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A Study on Impact of Agrochemicals on Ground Water Quality

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ABSTRACT: Ground water contamination is one among the major issue raised across globally. The present study is conducted to evaluate the influence of agrochemicals usage on ground water quality. The ground water samples were collected from ten selected agricultural areas around Mysore in the month of December 2021. The ground water samples were subjected to analysis of selected physico-chemical parameters. From the study, it was found that, the application of agrochemicals has influenced on the ground water quality parameters. Due to over application of agrochemicals, the alkalinity, potassium values were found to be higher in all the water samples in the study area. From the experimental results, one can conclude that, the main reason for leaching of an agrochemical through soil is due to the improper water management strategies. The people rely on ground water sources for their agricultural activities which indeed pressurize the sources that results in the scarcity of water resources especially during the summer months. So, implementation of restricted usage of agrochemicals with proper water management will help to retain the soil and water quality.

KEYWORDS: Ground water, Agricultural areas, Agrochemicals, Water management, Nutrients.

I. INTRODUCTION

The water scarcity is one among the major challenges that are facing across globally. The most important question arises in this scenario is how to meet up the fresh water resources for the entire planet. The key source of these fresh water resources are the aquifers that are stored below the ground which is primarily termed as the ground water. Since ground water plays a crucial role in the fresh water supply, it is essential that we need an effective means of management to conserve ground water. In order to monitor the level of pollution in ground water, it is essential to make an assessment of quantity as well as quality. The ground water sources are contaminated due to anthropogenic activities. The rate of ground water contamination was found to increase day by day due to over usage of fertilizers and rapid growth in industrialization and urbanization. So, due to these reasons, the water quality analysis has become a prime factor for maintaining the ground water standards. According to the World Health Organization, nearly 75 percent of diseases that is seen in humans are due to the usage of contaminated water sources. Once it is contaminated, it is very difficult to restore back in to its conventional position. So, estimating the water quality is one of the constructive methods for the determination of grade of water quality that will be helpful for both the policy makers as well as the concerned individuals of respective areas. The estimation of water quality parameters merely depends upon the type of water that an individual is handling up. In the present study, the ground water samples were collected from selected agricultural areas around Mysore to estimate the effect of the agrochemicals in to the ground water sources.

II. RELATED WORK

Many researchers proved that, the application of agrochemicals has impact on the water resources. The main agrochemicals that are responsible for the ground water contamination includes pesticides, fertilizers and some growth hormones that are used to stimulate the plant growth [1, 2]. These chemicals can cause various detrimental health effects such as cancer and damages human nervous system [3, 4]. Even though these chemicals enhance the yield and efficiency of the crops, the unbalanced approach in its application leads to release of several metal ions and other chemicals into the ground water sources which leads to bioaccumulation of these chemicals both in humans as well as on other living organisms [5, 6, and 7]. Most of these chemicals have higher persistence that would affect the succeeding crops [8]. The application of pesticides sometimes affects the non-targeted pest that could affect the food chain of the ecosystem in the soil [9, 10]. Based on the review of literatures, it was found that, most of the research has been carried out on physico-chemical analysis of ground water quality over different places across the world. Most of



the research was focused on surface and ground water quality modelling. Based on the above concept, the present study has undertaken with following objective to study the ground water quality in the agricultural areas around Mysore.

III. METHODOLOGY

Description of study area: The ground water samples were collected from 10 agricultural areas around Mysore. The samples were collected from the hand pumps that is located near to the agricultural areas. During the survey, it was found that, in the study area, there is a frequent application of different pesticides and chemical fertilizers in all the seasons. The Table No.1 represents the sampling location and the type of water collected.

Table 1: Sampling location and type of water collected

SLNO	Name of the sampling location	Type of water sample collected
WS-1	Jantagalli	Ground water
WS-2	Masanabayanahalli	Ground water
WS-3	Marigowdnahundi	Ground water
WS-4	Sajjihundi	Ground water
WS-5	Devalpura	Ground water
WS-6	Vajamangala	Ground water
WS-7	Varakodu	Ground water
WS-8	Mellahalli	Ground water
WS-9	Halagayyanahundi	Ground water
WS-10	Badayalahundi	Ground water

ExperimentalSection: During the study, the parameters selected for the chemical analysis of ground water includes pH, TDS, Calcium, Magnesium, Sodium, Potassium, Carbonates, Bicarbonates, Total alkalinity, Chloride, Nitrate and Phosphate. The Table 2 represents the water quality parameters and the method used for the analysis of sample (APHA 1999).

Table 2. Methods of Water Quality Analysis.

SLNO	PARAMETERS	METHODOFANALYSIS
1	pH	pHmeter
3	TDS	GravimetricMethod
4	CalciumandMagnesium	EDTATitrimetricMethod
5	CarbonateandBicarbonate	TitrimetricMethod
6	Sodium	FlamePhotometricMethod
7	Potassium	FlamePhotometricMethod
8	Chloride	Mohr’sMethod
9	Nitrate	SpectrophotometricMethod
10	Phosphate	SpectrophotometricMethod
11	Alkalinity	TitrimetricMethod

IV. TABLE 3. EXPERIMENTAL RESULTS OF GROUND WATER SAMPLES

Parameters	Unit	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	WHO Standard
pH		7.25	7.32	7.34	6.84	7.50	7.37	7.46	7.53	7.38	7.08	6.5-8.5
Total dissolved solids	mg/L	1.14	1.24	1.42	0.366	0.784	1.388	0.588	1.78	1.108	0.944	500
Calcium	mg/L	2.85	2.2	2.05	1.8	2.6	2.65	1.4	1.3	2.8	3	150
Magnesium	mg/L	2.65	1.8	1.7	1.85	1.8	4.1	1.2	1.95	1.25	1.05	100
Sodium	mg/L	130	129	121	112	117	125	110	101	123	132	200
Carbonate	mg/L	48	66	60	30	48	42	12	36	30	42	50
Bicarbonate	mg/L	439.2	244	199.2	280.6	347.7	439.2	274.5	353.8	335.5	408.7	500
Potassium	mg/L	125	120	117	104	102	112	103	92	115	122	12
Total alkalinity	mg/L	440	310	320	280	365	500	245	350	325	475	200
Chloride	mg/L	60.26	28.36	35.45	28.36	38.99	127.6	38.99	24.81	38.99	95.71	250-100
Phosphate	ppm	2	5.25	4.5	5.25	6.5	1.75	7	2.25	1.25	8.75	10
Nitrate	ppm	11.75	9.75	7	5.5	6.75	6.25	1.5	4	4.5	10.75	45-50



DISCUSSIONS:

pH: The Ph describes the acidic or basic condition of the water. Thenormal pHvaluesrangesfrom 6.5to 8.5 accordingto theWHOstandards. The results shows that,thepH ranges from6.84 to7.53.Thisshowsportable conditionofthegroundwater samples in the study area in comparison with the WHO Standards. Thefigure(1)given belowrepresents thepH ofthe watersamples.

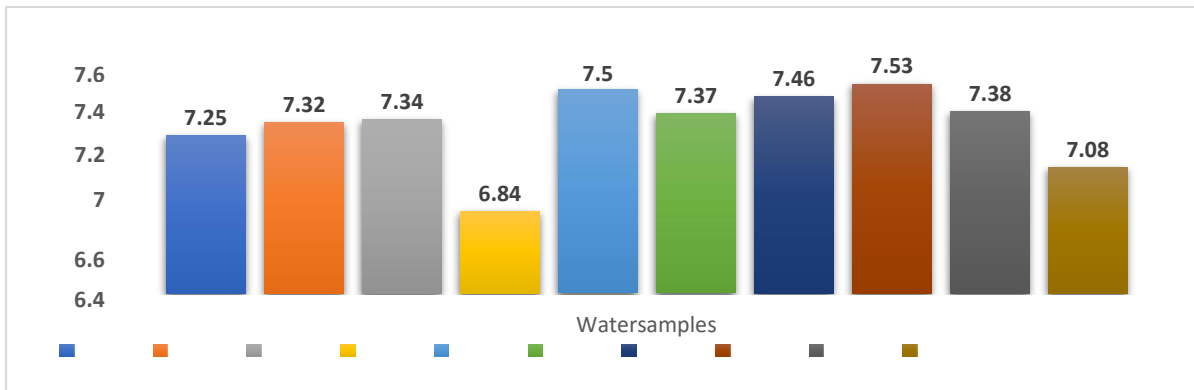


Figure-1: Variation of pH in ground water samples

Total dissolved solids: TDS is a good indicator for the determination of water quality. According to the WHO standards, the dissolved solids below 300 mg/L is considered as excellent.The TDS range 300 to600 mg/L is good whereas above 1200 mg/L is not acceptable. In the study, TDS values were found to be normal. The figure (2) given below represents the variation of total dissolved solids in water samples.

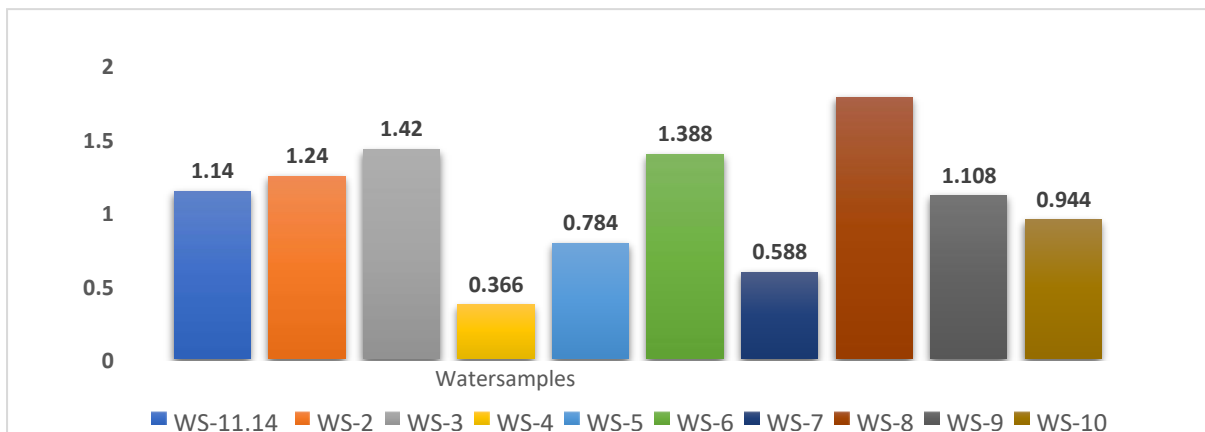


Figure -2:VariationofTotaldissolvedsolidsingroundwatersamples

Calcium and Magnesium: Both the ions are very significant for the growth and metabolism of living organisms. The WHO permissible limit for magnesium in water is 100 mg/L andforcalciumis150mg/L. In the study, the calcium and magnesium values were found to be very less. The figures(3) and (4) given below represents the variationofcalciumandmagnesiumcontentinwatersamples.

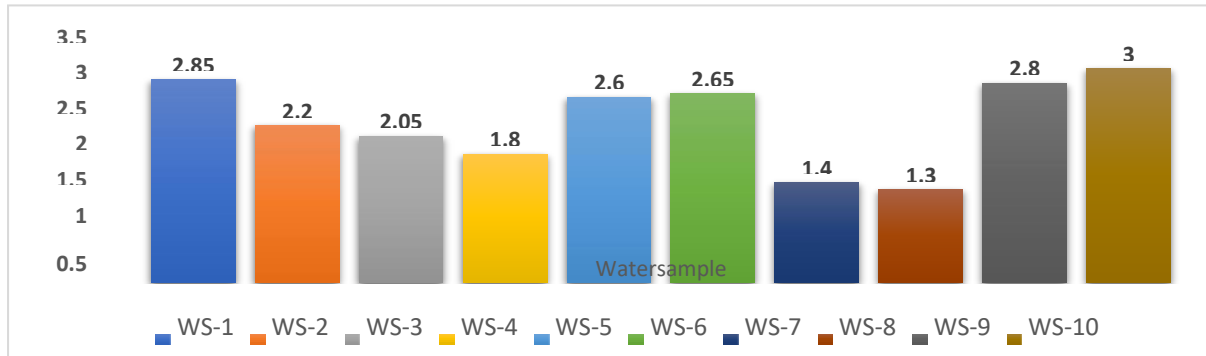


Figure-3: Variation of Calcium in ground water samples.

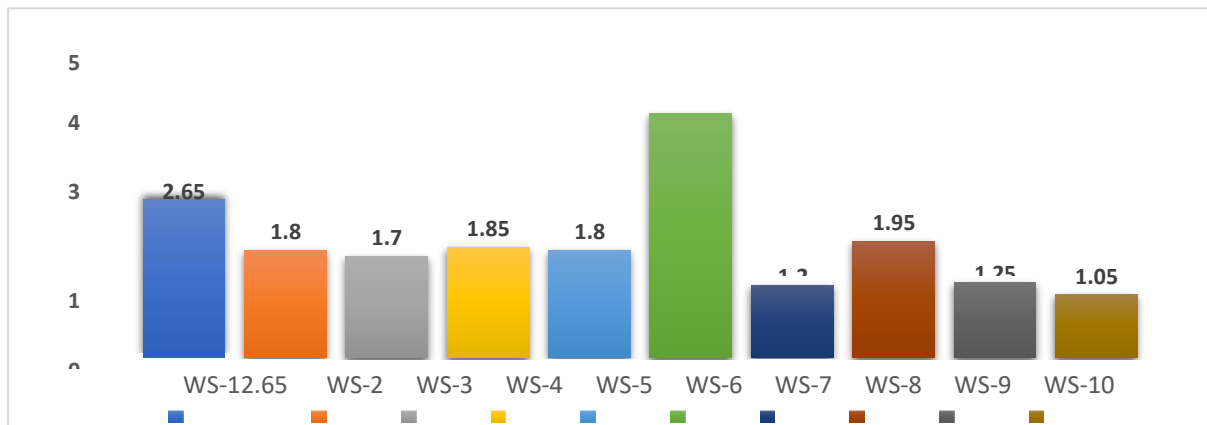


Figure-4: Variation of Magnesium in ground water samples

Totalalkalinity: Alkalinity is due to the presence of many dissolved components in the water. According to WHO standards, the permissible limit for alkalinity is 200 mg/L. During the study, in all ground water samples, increase in the alkalinity values was observed. The figure (5) given below represents the variations in total alkalinity of water samples.

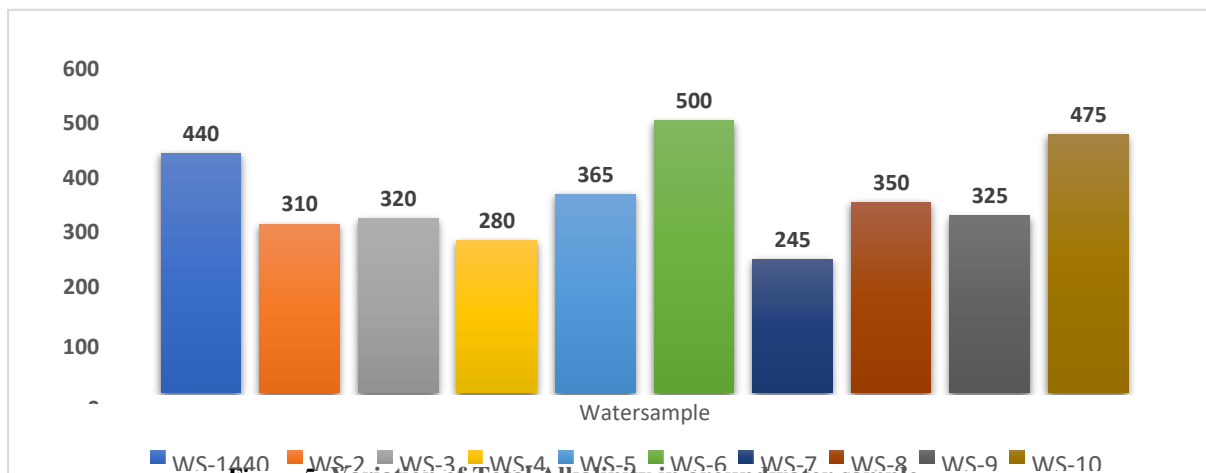


Figure-5: Variation of Total Alkalinity in ground water sample

Sodium: Sodium is an alkali metal and the presence of sodium is very essential for the living beings. But the elevated amount is harmful for the human beings. According to WHO the permissible limit of sodium is 200 mg/L. In the study, the sodium values were found to be within the permissible limit. The figure (6) given below represents the variation of sodium ions in the water samples.

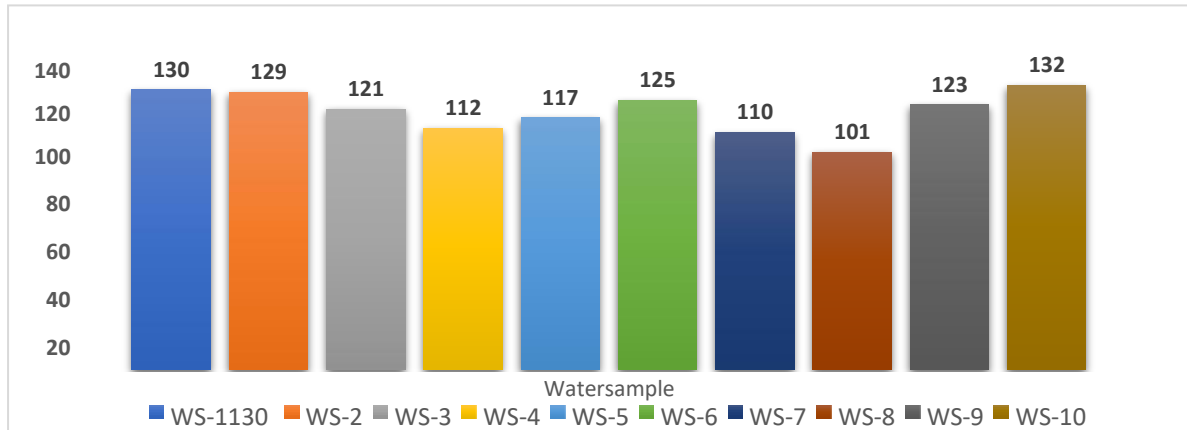


Figure-6: Variation of Sodium in groundwater samples

Potassium: Unlike sodium potassium is also an alkali metal. Which is very essential for living tissues and assist in hydration. According to WHO, the acceptable limit of potassium content in groundwater is 12 mg/L. In the study, the potassium values were found to be higher than the permissible limit. The figure (7) given below represents the amount of potassium in different samples.

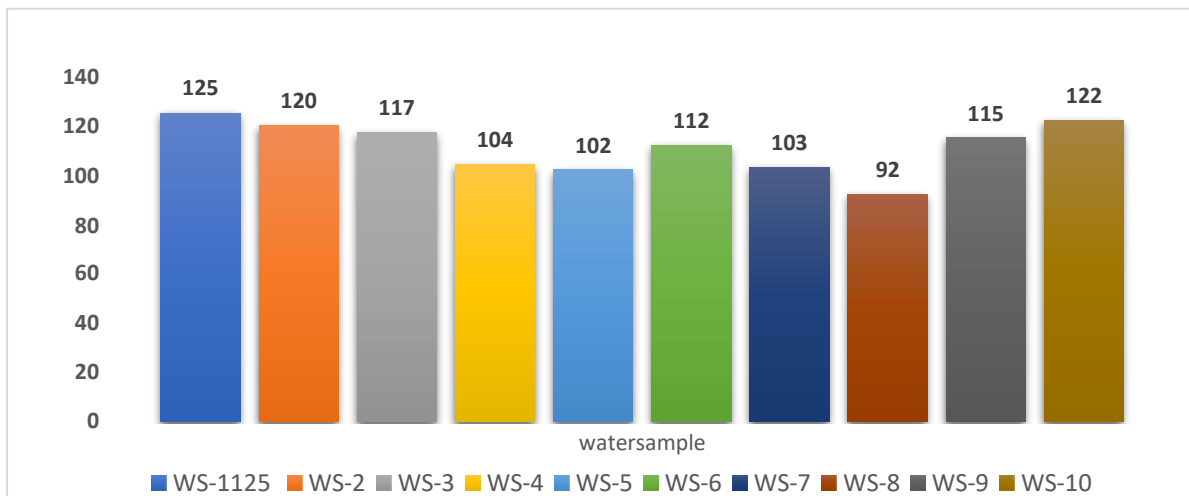


Figure-7: Variation of Potassium in ground water samples

Chloride: Chloride content in the water occurs due to the leaching of minerals from rocks or soil. The permissible limit of chloride in groundwater varies from 250 to 500 mg/L in comparison with the WHO standards. During the study, the chloride values were found to be lower. The figure (8) given below represents the variation of chloride content in the ground water samples.

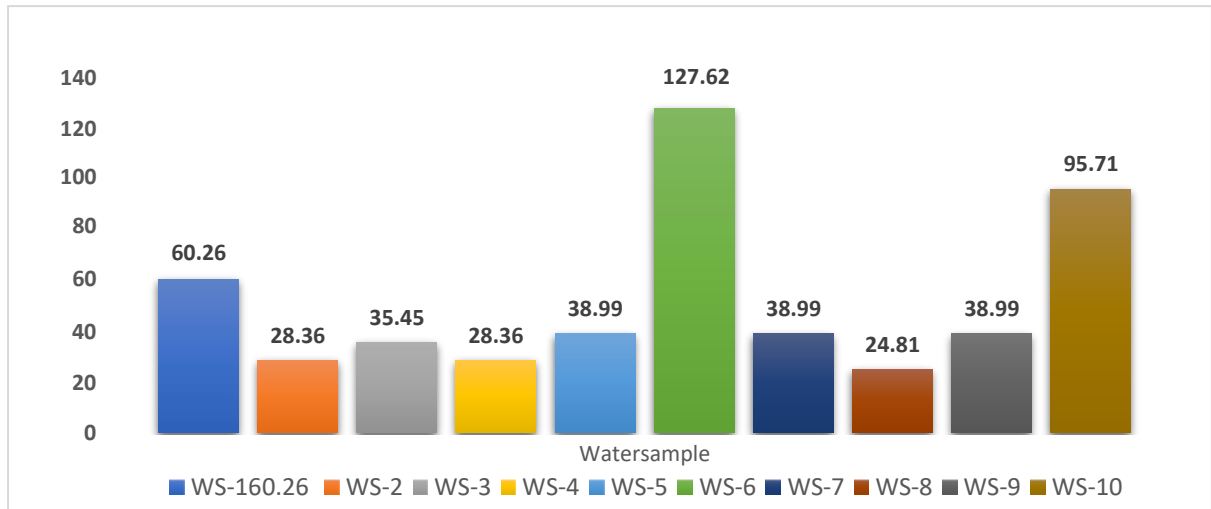


Figure-8: Variation of Chloride in groundwater samples

Phosphate: Due to weathering of rocks and leaching from soil, the aquifers near to agricultural areas get polluted with phosphate. This mainly occurs due to the over application of fertilizers into the soil. According to WHO standards, the permissible limit of phosphate content in ground water is 10 mg/L. The experimental results of the present study shows the normal range of phosphate content in ground water samples. The figure(9) given below represents the amount of phosphate contained in the ground water samples.

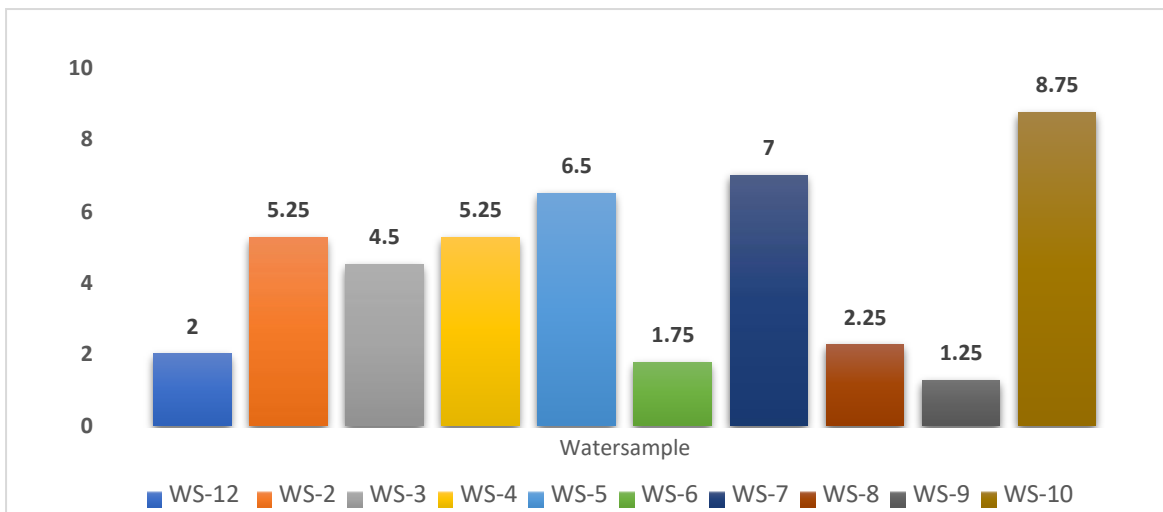


Figure-9: Variation of Phosphate in groundwater samples

Nitrate: Nitrate is water soluble inorganic component derived from nitrogen. Main source of nitrogen in ground water is mainly due to the anthropogenic activities. The permissible limit of nitrate in ground water is 45-50 mg/L. In the present study, the nitrate values were found to be reduced. The figure (10) above represents the amount of nitrate contained in the water samples.

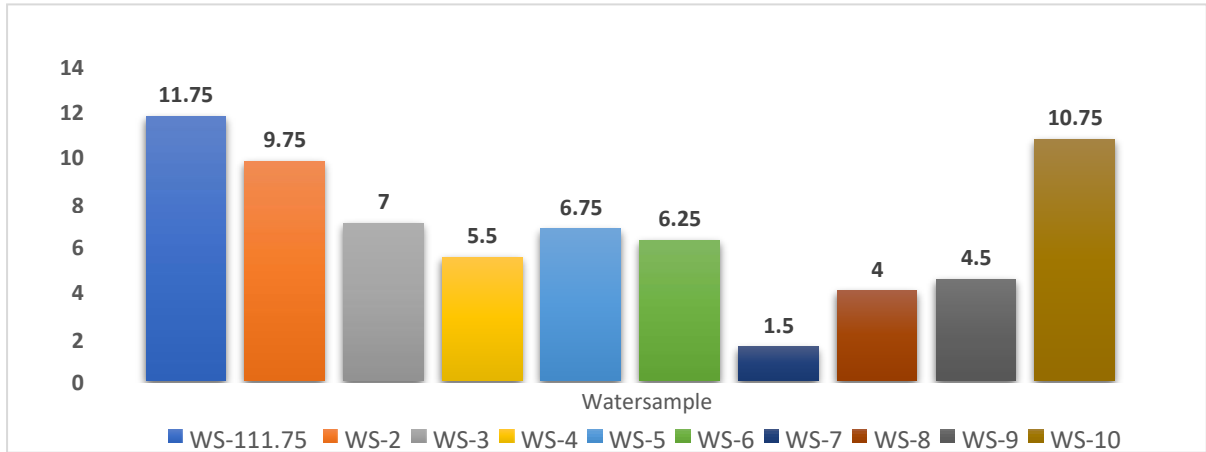


Figure-10: Variation of Nitrate in groundwatersamples

Carbonates and bicarbonates: Carbonates and bicarbonates are two important ionic components in ground water, basically formed due to dissolution of carbon dioxide into the water. According to WHO standards the maximum permissible limit of carbonate is about 50 mg/L and the standard reference for bicarbonate ions is about 500 mg/L. In the present study, a slight higher values of carbonates were observed in ground water sample (2) and (3). The figures (11) and (12) represents the amount of carbonate and bicarbonate present in the watersamples.

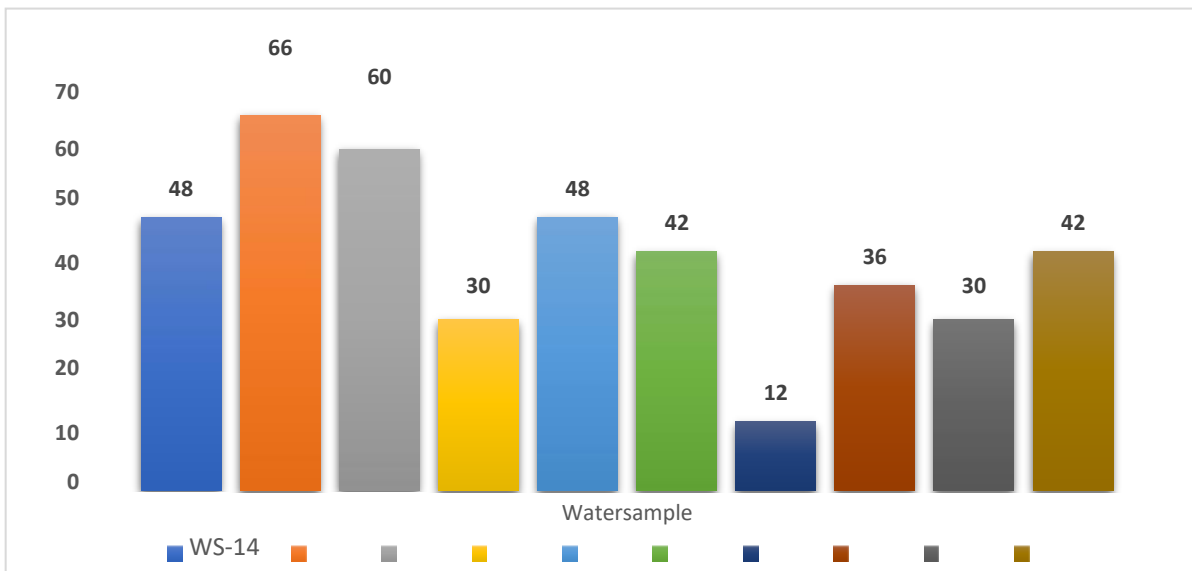
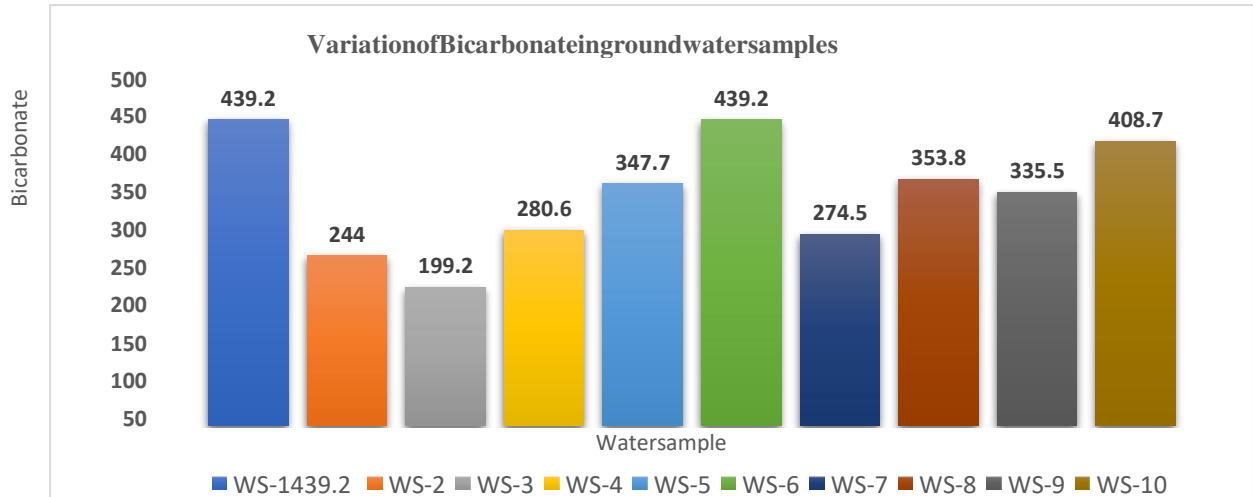


Figure-11: Variation of Carbonate in groundwatersamples



Graph-12

V. CONCLUSION

The present study is undertaken in order to determine whether agrochemicals get leached into the aquifer near the agricultural field and to assess the risk in that area. The water samples show high alkalinity beyond the permissible limit of WHO standards in some areas and also almost all the samples experienced with high rates of potassium content. So care has to be taken even though much pollution was not recorded, in future due to improper management, the ground water might get contaminated. The pesticides that are been used for various agricultural practices could leach out through the soil and would reaches the ground water sources. Eventually this would contaminate the drinking water supplies. The surface runoff occurs when the soil cannot accommodate more amount of water. Most of the time improper usage of as well in the quality management depletes the fresh water sources. The important criteria that have to be done in order to maintain the quality of water is to maintain a proper recording of data at a certain period of time. About the type and quantity of agrochemicals applied.

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