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Study of pH and EC in secondary environment around the Peddavura Schist Belt (PSB), Nalgonda district, Telangana state

Nagunayak Banovath, RSN Sastry and Vishnu Bhoopathi
Department of Applied Geochemistry, Osmania University, Hyderabad-500007
Email: nayaknagu1@gmail.com

Abstract

Soil is one of the common media for sampling and reflects variations in geogenic composition of the topmost layers of the Earth's crust. Soil and stream sediment pH shows more influence on biogeochemical process of soil. Soil and stream sediment of pH and EC are important factors for the controls nutrient availability in soils, growth and development of the crop, microbial activity in soil. Present studies of the pH differentiation in cultivated lands of Peddavura schist belt (PSB). 43 Soil samples and 20 stream sediment samples were collected randomly with covering 135 sq.km of Peddavura Schist Belt in the part of Eastern Dharwar Craton. This paper renders that, control the soil pollution with distribution and removing harmful material from organic soil and stream sediment. This research envisages that imparting oxidation and reduction of major and trace elements in surficial and stream sediment environment.

Keywords: Peddavura Schist Belt, Dharwar Craton, soil, stream sediment, pH, EC.

1. Introduction

The area of investigation is in Nalgonda district, Telangana State of India and is bounded by latitudes 16° 49' 23.792" N to longitudes 79°5'42.259"E and 16° 40' 57.465" N to 79° 14' 33.841" E. The study area has chlorite-sericite/amphibole schists, Banded Iron Formation as a part of the Peddavura Schist Belt in Eastern Dharwar Craton. The Lower Proterozoic basin has epidote, biotite, granites grouped as basement rocks formations. Number of numerous dykes and quartz veins are traversed across the country rocks. The lithological units of the schist belt comprise mainly meta-volcanics, predominantly consisting of meta-basalt with subordinate acid volcanics exposed as minor bands and banded iron formation. It contains shear zone formations, structural elements of joints and alterations. Morphological feature such as breccia formations and silicification features have been observed. The present study is focused on discrimination of soil pH and Electric Conductivity within the secondary environment.

2. Geology

The area highly deformed younger granitoids, stretched and sheared litho units. The contacts and cross cutting granitic phases are existence. The study area indicates heavy soil cover, more exposers and structurally older rock types are present. These green stone granites are well exposed and mineralized in the Dharwar Craton (Radhakrishna et al., 1986).The green stone belts contain rocks sedimentary volcanic origin subjected to greenschist to amphibole phases of metamorphism (Naqvi et al. 1987). The U-Pb age of the zircon is 2.4 Ga which is separated from rhyolite of PSB using secondary ion microprobe technique (Jayananda et al. 2013).The exposed lithological units of Peddavura schist belt are metabasalts, banded-magnetite-quartzite, schists, rhyolites, granitoids, genesis, breccia, banded iron formation and leaner segment of Peddavura Schist Belt (PSB). High strain and low strain are observed throughout the area of older rocks, younger granites, quartz reefs and dolerite dykes exhibits repeated brittle deformation features (Rajamanickam M. et al. 2013).

3. Materials and Methods

The Peddavura schist belt is a part of Eastern Dharwar Craton and NW direction of the Cuddapah basin. The area essentially covered with agriculture fields (like rice, cotton, chilli, and some other crops) and natural biodiversity. Total 43 soil and 20 stream sediment samples (Fig 1) were collected from 135 sq.km area with GPS locations. Meta-volcanics, predominantly consisting of meta-basalt with subordinate acid volcanics exposed as minor bands and banded iron formation are the dominant lithological units in the area. After removing top layer of the surface soil and stream sediment samples are collected randomly. The soil sediment samples were collected from B – horizon (Levinson, 1980). The stream sediment samples were collected from 1^{st}, 2^{nd}, and 3^{rd} order streams. Three horizons have been identified i.e. A-horizon, B- horizon and C- horizon of the soil profile (Fig 2). The collected soil and stream sediment sample were sundried in the field itself and sieved with -120 mesh size. Determination of pH and Electric Conductivity was done with the help of digital portal analyzer kit which is made by Systranics model-365, India (Gardner, C.M.K. et. al., 1991).

The pH of soil and stream sediment samples of Peddavura Schist Belt were determined 1.0 grams of each -120 mesh size of stream and soil sediment samples weighed into a 100 ml beaker and distilled water has been added in to the contents of beaker up to 100 ml volume. The contents were stirred thoroughly for one hour. The pH of prepared solution parameters determined on pH meters.

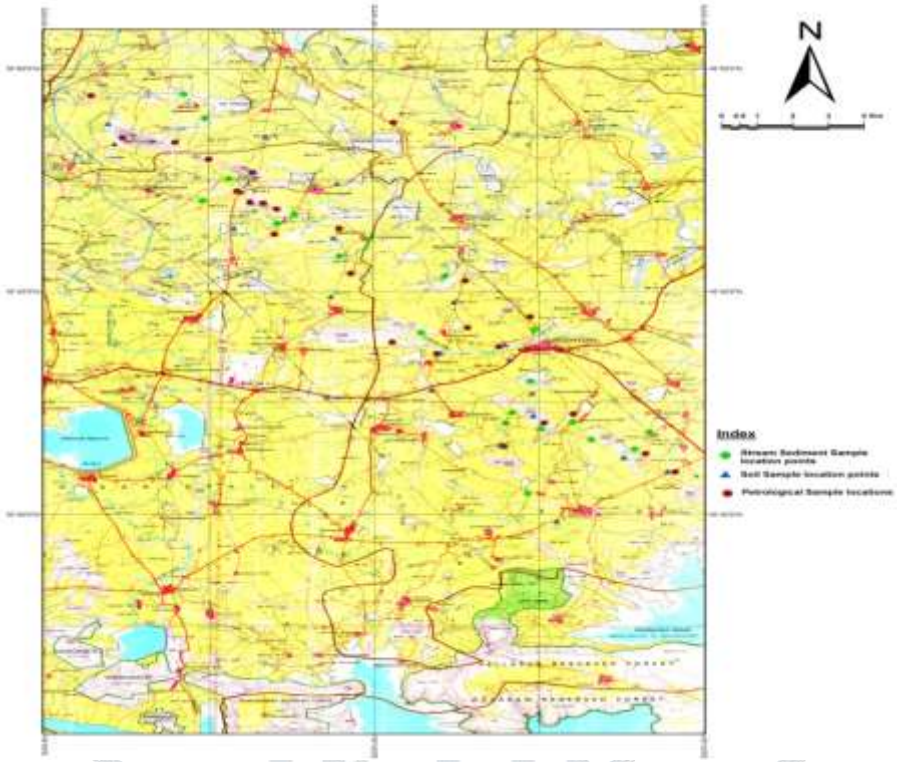


Fig 1 Sample and stream sediment location Map of PSB

Fig 2 soil profile of the Peddavura

Fig 3 collecting stream sediment sample

Table 1 pH and EC (mg/l) values of soil samples of PSB

Sample Number	pH	EC mg/l	Sample Number	pH	EC mg/l	Sample Number	pH	EC mg/l
S.S.1	8.28	313.76	S.S.16	8.10	392.2	S.S.31	8.10	313.76
S.S.2	7.94	470.64	S.S.17	8.04	470.64	S.S.32	7.74	784.4
S.S.3	7.97	392.2	S.S.18	8.15	313.76	S.S.33	7.75	470.64
S.S.4	8.06	313.76	S.S.19	8.02	627.52	S.S.34	8.10	392.2
S.S.5	8.12	862.84	S.S.20	7.94	941.28	S.S.35	7.90	1019.72
S.S.6	7.85	627.52	S.S.21	7.55	549.08	S.S.36	7.70	470.64
S.S.7	7.95	1019.72	S.S.22	7.79	470.64	S.S.37	7.89	627.52
S.S.8	8.01	784.4	S.S.23	7.75	1098.16	S.S.38	7.93	627.52
S.S.9	7.66	235.32	S.S.24	8.15	549.08	S.S.39	7.95	549.08
S.S.10	7.90	627.52	S.S.25	7.85	392.2	S.S.40	8.10	392.2
S.S.11	7.37	549.08	S.S.26	7.18	313.76	S.S.41	7.88	313.76
S.S.12	7.70	549.08	S.S.27	7.64	1333.48	S.S.42	7.97	1098.16
S.S.13	7.68	392.2	S.S.28	7.72	627.52	S.S.43	7.75	1568.8
S.S.14	7.71	2196.32	S.S.29	7.85	470.64			
S.S.15	8.12	549.08	S.S.30	7.39	313.76			

Table 2 pH and EC (mg/l) of the stream sediments

SAMPLE NUMBER	pH	EC mg/l	SAMPLE NUMBER	pH	EC mg/l
S 1	9.10	141.192	S 11	8.97	54.908
S 2	8.97	101.972	S 12	8.70	31.376
S 3	8.85	94.128	S 13	9.07	62.752
S 4	9.05	70.596	S 14	9.07	62.752
S 5	9.10	62.752	S 15	9.06	62.752
S 6	9.13	47.064	S 16	9.45	141.192
S 7	9.12	47.064	S 17	10.07	235.32
-S 8	9.15	62.752	S 18	9.67	133.348
S 9	10.01	141.192	S 19	9.12	62.752
S 10	10.01	211.788	S 20	9.15	54.908

Table 3 Statistical parameters

Statistical parameters of (stream sediment) pH							
Max.	Mini.	Mean	Median	Mode	Standard Deviation	Skew-ness	Kurtosis
10.07	8.7	9.241	9.11	9.1	0.391742397	1.239748	0.549457
statistical parameters of (stream sediment) EC mg/l							
Max.	Mini.	Mean	Median	Mode	Standard Deviation	Skew-ness	Kurtosis
235.32	31.376	94.128	62.752	62.752	56.16170228	1.334543	1.124892

Table 4 Statistical parameters of stream sediment pH and EC data

statistical parameters of soil pH							
Max.	**Mini.**	**Mean**	**Median**	**Mode**	**Standard Deviation**	**Skew-ness**	**Kurtosis**
8.28	7.18	7.81	7.85	#N/A	0.227913644	-0.85166	1.021265
statistical parameters of soil EC mg/l							
Max.	**Mini.**	**Mean**	**Median**	**Mode**	**Standard Deviation**	**Skew-ness**	**Kurtosis**
2196.32	235.32	636.6409	549.08	313.76	382.8281	2.171199	5.958614

The samples fall in pH range from 7.18 to 8.28 it is indicating the slightly neutral to slightly alkaline. The trend shows from neutral to slightly alkaline, EC range from 549.08 to 2196.32. The EC values have been observed that soils are more than that of stream sediments. It is stating that the soil samples have more salinity and shows high conductivity than stream sediment in Peddavura schist.

Table-5 "The US Dept. classification of soil pH values Conservation Services of Agri. Natural Resources (*Soil survey division 1993*)"

Determination	**pH**	**Determination**	**pH**
Ultra acid limit	less than 3.5	Neutral	6.6 to 7.3
Extremely acid limit	3.5 to 4.4	Slightly alkaline	7.4to 7.8
Very strongly acid limit	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid limit	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Moderately acid limit	5.6 to 6.0	Very strongly alkaline	less than 9.0
Slightly acid limit	6.1 to 6.5		

According to Dilip H. Patel and Milan M. Lakdawal, 2014, the soils pH categorised into four stages i.e. 1) Acidic, 2) Normal, 3) Alkaline and 4) Alkali type.

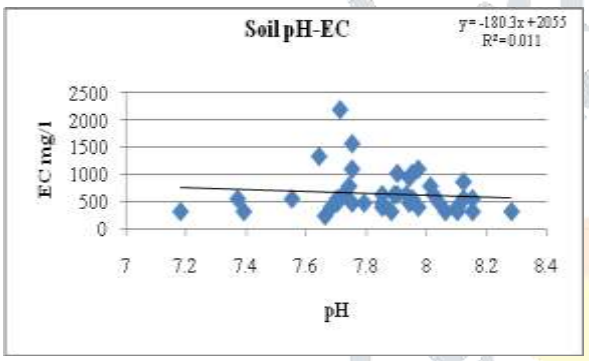
Table 6 "EC and pH ranges (Dilip H. Patel* and Milan M. Lakdawal, 2014)"

Category	pH Range
Acidic state	Less than 6.5
Normal state	6.5- 7.8
Alkaline state	7.8 – 8.5
Alkali state	More than 8.5

EC Range	Soils stats
Less than 0.8 ds m^{-1}	Normal
0.8 to 1.6 ds m^{-1}	Critical salt sensitive crops
1.6 to 2.5 ds m^{-1}	Critical salt tolerant crops
Less than 2.5 ds m^{-1}	Injurious to more crops

4. Results and discussion

The pH of soil (table 1) samples fall in neutral to slightly alkaline range. The Samples are 1, 5, 15, 18, and 24 showing high alkaline range. The EC ranges from 31.376 to 235.32 in stream sediments of PSB (table 3 & 4). The stream sediments (table 2) varied from 8.7 to 10.07 and it is indicating that the samples belong to strongly alkaline to very strongly alkaline category (table 5 & 6). The pH ranges from 8.70 to 10.97 in stream sediments of (PSB) from slightly alkaline towards alkaline.



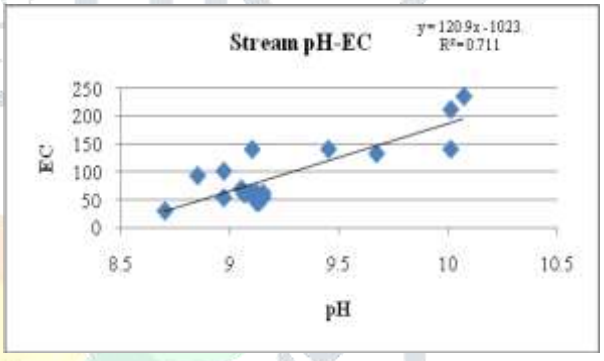


Fig 1 relationship between pH vs EC (Soil) Fig 2 relationship between pH vs EC (S S)

The relationship between pH and EC (Fig 1& 2) in the entire soil samples have been deduced in their binary plot. It indicates that the EC values are inverse relation to the pH.

Stream sediment pH vs. EC binary plot

Bivariate plot between pH and EC values shows good positive trend with two clusters, around at pH 9.00 and at pH 10.0. In general the bivariate diagrams between EC and trace elements clearly drive home point that there are two clusters of elements showing higher concentration of elements at lower EC and lower concentration of trace elements at higher EC (Vishnu et al., 2013). This is the best evidence for the control of trace elements by pH and EC. Hence it is evident that in the stream sediments of PSB the trace elements distribution, configuration and precipitation is based on pH and EC.

The soil pH is below 5.6 it considered as low for most of the crops. The pH between of 6.0 to 7.0 is considered as ideal. When the soil pH is more than 8.0 considered high for most of the crops. When soil pH is below 5.5 it indicate low availability of magnesium, calcium and phosphorus, iron, boron and aluminium is high at this pH. When soil pH is 7.8 or more it indicates abundance of calcium and magnesium. High pH

of soils indicates inadequate availability of copper, iron, zinc, manganese, and especially phosphorus and boron (USDA Natural Resources Conservation Service January 1998; Dora Neina, 2019).

5. Conclusion

The pH ranges in PSB indicates that in the soil between of 7.18 to 8.28 indicating neutral to slightly alkaline. The same pH ranges from 8.70 to 10.97 in stream sediments showing (PSB) from moderately alkaline to alkaline nature. EC ranges from 31.376 to 235.32 mg/l in stream sediments of (PSB). The result of soil pH geochemistry relationship indicates increasing yield for particular crops through recycling of nutrient and enhances crop development. Most important is to control the soil pollution with the distribution and removing harmful material from organic soil and stream sediment. This research envisages that imparting the oxidation and reduction of major and trace elements in surficial and stream sediment environment.

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