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Physico-Chemical Study of Foliar Chemicals of Neem *(Azadirachta Indica* A. Juss*)* in Different Seasons, around Amarkantak Thermal Power Plant, Chachai (Madhya Pradesh) India

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Abstract: ***This study investigated the seasonal variation in foliar chemicals of Neem (Azadirachta Indica A. Juss.) nearby areas of Amarkantak Thermal Power Plant, chachai Madhya Pradesh which is situated at 23º 10'04" N and 81º39'15" E in Survey of India toposheet nos. 64E, 64F & 64 I. Neem is the most popular medicinal plant having a long series of antibiotic drug properties. The quantitative estimation of foliar chemical may lead to the significant use of natural products for medicinal, social and research areas. The present study carried out with standard Laboratory and instrumental methods of Elemental analysis. The neem tree was selected in Amarkantak Thermal Power Station (ATPS) Colony, Chachai (MP), on the basis of morphological characteristic. Chlorophyll was estimated from fresh leaves by using Spectrophotometer while protein, polyphenols, carbohydrates, Nitrogen and phosphorus were quantified from dried leaves by using UV-VIS Spectrophotometer. Elemental composition of Sodium, Potassium and Calcium were quantified by flam photometry. Study concludes that all foliar chemicals were found to be significantly different in different months of year. Protein content was found maximum in February (8.11%) while minimum observed in the month of July (3.48%), Polyphenols content was found maximum in Month of April (7.06%) and minimum in the month of September (4.35%), carbohydrate Max. found in February (9.70%) and Min. observed in October (4.50%). Although significant variation (P<0.05 – P<0.01) was observed in elemental composition in different months of the year except Phosphorous content, which was suddenly increased in the month of July (8.93) and October (7.93%).***

Keywords: Foliar Chemicals, Neem (Azadirachta Indica A. Juss.), Seasonal Variation, Elemental composition, Quantitative Analysis

1. Introduction

The purpose of current study is to evaluate the Foliar Chemicals of Neem (*Azadirachta indica)* around Amarkantak Thermal Power Station Chachai, (M.P.) in keeping view their sustainable growth aligned with natural habitats. Many of researchers has been confirmed that neem tree have great potential towards their growth in polluted environment. A study was conducted to evaluate biochemical traits in leaves to assess the pollution impact on plants with special reference of the ten deciduous species caused by gaseous emission around Thermal Power Station [1]. Research works concluded around two thermal power plants of India to quantify the changes in foliar elemental concentrations due to emission in a low rainfall tropical area expose that Sulphur dioxide and particulates were at high levels which may cause serious ecological effects [2]. Emissions from the power plants have altered the elemental concentrations in the leaves of evergreen and deciduous plants. Some structural and functional changes in plant communities in nearby area of industrial belt were observed [3]. In the process of pollutant deposition and plant pollutant interaction they undergo morphological, physiological and biochemical changes [4]. A careful observation of plant responses in terms of pigment content, appearance of other metabolites and finally the injury symptoms can be used to assess the status of ambient air with respect to air pollution [5]-[6]. As a result of gaseous pollution the leaf biochemical mechanisms alter their pattern either in self defence or as a result of detrimental effects [7].

Trace elemental analysis was also introduced in the leaves of *Azadirachta indica* and *Pongamia glabra*, for different environmental sites of Visakhapatnam [8]. According to researcher, it is a very common species which is being used in surrounding of all industrial areas of India for plantation purpose [9]. In India neem occurs in tropical dry deciduous and thorn forests [10]. Coal based thermal power plant considered as source of emission and deposition of pollutants on above ground vegetation leads chlorophyll degradation. The difference in Chlorophyll a / b ratio was also reported [11]. Among all the chemical compounds in plants, secondary metabolites are of great importance [12]. Plant–environment relationship is significant with reference to phenolic compounds [13]. As they are the strong antioxidant properties are known to diffuse the toxic free radicals [14].

2. Materials and Methods

The Amarkantak Thermal Power Station in Chachai (M.P.) is a link in Korba-Amarkantak-Satpura power chain and is situated at 23º 10'04" **N** and 81º39'15" **E,** falling in Survey of India toposheet nos. 64E, 64F&I. It is interconnected to the 220 KV lines Madhya Pradesh grid line and the Rihand system of Uttar Pradesh through 132 KV lines [15]. This area has a semi-arid type of climate with an Average rainfall of 1235mm. The puls tree of neem is selected on the basis

of morphological Characteristics and study Location (around 2.0 km from ATPS) in residential colony.

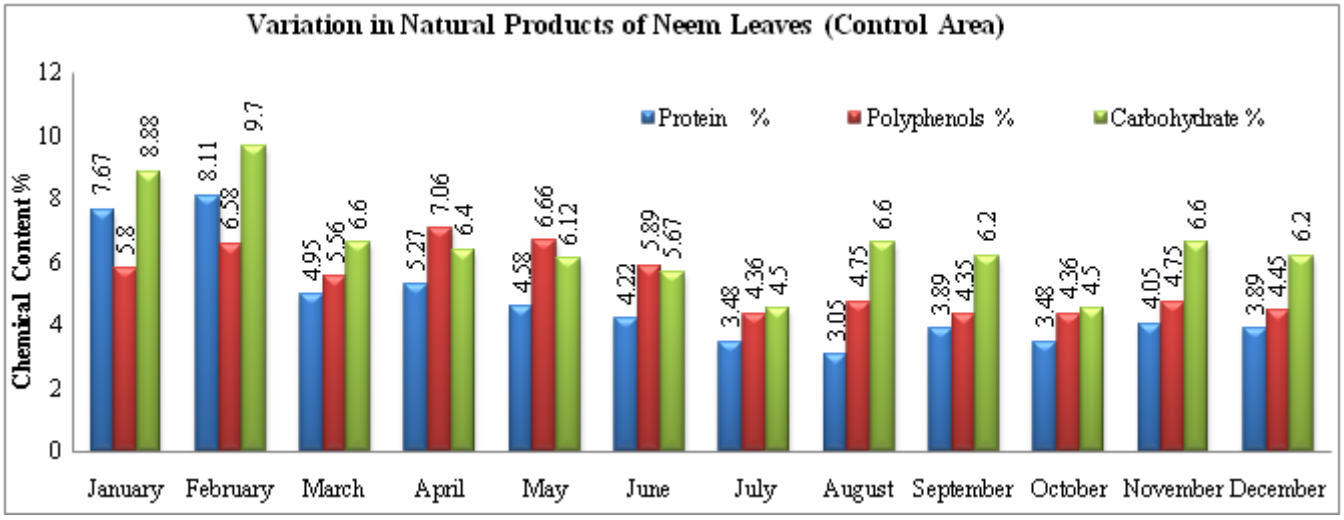
The samples of neem leaves were collected throughout the year homogeneously from a height of 2 meters of matured neem tree and after laboratory processing followed by Physico-chemical analysis of the samples has been done by using standard methodology. Chlorophyll was estimated from fresh leaves by Spectrophotometry [16]. while protein [17], polyphenols [18], carbohydrates [19], Nitrogen (H_2O_2 method -525 nm) and phosphorus (470 nm) were quantified from dried leaves by using UV-VIS Spectrophotometer. Rest Elemental composition of Sodium, Potassium and calcium were quantified by flam photometry.

3. Results and Discussion

Neem leaves are excellent source of some minerals and they contain adequate quantity of trace minerals except Zinc, for which the recommended requirement is 40 ppm [20]. However optimal levels of Zn are necessary for the normal function of the human body since Zn toxicity is associated with low Cu status, altered Fe function, reduced immune function and reduced levels of high-density lipoproteins [21]. Quantitative Analysis of neem leaves carried out from the collected leave samples from A.T.P.S. Residential colony, Chachai (M.P.) on monthly basis during the year. The results of Quantitative analysis of Fresh Neem Leaves after laboratory processing are given hereunder (Table: 1).

Table 1: Quantitative Analysis of Natural Products of Fresh Neem Leaves (control area)

Month	*Protein %*	*Polyphenols %*	*Total carbohydrate %*
January	7.67	5.8	8.88
February	8.11	6.58	9.7
March	4.95	5.56	6.6
April	5.27	7.06	6.4
May	4.58	6.66	6.12
June	4.22	5.89	5.67
July	3.48	4.36	4.5
August	3.05	4.75	6.6
September	3.89	4.35	6.2
October	3.48	4.36	4.5
November	4.05	4.75	6.6
December	3.89	4.45	6.2
CD $_{0.05}$	0.0705	0.3339	0.5095
CD $_{0.01}$	0.0966	0.4575	o.6980
SE ±	0.0336	0.1589	0.2425

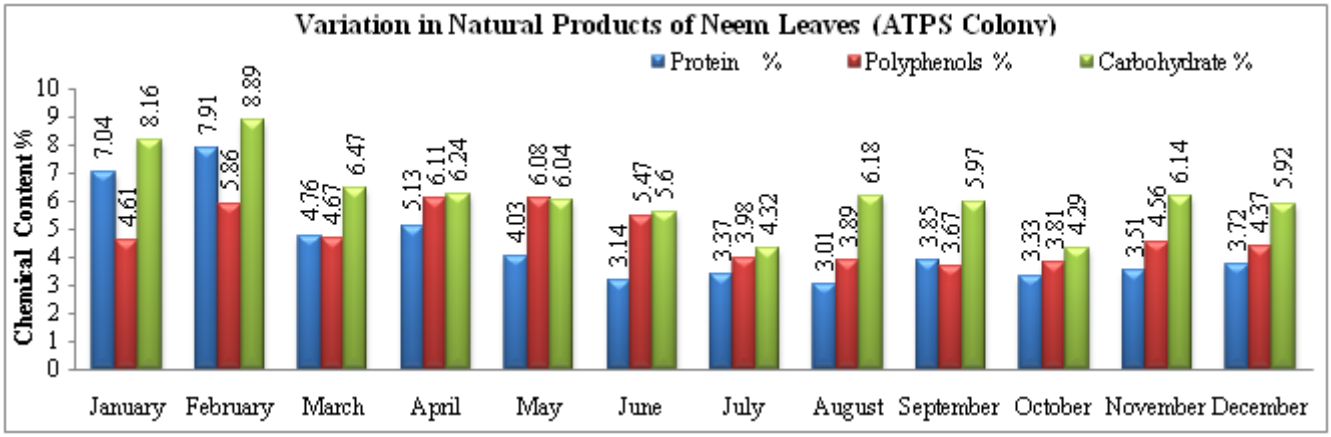


Graph 1: for Table: 1 (Quantitative Analysis of Natural Product of Fresh Neem Leavs- Control Area)

Statistically significant seasonal difference ($P<0.05$) were found for Protein, Polyphenols and Total carbohydrate. While in the analysis of ATPS colony neem leaves it was observed that leaves have less Protein, Polyphenol and Carbohydrate content (table-2) than neem leaves (control area) presented in Table-1.

Table 2: Quantitative Analysis of Natural Product in Neem Leaves at ATPS Colony throughout the Year.

Month	*Protein %*	*Polyphenols %*	*Carbohydrate %*
January	7.04	4.61	8.16
February	7.91	5.86	8.89
March	4.76	4.67	6.47
April	5.13	6.11	6.24
May	4.03	6.08	6.04
June	3.14	5.47	5.6
July	3.37	3.98	4.32
August	3.01	3.89	6.18
September	3.85	3.67	5.97
October	3.33	3.81	4.29
November	3.51	4.56	6.14
December	3.72	4.37	5.92
CD $_{0.05}$	0.0680	0.3346	0.5011
CD $_{0.01}$	0.0935	0.4569	0.6835
SE ±	0.0316	0.1572	0.2537

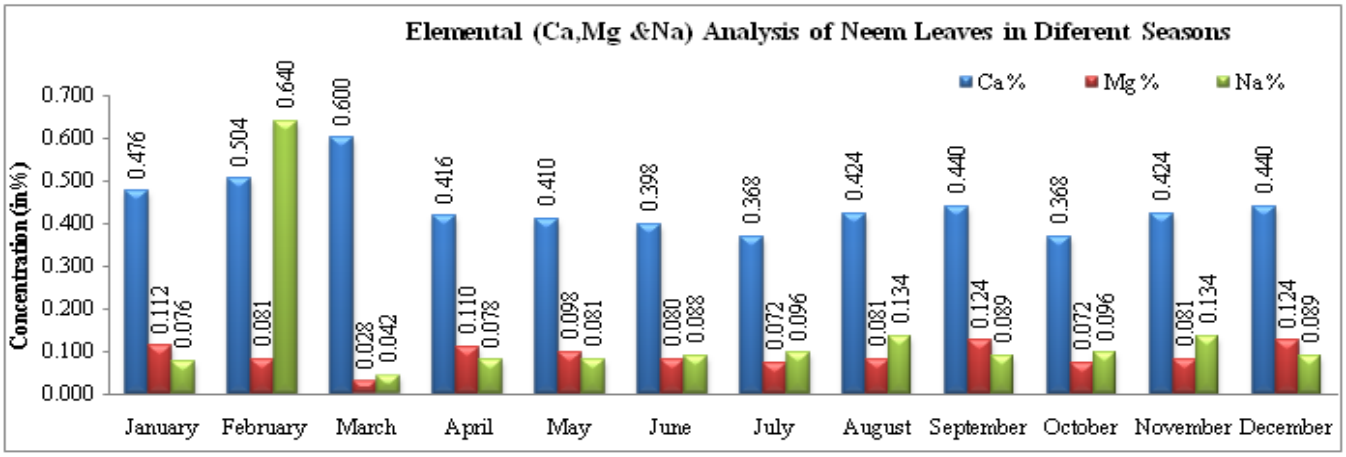


Graph 2: for Table: - 2 (Quantitative Analysis of Natural Product in Study site [ATPS Colony] Neem Leaves)

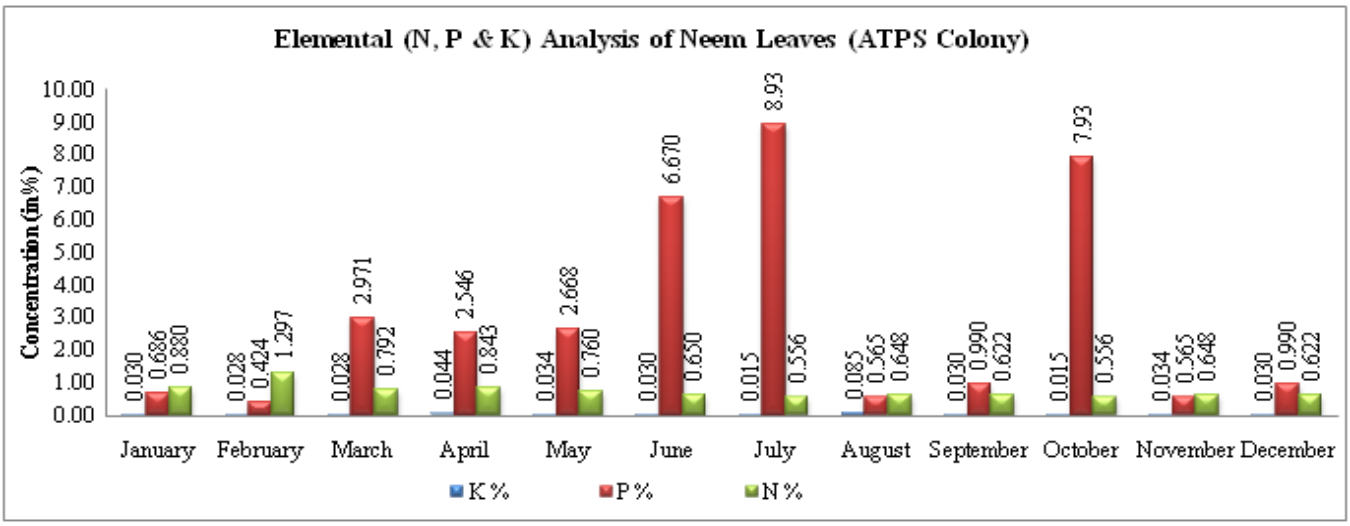
Significant variation was observed in elemental composition but the amounts of elements were more or less uniformed except Phosphorus (Table: 3).

Table 3: Elemental Analysis of Neem leaves in Different Seasons

Month	Ca %	Mg %	Na %	K %	P %	N %
January	0.476	0.112	0.076	0.030	0.686	0.880
February	0.504	0.081	0.640	0.028	0.424	1.297
March	0.600	0.028	0.042	0.028	2.971	0.792
April	0.416	0.110	0.078	0.044	2.546	0.843
May	0.410	0.098	0.081	0.034	2.668	0.760
June	0.398	0.080	0.088	0.030	6.670	0.650
July	0.368	0.072	0.096	0.015	11.930	0.556
August	0.424	0.081	0.134	0.034	0.565	0.648
September	0.440	0.124	0.089	0.030	0.990	0.622
October	0.368	0.072	0.096	0.015	11.930	0.556
November	0.424	0.081	0.134	0.034	0.565	0.648
December	0.440	0.124	0.089	0.030	0.990	0.622
$CD_{0.05}$	0.0290	0.0417	0.0023	0.1354	0.0212	0.0049
$CD_{0.01}$	0.0398	0.0571	0.0032	0.1855	0.0290	0.0067
$SE \pm$	0.0138	0.0198	0.0011	0.0644	0.0101	0.0023



Graph 3: for Table: 3 (Analysis of Ca, Mg & Na in Neem leaves)

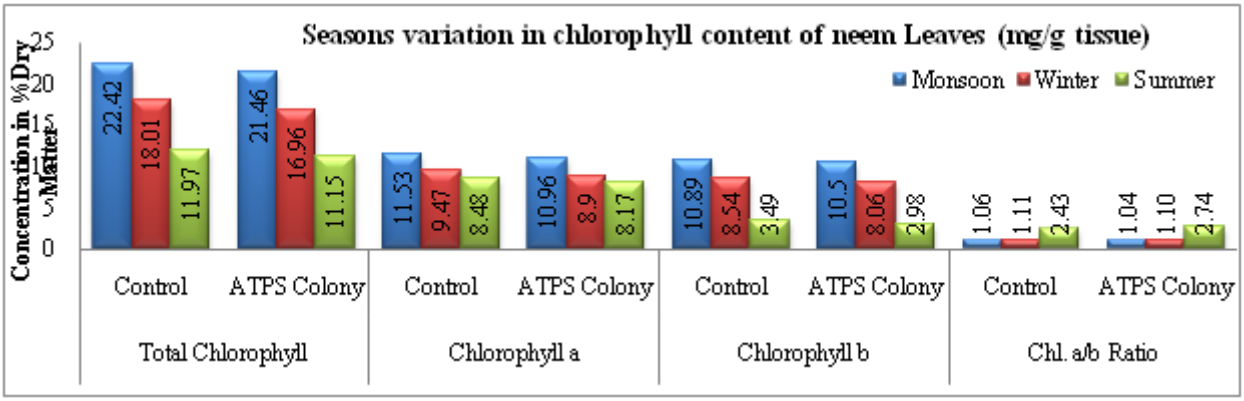


Graph 4: for Table: 3 (Analysis of N, P and K in Neem leaves)

The green Neem leaves were extracted and absorbance of these extracts was read against blank at 645 and 663 nm wavelengths. Chlorophyll (a, b and Total) amounts were calculated from the obtained absorbance values.

Table 4: Seasonal variations in chlorophyll content of Neem Leaves (mg/g tissue)

Sl. No.	*Season*	*Total Chlorophyll*		*Chlorophyll a*		*Chlorophyll b*		*Chlorophyll a/b Ratio*	
	Area	Control	ATPS Colony	Control	ATPS Colony	Control	ATPS Colony	Control	ATPS Colony
1	**Monsoon**	22.42	21.46	11.53	10.96	10.89	10.5	1.06	1.04
2	**Winter**	18.01	16.96	9.47	8.9	8.54	8.06	1.11	1.10
3	**Summer**	11.97	11.15	8.48	8.17	3.49	2.98	2.43	2.74



Graph 5: for Table: 4 Seasonal variations in Chlorophyll contents of Neem Leaves

4. Conclusion

This study concludes that all foliar chemicals were found to be significantly different in different months of year. Protein content was found maximum in February (8.11%) while minimum observed in the month of July (3.48%), Polyphenols content was found maximum in Month of April (7.06%) and minimum in the month of September (4.35%), carbohydrate Max. found in February (9.70%) and Min. observed in October (4.50%). Although significant variation ($P<0.05$ – $P<0.01$) was observed in elemental composition in different months of the year except Phosphorous content, which was increased in the month of June (6.67%), Oct. (7.93%) and July (8.93%). The Total Chlorophyll content in the Control Area neem Leaves reported (mg/g tissue) max. In Monsoon (22.42) comparatively higher followed by winter (18.1) and summer (11.97) however the Chl. a/b ratio is high in summer (2.43) against monsoon season (1.06). Meanwhile Chlorophyll content in the ATPS Colony neem Leaves reported (mg/g tissue) max. In Monsoon (21.46) comparatively higher against winter (16.96) and summer (11.15) however the Chl. a/b ratio is high in summer (274) against winter (1.10) and monsoon season (1.06). Hence on the basis of overall data obtained from the quantitative analysis of foliar chemicals reveals the sustainable growth of neem around Amarkantak Thermal Power Plant. Consequently it is recommendable to the new coming thermal power industries that Neem Tree "*Azadirachta Indica* A. Juss" is more effective and appropriate to build the greenbelt cover along with protection of environment by plantation of such Sustainable species in and around of coal fired Thermal Power Plants.

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