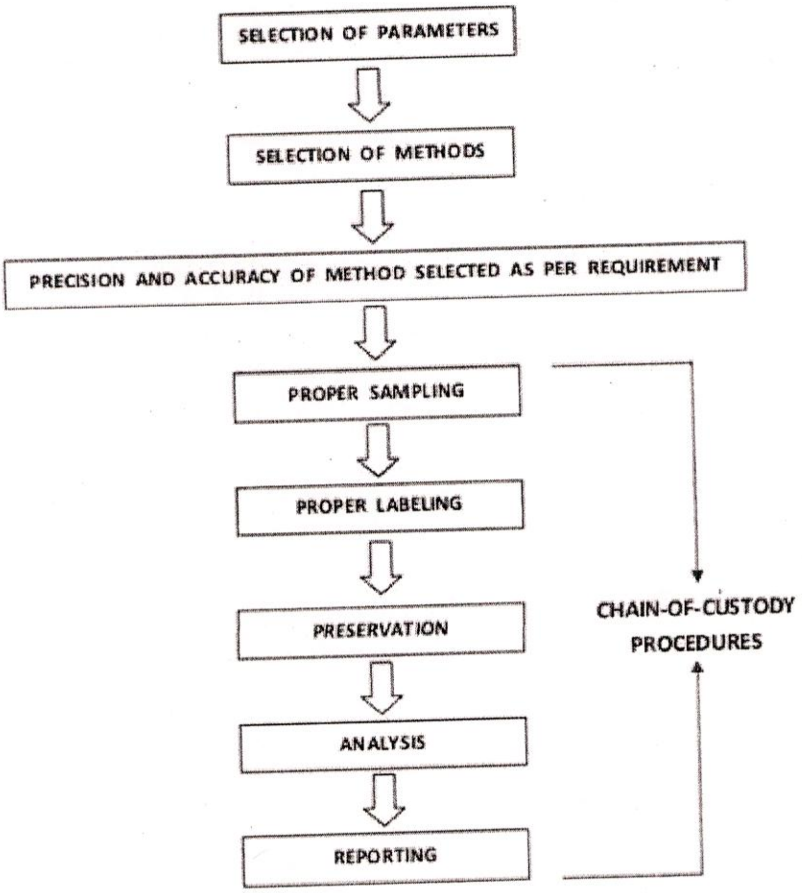
Poor water quality can pose a health risk for people. Poor water quality can also pose a health risk for ecosystem.

FOLLOWING TECHNIQUES ARE USED-

- Titration
- Flame emission
- Colour develop with absorption measurement
- Turbidity

Procedures of Water Quality Analysis

The general flow of procedures for water quality analysis is as follows:



SELECTION OF PARAMETERS

The parameters of water quality are selected entirely according to the need for a specific use of that w

Some examples are:

- **Drinking**
  As per WHO/CPCB Standards
- **Irrigation**
  pH
  Conductivity
  Sodium & Potassium
  Nutrients
- **Industries**
  As per specific requirement
- **Domestic Consumption**
  As per BIS Standards
- **Water Bodies**
  As per CPCB guidelines

CHAPTER- 2

PURPOSE OF STUDY

PURPOSE OF THE STUDY

In India, 12% of the people get clean drinking water, the rest 88% quench their thrust from polluted lakes, rivers and well due to which more than 3 million people get affected or die from enteric diseases every year. This surface water, ground water and glacier water mainly polluted by anthropogenic activities like urbanisation and industrialisation, disposing garbage etc.

Water quality of lakes is deteriorating solid and liquid disposal of water. Any contamination of lakes affects the greatly the flora and fauna and also the human health, if the water is used domestic supply. The environmental health of any lake system depends upon the nature of that lakes and its exposure to various environmental factors such as temperature, depth of water and wind speed, soil type and land use of the catchment.

Most people do not really understand that the drinking water comes from sources like the Himalayan bhojwasa glacier, and in the coming years very serious problem that water shortages will ensure due to melting of these glaciers.

Six samples of bhojwasa glacier has been analyzed for determine the anion that is fluoride, chloride, nitrate, sulphate and cation that is sodium, potassium, calcium and magnesium etc. in glacier water samples by using ion chromatography. And also determine the water quality parameters viz. pH, EC, alkalinity and hardness.

CHAPTER- 3

ABOUT GLACIER

WHAT IS A GLACIER?

A glacier is a large mass of ice formed by compaction and re-crystallisation of snow, moving slowly by creep down slope, due to the stress of its own weight, and surviving from year to year. Glaciers occupy about 10% of the earth's land surface but hold roughly 77% of its fresh water; more than 96% of glaciers ice lies in the polar region, Antarctica and Greenland.

A glacier is a large, perennial accumulation of ice, snow, rock, sediment and water originating on land moving down slope under the influence of its own weight. Glaciers are complex and dynamic and are continuously changing in response to changes in temperature, precipitation and other processes. A temperate glacier is one in which during part or all of the year, liquid water coexists with ice. Hence, a small change in temperature can have a major impact on glacier melting, area, volume, and sea level.

Glaciers store about 75% of the world's fresh water and glaciers are the world's largest reservoirs of water on our planet. Hence melting glaciers can create severe environmental problem like-rising sea level, floods and water shortages in years to come.

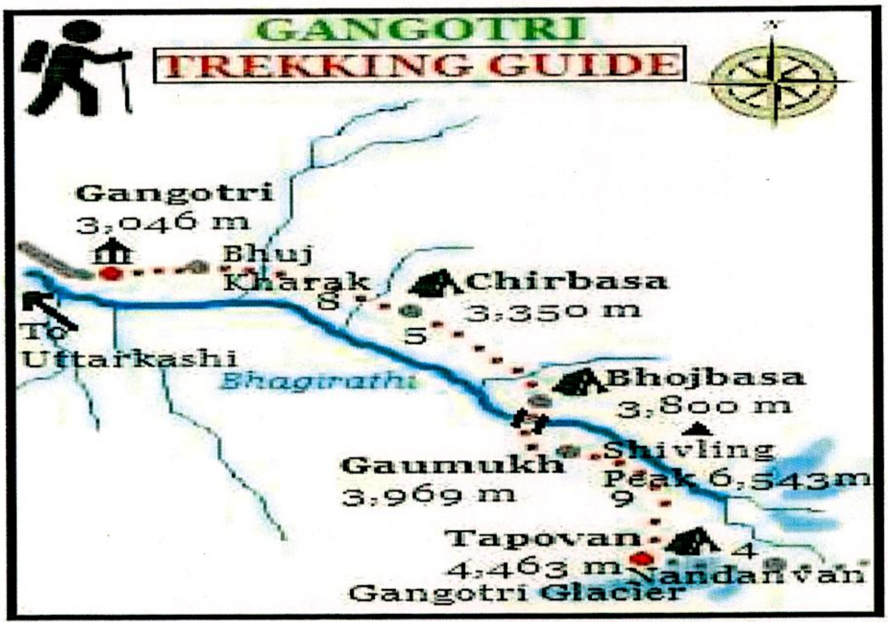
CAUSES OF MELTING-

The increased atmospheric temperature from global warming is the main cause for the melting of glaciers. Melting is due to global warming from the burning of fossil fuels, but climate change is the biggest factor. Global warming is the rise in average global temperature, and this Increase in temperature has been taking place over the past century. In turn, global warming is tightly linked to the rapid industrial growth over the past century, where the use of fossil fuels in industries, offices and home became rampant and the release of green house gasses like CO2. The increased level of green house gas in turn leads to more heat trapped in the earth's atmosphere, resulting in overall warmer temperatures. This increase in global temperature is the biggest cause of melting glaciers.

Melting glaciers have several different affects. For example- the melting of glaciers in the Himalayas will affect the drinking supplies of the millions of people who rely on melt water rivers. When sea level rise, people living close to sea level will have their homes flooded. Melting glaciers can also release energy and trigger massive earthquakes.

STUDY AREA- (BHOJWASA, GANGOTRI)

Bhojwasa is a scenic spot on the rugged terrains, situated at an altitude of 3,775 mts above sea level. Bhojwasa can be reached by 14 kms trek that starts from gangotri. The trek goes through rugged terrains along with the Bhagirathi river.Bhojwasa acts as the last point of accommodation on the way to the sacred Gaumukh glacier. It is situated 5 kms before Gaumukh glacier, the source of the river ganga. This beautiful place offers enchanting views of the Bhagirathi peaks (6,856 mts). Bhojwasa is a vast open expanse of land in the valley.



How to do sample collection-

Liquid samples should be filtered prior to evaluation with an ion chromatograph to remove sediment and other particulate matter as well as to limit the potential for microbial alteration before the sample is run. Aqueous samples should be collected using a sterile syringe or bottle rinsed three times with sample water and then filtered through filters. The collection vial should likewise be rinsed three times with filterate before being filled brim-full of sample filterate. Samples should be stored cold until they can be processed.

TABLE 1: SAMPLE LOCATION AND IDENTITY

S.NO.	PLACE OF WATER COLLECTION SITE	SAMPLE ID	SOURCE	DATE	VOLUME OF SAMPLE COLLECTION
1.	BHOJWASA	BJW-176	River bank	26-9-2015	1litre
2.	BHOJWASA	BJW-177	River bank	26-9-2015	1litre
3.	BHOJWASA	BJW-178	River bank	27-9-2015	1litre
4.	BHOJWASA	BJW-179	River bank	27-9-2015	1litre
5.	BHOJWASA	BJW-180	River bank	28-9-2015	1litre
6.	BHOJWASA	BJW-181	River bank	28-9-2015	1litre

TABLE 2: SUGGESTED PRESERVATION TECHNIQUES

PARAMETER	PRESERVATIVE	MAXIMUM SHORTAGE TIME
colour	Cool to 3 – 4^0 C	24 hours
turbidity	Cool to 3 – 4^0 C	7 days
pH	-	immediately
alkalinity	Cool to 3 – 4^0 C	24 hours
hardness	Add 2ml HNO_3/L & cool to 3 – 4^0 C	7 days
sulphate	Cool to 3 – 4^0 C	7 days
chloride	-	7 days
phosphate	Cool to 3 – 4^0 C	7 days
nitrate	Add 2ml H_2SO_4/L & cool to 3 – 4^0 C	7 days
B.O.D	Cool to 3 – 4^0 C	6 hours
metals	Add 5ml HNO_3/L	6 months

CHAPTER- 4

CHROMATOGRAPHY

BASIC TERM USED IN CHROMATOGRAPHY:

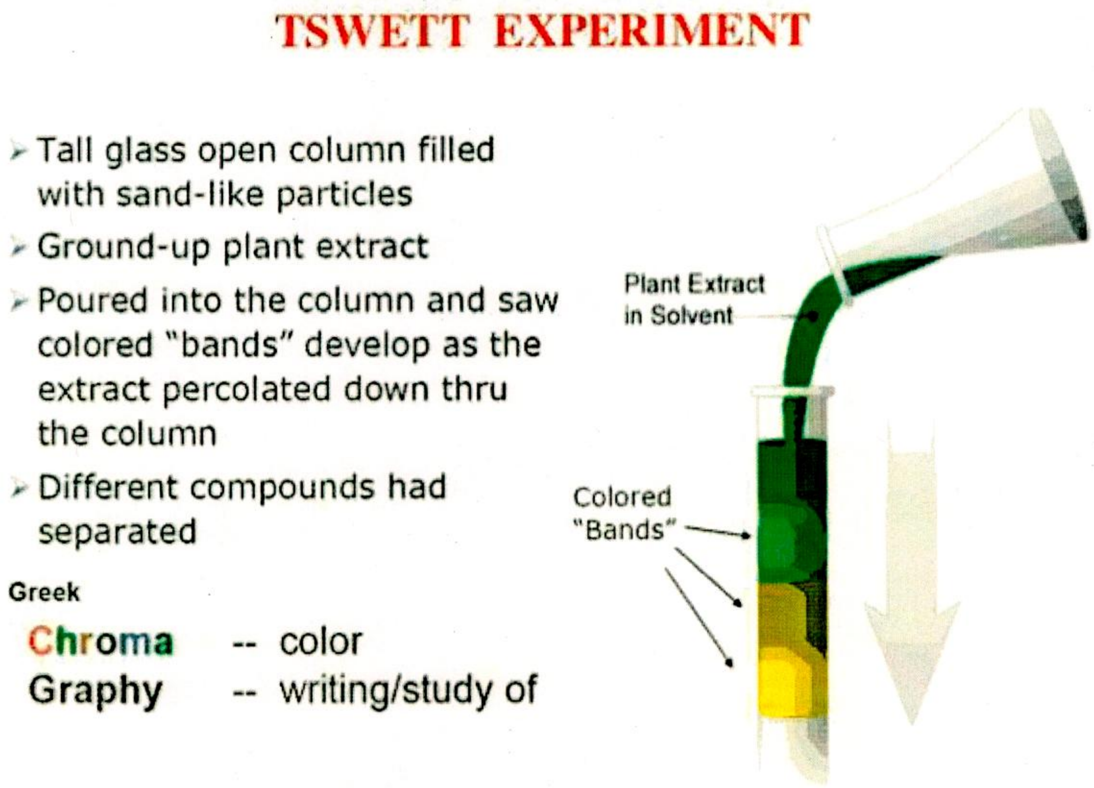
1. **CHROMATOGRAM-** a graphical or other presentation of detector response, concentration of analyte in the effluent or other quantity used as a measure of effluent concentration versus effluent volume or time.
2. **CHROMATOGRAPH-** it is the equipment that enables a sophisticated separation.
3. **EFFLUENT-** it is the mobile phase leaving the column.
4. **ELUENT-** it is the solvent that carries the analyte.
5. **SAMPLE-** the mixture consisting of a number of components the separation of which is attempted on the chromatographic bed as they are carried or eluted by the mobile phase.
6. **SOLVENT-** the term solvent has been often used for the mobile phase.
7. **SOLUTE-** a term referring to the sample components in partition chromatography.
8. **MOBILE PHASE-** a fluid which percolates through or along the stationary bed, in a definite direction. It may be liquid or a gas.
9. **STATIONARY PHASE-** term referring to the sample components in partition chromatography. the stationary phase is one of the two phases forming a chromatographic system. It may be a solid or a gel.

10. **ANALYTES-** the analyte is the substance to be separated during chromatography.

11. **RETENTION TIME-** it is the characteristic time it takes for a particular analyte to pass through the system. (from the column inlet to the detector).

HISTORY OF CHROMATOGRAPHY

- The chromatography technique was first invented by M.TSWETT in 1906.
- The term chromatography (Greek: CHROMATOS- colour and GRAPHEIN- to write).
- He used the technique to separate various plant pigment such as chlorophyll and xanthophyll.



TSWETT EXPERIMENT

- Tall glass open column filled with sand-like particles
- Ground-up plant extract
- Poured into the column and saw colored "bands" develop as the extract percolated down thru the column
- Different compounds had separated

Greek

Chroma -- color
Graphy -- writing/study of

CHROMATOGRAPHY

- Laboratory technique for the separation of mixtures.
- Colour bands- separation of individual compounds.
- Measured or analysed.
- It is a technique used to separate and identify the components of a mixture.

  Components- mobile phase, stationary phase and supporting medium.

PURPOSE OF CHROMATOGRAPHY-

- Analytical

  Determine chemical composition of a sample.
- Preparative

  Used to purify sufficient quantities of a substance

"Chromatography is usually introduced as a technique for separating and identifying the components in a mixture".

Chromatography is a physical method of separation in which the components to be separated are distributed between two phases-

1. **Stationary phase**
2. **Mobile phase**

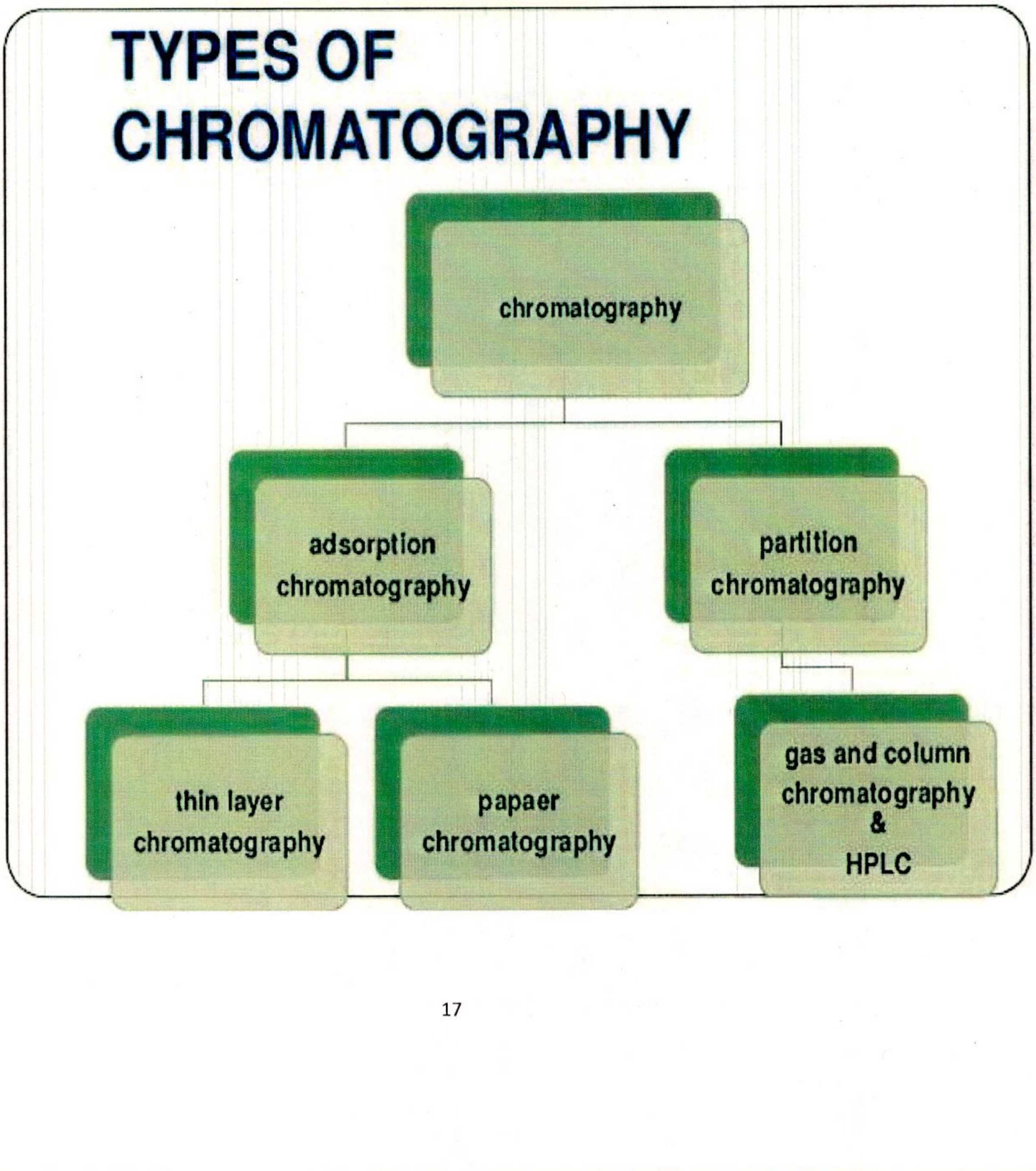
The separation is done due to differential affinities of compounds towards stationary phase and mobile phase. After separation the compounds they are identified by suitable detection method. The components in a mixture have different tendencies to absorb onto a surface or dissolve in a solvent. It is a powerful method in industry, where it is used on a large scale to separate and purify the intermediates and products in various synthesis.

PRINCIPLE OF CHROMATOGRAPHY-

Chromatography is based on the principle of separation of compounds into different bands and then identification of those bands.

The samples are subjected to flow by mobile liquid onto or through the stable stationary phase. The sample components are separated into fractions based on their relative affinity towards the two phases during their travel. The fraction with a greater affinity to stationary layer travels slower and at a shorter distance, while that with a lesser affinity towards faster and longer.

TYPES OF CHROMATOGRAPHY-



CHAPTER- 5

ANALYTICAL INSTRUMENT USED FOR ANALYSIS

ION CHROMATOGRAPHY

INTRODUCTION

Ion chromatography is used for water chemistry analysis. Ion chromatographs are able to measure the concentration of major anions, such as fluoride, chloride, nitrate, sulphate as well as major Cations such as, sodium, potassium, calcium and magnesium in parts per billion (ppb).

Concentration of organic acid can also be measured through ion chromatography.

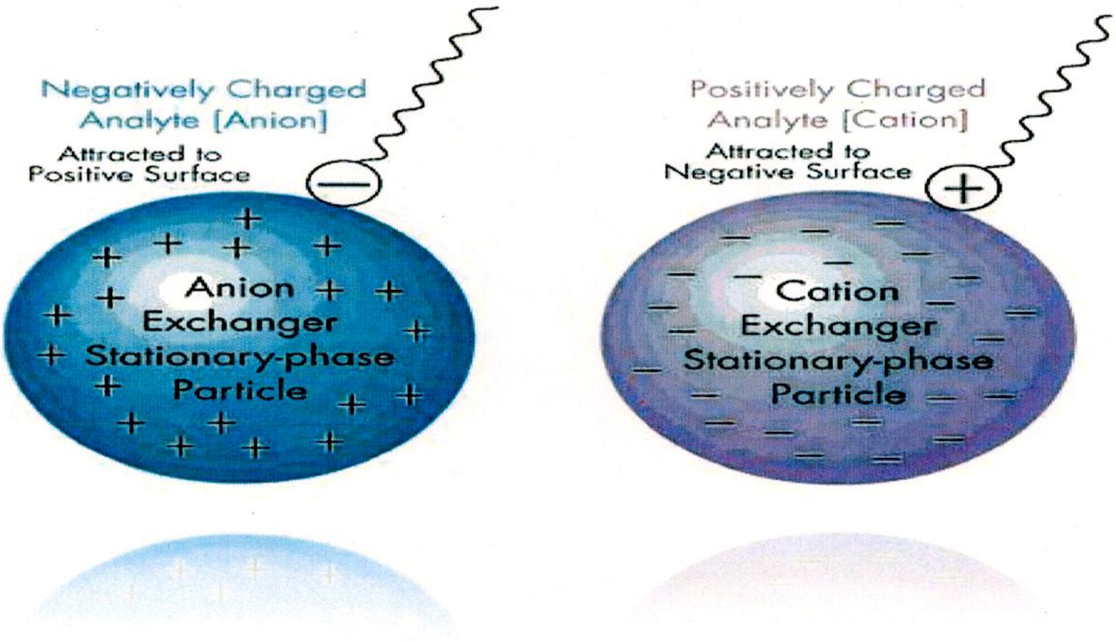
WHAT IS ION CHROMATOGRAPHY-

Ion chromatography is the process of separating ions (positively or negatively charged atoms or molecules) from a solution using a stationary phase that contains oppositely charged ions.

There are two main types of ion chromatography:

Anion chromatography is commonly used to measure negatively charged anions such as chloride, fluoride, sulphate, nitrate and phosphate etc.

Cation chromatography is commonly used to measure the positively charged cations such as calcium, magnesium, sodium and potassium etc.



PREPARATION OF MOBILE PHASE-

CATION- 227mg di piclonic acid in distilled water and heat to dissolve then cool and add 1.7ml of HNO_3 and make up to 1litre with distilled water.

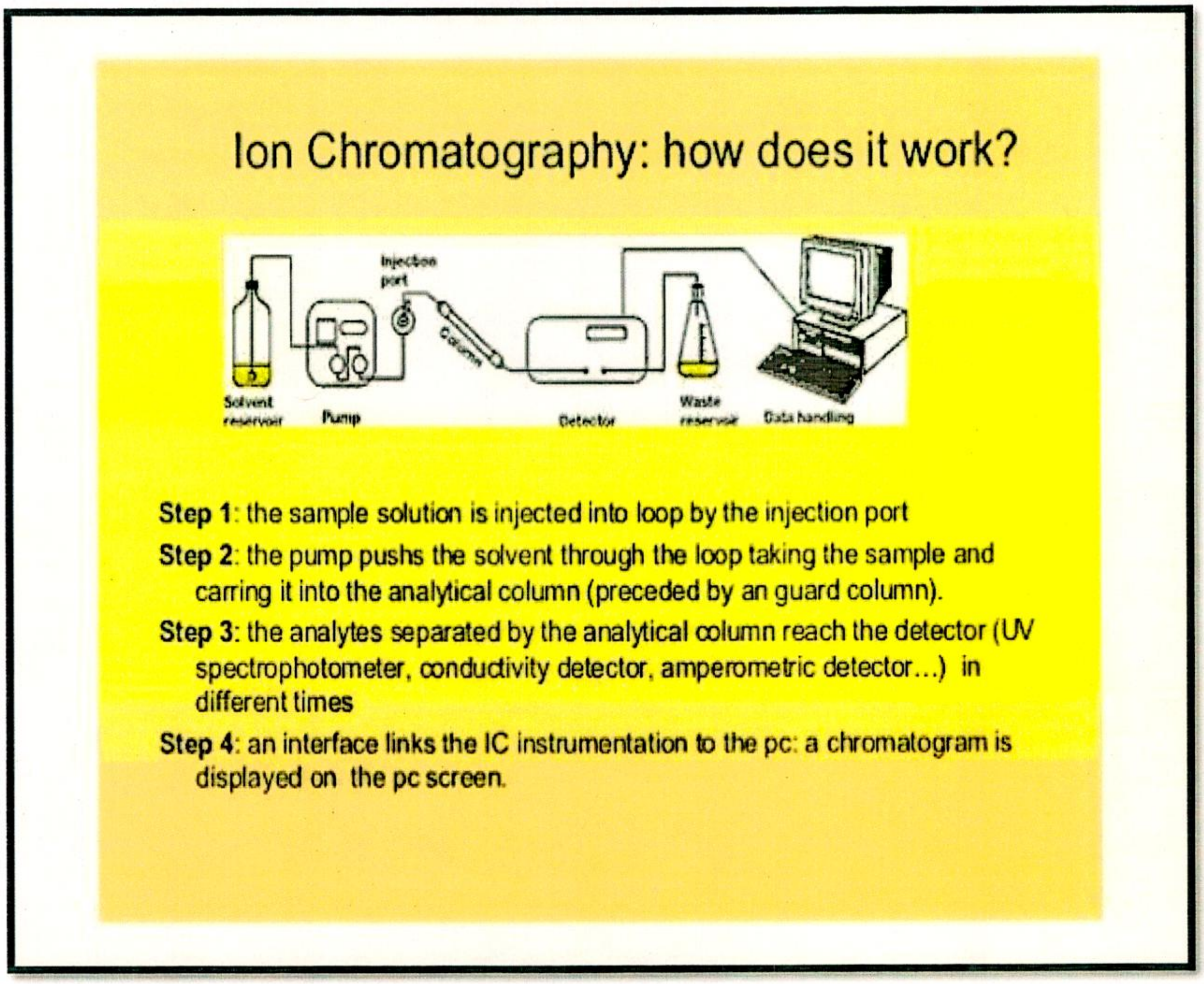
ANION- take 339mg of sodium carbonate and 84ml of sodium bi carbonate dissolve in distilled water and make up to 1litre.

STATIONARY PHASE- it is a resin or gel matrix consisting of agarose or cellulose beads.

ION CHROMATOGRAPHY PROCESS-

First of all the sample is introduced then flows through the guard and into the analytical ion exchange columns where the ion exchange occurs. After separation, the suppressor reduces the conductivity of the eluent and increase the conductivity of the analytes so they are delivered to the detector. A computer and software are used to control the system.

FLOW DIAGRAM OF IC-



Ion Chromatography: how does it work?

Step 1: the sample solution is injected into loop by the injection port

Step 2: the pump pushs the solvent through the loop taking the sample and carring it into the analytical column (preceded by an guard column).

Step 3: the analytes separated by the analytical column reach the detector (UV spectrophotometer, conductivity detector, amperometric detector...) in different times

Step 4: an interface links the IC instrumentation to the pc: a chromatogram is displayed on the pc screen.

INSTRUMENTATION

A typical ion chromatography consists of following components –

- **PUMP**
- **INJECTOR**
- **COLUMN**
- **SUPPRESSOR**
- **DETECTOR**
- **RECORDER**

1. **PUMP-** the IC pump is considered to be one of the most important components in the system. Which has to provide a continuous constant flow of the eluent through the IC injector, column and detector.

   The solvent then passes from the selector to a high pressure pump. The mobile phase passes from the pump to the sampling device, usually a simple rotating valve that on rotation places the sample in line with the mobile flow which then passes on to the column.

2. **INJECTOR-** sample introduction can be accomplished in various ways. The simplest method is to use an injection valve. In more sophisticated LC, automatic sampling devices are incorporated where sample introduction is done with the help of auto- samplers and microprocessors.
   Injector should provide the possibility of injecting the liquid sample

3. **COLUMN-** Ion exchange columns are vary widely in size, packing material and material of construction. The column where the components of interest are separated. The column material may be stainless steel, titanium, glass or plastic. The life of a column will depend largely on the type of samples it is used to separate.

4. **SUPPRESSOR-** Ion chromatography suppressors are membrane-based devices. Suppressor can be used with the aqueous/organic eluents needed to elute organic analytes which are retained on the stationary phase.

   The suppressor reduces the background conductivity of the chemicals used to elute samples from the ion exchange column. Which improves the conductivity measurement of the ions being tested.

5. **DETECTOR-** Electrical conductivity is commonly used. The sensor of the electrical conductivity detector is the simplest of all the detector sensors and consists of only two electrodes, situated in a suitable flow cell. The sensor consists of two electrodes sealed into a glass flow cell.

6. **AMPLIFIER-** The amplifier output is then either digitized, and the binary number sent to a computer for storage and processing, or the output is passed directly to a potentiometric recorder.

AUTO TITRATION

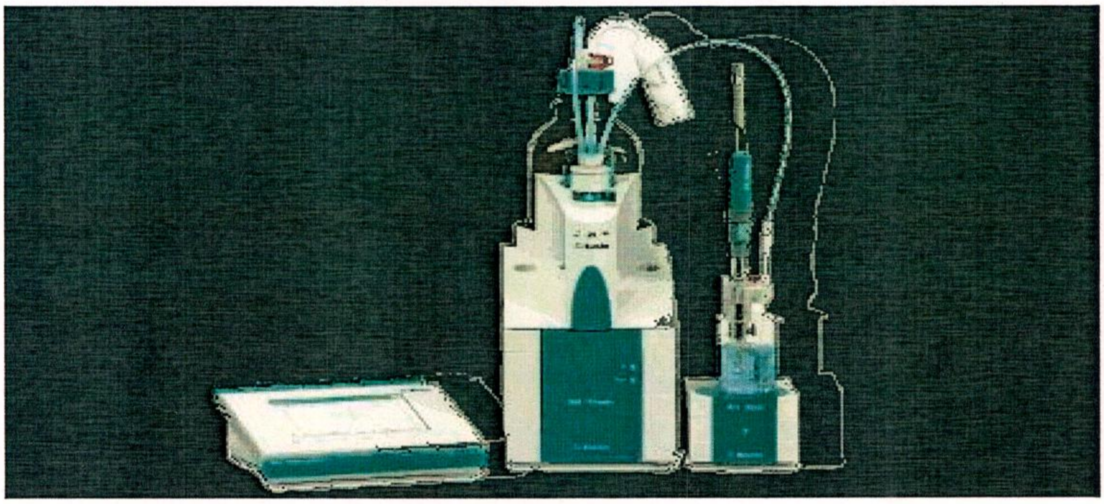
WHAT IS TITRATION?

Titration is a quantitative chemical analysis. It is used to determine an unknown concentration of a known substance in a sample.

WHAT IS AN AUTOTITRATOR?

Automated titrators are micro-processor controlled instruments which allow the automation of all operations involved in titration:

- **Titrant addition**
- **Monitoring of the reaction**
- **Recognition of the end point**
- **Data storage**
- **Calculation**
- **Result storage**
- **Transfer of data to printer or computer**



In addition to the automatic titrator can be potentiometric titration, including acid-base titration, redox titration but can also be a constant pH measurements when the automatic titrator and automatic sample changer multi line use, not only can efficiently automate the measurement of large number of samples, but also improve the analysis of repeatability, reliability, easy operation, saving time and effort. Suitable for quality control , inspection, analysis all aspects of research, development and so on.

HOW DOES AN AUTOTITRATOR WORK?

Automated titrators follow a defined sequence of operations. This sequence is basically the same for all different model.

It is performed and repeated several times until the end point of the titration reaction is reached. The titration cycle consists mainly four steps:

- **Titrant addition**
- **Titration reaction**
- **Signal acquisition**
- **Evaluation**

ADVANTAGES AND DISADVANTAGES OF ION CHROMATOGRAPHY-

ADVANTAGES

- The main advantage of ion chromatography is that multiple ions can be analyzed at once since each ion elutes at a different rate. Furthermore, the time it takes to analyze a sample is typically around ten minutes.
- Shorter analysis time for simpler samples (generally 10-12minutes)
- Small sample volume
- Long life of resins
- Cheap maintenance
- Metal-free peak system
- Powerful separation
- Ion chromatography developed into a powerful analytical technique verstility, speed of operation and reasonable cost are some of the factors that have contributed to its
- Usage of cheap, safe and environmental friendly chemicals.
- Highly selectivity for the detection of compounds like- halogens, peroxides, quinines, nitrates etc.

DISADVANTAGES

- Soil, sediment, geological sample prep is more extensive
- Longer analysis time for more complex samples
- Can't select specific compounds for high speed analysis
- Sometimes overlap can occur in chromatogram when compounds have similar separation characteristics.
- Least sensitive to compounds whose molecules have negligible affinity for electron.
- Carrier gas used should be of pure form like pure nitrog

COMMON APPLICATION OF ION CHROMATOGRAPHY

- This technique has been used for the analysis of anions and cations, including metal ions, mono and oligosaccharides, and other compounds amino glycosides, organic acids, amines, alcohol, phenols and other polar molecules.
- It has been successfully applied to the analysis of raw material, bulk active ingredients, impurities and degradation products, excipients, diluents and at different stages of the production equipment cleaning solutions, waste streams and other applications.
- Drinking water analysis for pollution and other constituents
- Determination of water chemistries in aquatic ecosystems
- Determination of sugar and salt content in foods
- Isolation of select proteins
- Softening of hard water
- Demineralization of water
- To separate protein mixtures
- To measure the additives in food and drug sample
- It can be used for almost any kind of charged molecule including large proteins, small nucleotides, nucleic acids and amino acids.
- It is often used in protein purification, water analysis.
- Separation conditions are within physiological range of salt and pH and in the most cases a native protein can be obtained.

CHAPTER-6

RESULT & DISCUSSION

RESULTS-

Sample 1: BHOJWASA REGION

Sample id: BJW-176

Date and time: 26-09-2015, Morning.

TABLE FOR ANALYZE THE COMPONENTS

FOR ANIONS:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	Fluoride	0.31
2.	Chloride	0.07
3.	Nitrate	0.20
4.	Sulphate	27.32

FOR CATION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/L)**
1.	Sodium	1.42
2.	Potassium	2.22
3.	Calcium	11.27
4.	Magnesium	2.18

pH: 6.5

ALKALINITY: 28.67

HARDNESS: 37.07

Sample 2: BHOJWASA

Sample id: BJW- 177

Date and time: 26-09-2015, Evening.

TABLE FOR ANALYZE THE COMPONENTS

FOR ANION:

S.NO.	COMPONENT NAME	CONCENTRATION (mg/l)
1.	Fluoride	0.22
2.	chloride	0.22
3.	nitrate	0.13
4.	sulphate	20.41

FOR CATION:

S.NO.	COMPONENT NAME	CONCENTRATION (mg/l)
1.	sodium	0.93
2.	potassium	1.24
3.	calcium	7.85
4.	magnesium	1.79

pH: 6.1

ALKALINITY: 23.91

HARDNESS: 26.93

Sample 3: BHOJWASA

Sample id: BJW-178

DATE AND TIME: 27-09-2015, Morning.

<u>TABLE FOR ANALYZE THE COMPONENTS</u>

FOR ANION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	Fluoride	0.28
2.	Chloride	0.22
3.	Nitrate	0.16
4.	Sulphate	25.76

FOR CATION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	sodium	1.36
2.	potassium	1.80
3.	calcium	9.86
4.	magnesium	2.34

pH: 6.5

ALKALINITY: 27.26

HARDNESS: 34.20

Sample 4: BHOJWASA

Sample id: BJW-179

Date and time: 27-09-2015, Evening.

<u>TABLE FOR ANALYZE THE COMPONENTS</u>

FOR ANION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	fluoride	0.19
2.	chloride	0.17
3.	nitrate	0.13
4.	sulphate	19.20

FOR CATION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/L)**
1.	sodium	0.98
2.	potassium	1.24
3.	calcium	7.37
4.	magnesium	1.64

pH: 6.2

ALKALINITY: 24.46

HARDNESS: 25.11

Sample 5: BHOJWASA

Sample id: BJW-180

Date and time: 28-09-2015, Morning.

<u>TABLE FOR ANALYZE THE COMPONENTS</u>

FOR ANION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	fluoride	0.32
2.	chloride	0.27
3.	nitrate	0.33
4.	sulphate	33.65

FOR CATION:

S. NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	sodium	1.65
2.	potassium	2.39
3.	calcium	11.31
4.	magnesium	1.98

pH: 6.5

ALKALINITY: 27.26

HARDNESS: 36.34

Sample 6: BHOJWASA

Sample id: BJW-181

Date and time: 28-09-2015, Evening.

TABLE FOR ANALYZE THE COMPONENTS

FOR ANION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	fluoride	0.20
2.	chloride	0.98
3.	nitrate	0.16
4.	sulphate	20.95

FOR CATION:

S.NO.	**COMPONENT NAME**	**CONCENTRATION (mg/l)**
1.	sodium	1.40
2.	potassium	1.61
3.	calcium	8.29
4.	magnesium	1.92

pH: 6.3

ALKALINITY: 23.24

HARDNESS: 28.57

DISCUSSION

The purpose of the present study was to characterize the glacier water of different regions of bhojwasa glacier. Six samples named (BJW-176, BJW-177, BJW-178, BJW-179, BJW-180, BJW- 181) having pH=6.5, 6.1, 6.5, 6.2, 6.5, 6.3, ALKALINITY=28.67, 23.91, 27.26, 24.46, 27.34, 23.24 mg/L and HARDNESS=37.07, 26.93, 34.20, 25.11, 36.34, 28.57 mg/L respectively were analyzed as per IS specifications. The anions and cations were determined by ion chromatography, specifically by titrimetric method.

We observed from the result that the hydrogen ion concentration in all the collected water samples were nor too high and neither too low. The concentrations obtained were within the permissible limits, that is approximately 6.1-6.5 pH (for drinking water).

While other parameters within the range as per IS specification, although a few anions() and cations () were formed to be present in high concentration in the water sample.

Hydro-chemistry of glacial melt waters of the bhojwasa were studied. The nature of pH, hardness, variable alkalinity and concentration of anions and cations were observed typically of river bank water samples. There has been an increase in the concentration of cations from the last few years, which may be due to increase in chemical weathering due to increased temperature in the glacier. The elemental ratios (Ca, Si and Na, K) were typical of glacial melt water. And the low (Na, Cl and K, Cl) ratios indicated major contribution from atmospheric precipitation to the observed dissolved ions of water.

NIH IC REPORT

Date2016-01-13 08:25:08 UTC+5:30

Anion&

Anion

Component name	Retention time min	Height µS/cm	Area (µS/cm) x min	Concentration mg/L
Fluoride	6.33	1.369	0.256	1.000
Chloride	10.35	0.620	0.137	1.000
Nitrite	12.82	0.341	0.093	1.000
Nitrate	20.00	1.336	0.619	1.000
phosphate	26.50	0.010	0.005	1.000
Sulfate	31.71	0.221	0.137	1.000

Cation

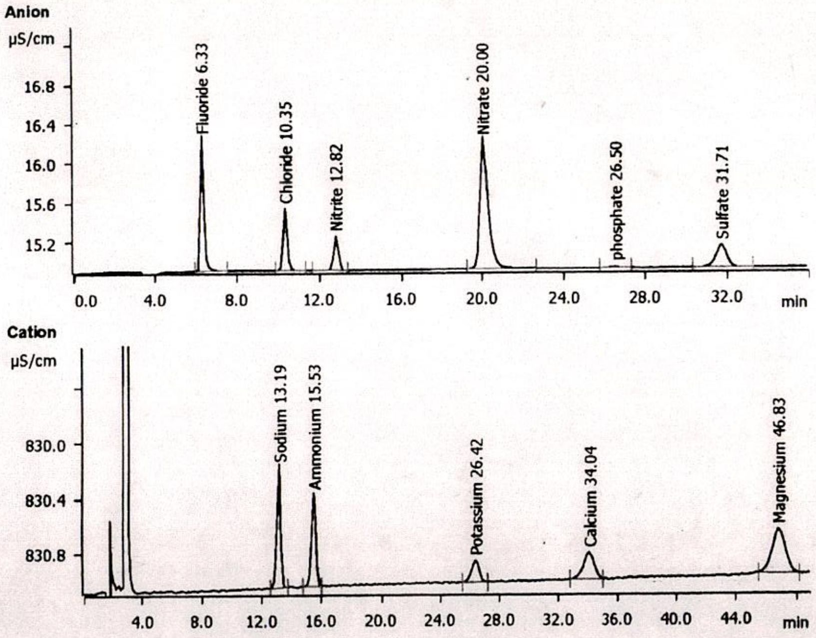
Component name	Retention time min	Height µS/cm	Area (µS/cm) x min	Concentration mg/L
Sodium	13.19	0.905	0.272	1.000
Ammonium	15.53	0.686	0.231	1.000
Potassium	26.42	0.162	0.100	1.000
Calcium	34.04	0.192	0.168	1.000
Magnesium	46.83	0.320	0.334	1.000

Sample pH--------------------------------------n.d.

Total Hardness by IC-----------------------------0.066

NIH IC REPORT

Date2016-01-13 08:25:08 UTC+5:30



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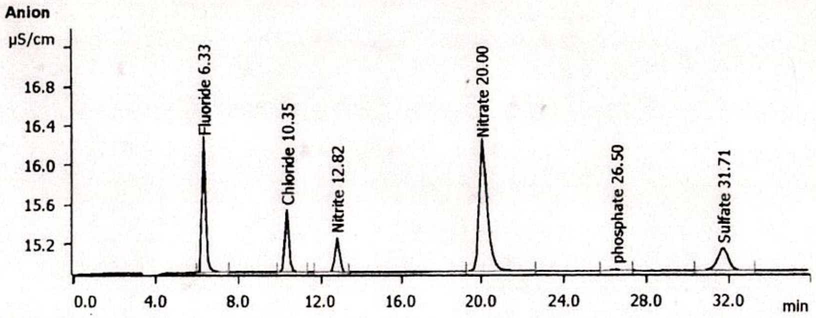
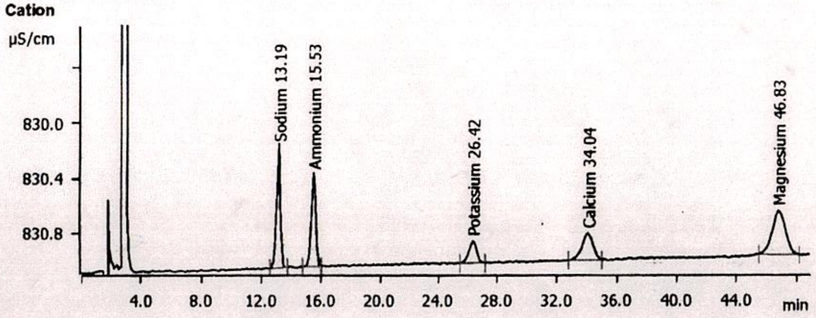
Date2016-01-13 08:25:08 UTC+5:30





CHAPTER- 7

CONCLUSION

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