JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

REGIONAL PROXIMATE EVALUATION OF *Ricinus communis, Carica papaya, Tamarindus indica* leaf samples and Biochar sample.

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Abstract*:** *This study has been undertaken to investigate the regional variations with respect to properties like moisture content, ash content and elemental content such as calcium and magnesium for samples of the dried and powdered leaf samples* ***Ricinus communis, Carica papaya, Tamarindus indica and Biochar sample *obtained from the states of Kerala and Maharashtra in India using various laboratory physical and chemical tests and hence the approximate amount of various aforementioned characteristics was determined. Significant fluctuation was observed in the values thus obtained of various parameters and these values act as major influencing factors as for when the plants are chosen for purposes such as production of fertilizers, medicinal uses and various other significant applications.*

I. INTRODUCTION

The determination of a set of closely related molecules in a substance, such as plants, is known as proximate analysis. Moisture, ash, crude protein, crude fat, crude fibre, and nitrogen free extracts are the most common classifications for these closely related components. Understanding the nutritional makeup of a plant necessitates the investigation and study of proximate composition (Ilodibia, et al., 2014). To determine the level of heavy metals, minerals, and proximate composition, we conducted regional study on plant leaves such as *Ricinus communis* (Kerala and Maharashtra), *Carica papaya* (Kerala and Maharashtra), *Tamarindus indica* (Kerala), and Biochar.

Ricinus communis, also known as castor, is a member of the Spurge Family (Euphorbiaceae). *Ricinus communis* is native to tropical Africa, but it has become a weed in many tropical and subtropical areas around the world. Plants are primarily grown in India, China, and Brazil (Petruzzello, 2021). It is majorly grown in India in the states like Gujarat, Rajasthan, Andhra Pradesh, Telangana and Odisha. According to the government's third advance projections, total production of *Ricinus communis* in India had reached 17.74 lakh tonnes in 2020-21. In 2021-22, the area under castor reported was 1.484 lakh hectares (3.67 lakh acres), compared to 1.732 lakh hectares (4.28 lakh acres) in 2020-21. It is grown in dry and semi-arid climate. *Ricinus communis* is a fast-growing delicate perennial herbaceous or semi-woody big shrub or small tree that reaches a height of around 40 feet. They are grown as annuals in temperate climates, growing 1.5 to 2.5 metres (4.9 to 8 ft) in a single season. *Ricinus communis* is grown commercially for its oil, which is used in pharmaceutical and industrial applications, as well as for landscaping. Its leaves are crushed and ground into a paste that is administered externally to treat jaundice, migraines, lower back pain, sciatica pain, arthritis pain, mastitis, and other pain-related skin conditions (H.J.V., 2020).

Ricinus communis

Carica papaya is a member of the Caricaceae family, commonly known as papaya. It is currently grown all across the tropical world, as well as in the hottest subtropical regions. *Carica papaya* is grown in over fifty-seven countries, and the leaves are sold fresh in Asian, Southeast Asian, Australian, African, Caribbean, United States, Central America, and South American markets. Karnataka, Andhra Pradesh, Gujarat, Orissa, West Bengal, Assam, Kerala, Madhya Pradesh, and Maharashtra are the main producers of *Carica papaya* in India. In fiscal year 2021, India's *Carica papaya* output totalled 5.95 million metric tonnes. This was a little increase over the previous fiscal year. *Carica papaya* grows best on well-drained, rich sandy loam soils or medium black, drought-resistant soils. Light soils with a pH of 6.5-7 are good for cultivation of *Carica papaya* if properly manured. *Carica papaya* thrives in a temperate tropical climate and at altitudes ranging from sea level to 1000 metres, despite being a tropical crop. It should not be grown in areas where there are strong, hot, or dry winds. The sweetness of the fruits is improved by maturing in a dry environment. Temperatures of 25 to 30 degrees Celsius are optimum for producing the fruit, while temperatures of less than 10 degrees Celsius prevent ripening (Petruzzelo, 2018). Papaya leaf contains unique plant compounds that have demonstrated extensive pharmacological potential in test tubes and animals. Despite the lack of human research, papaya leaf preparations such as teas, extracts, tablets, and juices are widely used to treat a variety of diseases and improve overall health. The fruit is high in antioxidants such as vitamin E, C, and beta-carotene, while the seeds are high in fatty acids and papaya oil, have a sharp peppery flavour, and can be used in place of spices. (Hill, 2020)

Carica papaya

Tamarindus indica belongs to the family Fabaceae, subfamily Caesalpinioideae, commonly known as tamarind (Imli). It is a tropical fruit that originated in Madagascar and is now widely grown in India, Myanmar, Bangladesh, Malaysia, Sri Lanka, Thailand, and a number of African, Central American, and South American countries. Madhya Pradesh, Andhra Pradesh, Tamil Nadu, and Karnataka are the states in India where it is primarily farmed. *Tamarindus indica* is a huge perennial tree that is commonly grown as an aesthetic and shade tree, as well as for its valuable wood and edible fruits. Due to its multiple uses, the farming of *Tamarindus indica* has grown around the world, mainly in tropical and subtropical countries. With a height of up to 24 metres and a circumference of up to 7 metres, it is a medium to big evergreen tree. *Tamarindus indica* is found in woodlands, savannahs, and bushy areas, and is frequently found near termite mounds. It prefers arid and semi-arid regions, as well as forested grassland. *Tamarindus indica* has been used in Indian cuisine for generations to impart that typical sour flavour, but the leaves, as well as the fruit, have long been employed in cuisine and Ayurveda. It relieves malaria and menstrual cramps, cures jaundice, diabetes, and

scurvy, speeds wound healing, promotes lactation, and prevents genital infections, among other things. It has an anti-inflammatory effect (Lybrate, 2020).

Tamarindus indica

Elements such as carbon, hydrogen, sulphur, oxygen, and nitrogen, as well as minerals in the ash portion, make up biochar. Biochar is a carbon-rich material formed during the pyrolysis process, which is a thermochemical decomposition of biomass at a temperature of around 700°C in the absence or restricted presence of oxygen. As a soil amendment, biochar appears to have numerous advantages. It increases yields, fertilizer efficiency, removes pollutants and pesticides, mitigates climate change, increases soil moisture, pH, soil microbe populations, increases cation exchange of soil, holds water, works as a fertilizer, and grows larger plants. It is also environmentally friendly, as it sequesters carbon in the soil for thousands of years (Rawat, 2019).

II. EXPERIMENTAL MEHODOLOGY

1. Sample preparation

In this research, the samples under observation were collected from Thrissur district in Kerala and Mumbai in Maharashtra between the 20th and 30th of December 2021. The plant identification was carried out in the Department of Botany, Mithibai College, Mumbai, Maharashtra. The biochar sample used was Casa De Amor ® BIOCHAR manufactured on 1st January 2022.

2. Pre-treatment of the sample

The leaf samples were initially separated from the stalks, washed with water and then air-dried in the absence of sunlight. The dried leaf samples were then powdered in the grinder in our laboratory, sieved and packed, and stored away from the sunlight in a dry place. The biochar sample was finely powdered and stored in airtight container.

III. CHEMICAL ANALYSIS

1. Moisture Content:

1.0 g of leaf powder were oven dried for 2 hours at 110± 10° C, the samples were taken out and cooled in a desiccator, and the weight loss of the sample was recorded to assess the moisture content of the seeds. The drying and weighing mechanism was performed repeatedly until the sample attained a constant weight (Anu Babu, 2019).

Table 1 : Analysis of Moisture Content in the six samples

Serial No.	Sample (location)	Total weight before loss of moisture (Mean±SD)	Total weight loss after loss of moisture (Mean±SD)	Percentage moisture Content (constant value)
1	***Ricinus communis* (Kerala)**	1.0 g	0.091±0.042 g	9.1%
2	***Ricinus communis* (Maharashtra)**	1.0 g	0.078±0.014 g	7.8%
3	***Carica papaya* (Maharashtra)**	1.0 g	0.057±0.029 g	5.7%
4	***Carica papaya* (Kerala)**	1.0 g	0.081±0.033 g	8.1%
5	***Tamarindus indica* (Kerala)**	1.0 g	0.064±0.011 g	6.4%
6	**Biochar**	1.0 g	0.063±0.065 g	6.3%

2. Aqueous Extraction and elemental analysis

Approximately 5.0 g of powdered sample were properly weighed and transported to an extraction device, where they were heated for 1 hour with 100ml distilled water until the volume was reduced to half. The resulting solution was chilled, and the contents were filtered using circular filter paper via Buchner's funnel under suction (Whatman No. 41). Boiling water was used to wash away the insoluble materials. The water insoluble substance was dried and weighed in an oven at 110 ± 10^0 C

The resulting filtrate was utilized to conduct additional elemental analysis.

2.1 Calcium:

Prepare 10.0 mL of aqueous solution of extracts from powdered plant leaves with 1:1 HCl and dilute up-to 100 ml in standard measuring flask with distilled water.

Pipette out 10 ml of the aforementioned solution into a conical flask, add a pinch of Patton-Reader indicator and 8M KOH till the colour of Patton-Reader indicator appears. Then add one test tube of 10% NH_2OH. HCl solution till clear red solution is obtained and titrate against 0.05M EDTA solution till the colour of solution changes to blue.

2.2 Magnesium:

Prepare 10mL of extracts from powdered sample with 15mL of 4N H_2SO_4 and 100mL of distilled water in a standard measuring flask. Pipette 10mL of the aforementioned solution into a conical flask, add 5mL of buffer solution, and 2-3 drops of Eriochrome Black T indicator (complexometric titration). It was then titrated against 0.01M EDTA solution until the colour changes from wine red to blue (Sajid M. Mansoori, et al., 2017).

3. Ash content and its Analysis:

In a previously ignited and weighted silica crucible, around 2.0 g of the leaf sample was burnt on the Bunsen burner to ash until it turned white indicating the complete absence of carbon. It was cooled in vacuum desiccators over calcium chloride, weighted, and the increase over the first weight of the crucible is being used to estimate the ash content. (Sonkamble & Narayan Pandhure, 2015)

$$\text{Ash value \%} = \frac{\text{Weight of Ash}}{\text{Weight of sample}} \times 100$$

Water Soluble Ash: To determine water-soluble ash, the entire ash was boiled in 10 mL of distilled water. The resulting aqueous suspension was filtered through an ash-free filter paper (Whatman No. 41) and carefully rinsed with hot distilled water. The residue-containing filter paper was then ignited in the original crucible, cooled in a desiccator, and the water-insoluble ash was weighted. Based on these values, the "water soluble" ash was computed as follows:

$$\text{Water soluble ash} = \text{Total ash} - \text{Water insoluble ash}$$

3.1 Alkalinity test

The alkalinity of water-soluble ash was evaluated in the filtrate produced after cooling and titrating it against 0.1N sulphuric acid. For this titrimetric analysis, Methyl orange was used as the indicator for producing a visual colour change. The alkalinity thus obtained is mapped in terms of milliequivalents of sodium carbonate

$$\textbf{1 ml 0.1 N } H_2SO_4 \textbf{ = 0.1 milliequivalents } Na_2CO_3$$

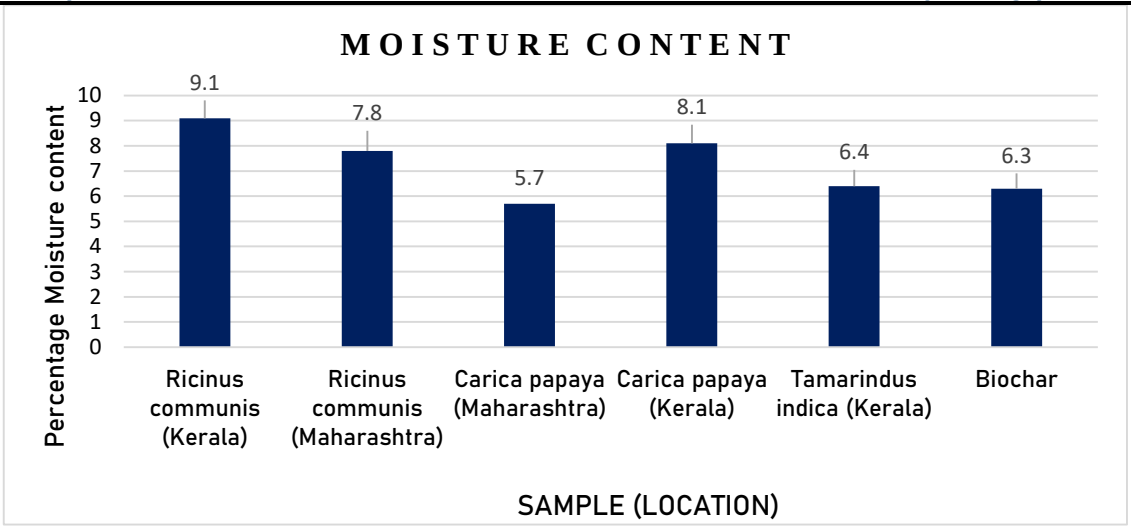
IV. RESULTS AND DISCUSSION

1.Morphological Characteristics of the leaf samples

Table 2: Analysis on the basis of Morphological Characteristics

Parameters	*Ricinus communis* (Kerala)	*Ricinus communis* (Maharashtra)	*Carica papaya* (Maharashtra)	*Carica papaya* (Kerala)	*Tamarindus indica* (Kerala)
Colour	Mild green	Dark green	Pale green	Dark green	Dark green
Length of leaflet	12-14 cm	14-16 cm	15-18 cm	16-18 cm	1-2 cm
Width of leaflet	10-12 cm	12-15 cm	16-18 cm	15-18 cm	0.5-1.0 cm

The regional proximate analysis in qualitative and quantitative aspects of the *Ricinus communis, Carica papaya, Tamarindus indica leaf samples* and Biochar Sample showed significantly immense variation with regards to a number of properties under investigation. The moisture content per gram of the sample in *Ricinus communis* (Kerala) was found to be 9.1%, for *Ricinus communis* (Maharashtra) it is 7.8%, for *Carica papaya* (Maharashtra) 5.7%, *Carica papaya* (Kerala) – 8.1%, *Tamarindus indica* (Kerala) it was found to be 6.4% and 6.3% for the Biochar sample.

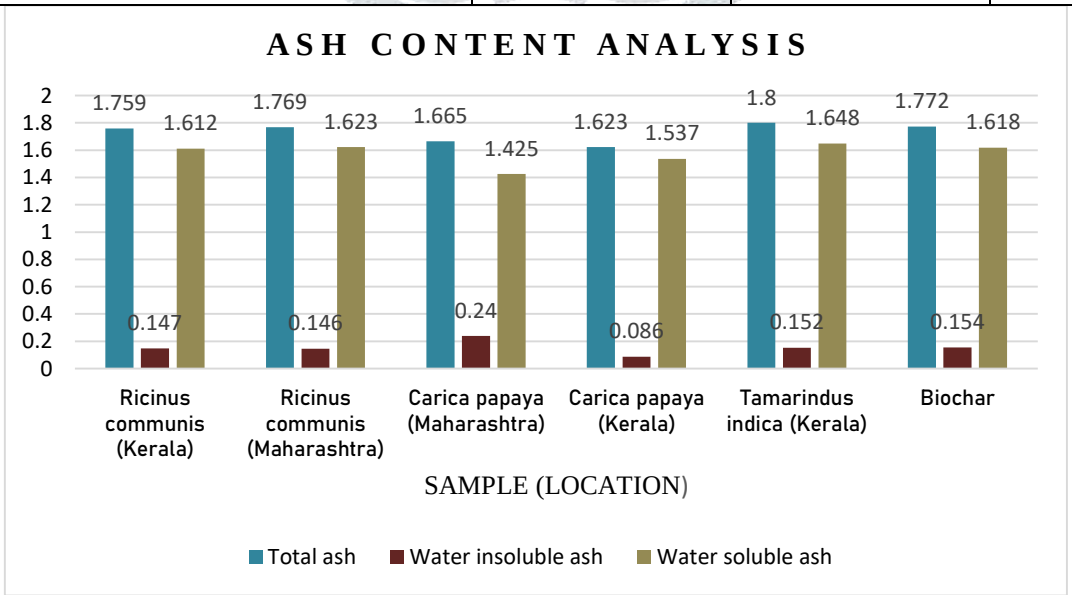


1. Graphical Representation of Moisture Content comparison between the samples

While analysing the Ash content, the quantitative analysis for the solubility of the ash in water was also carried out per 2.0 grams of the powdered leaf sample.

Table 3: Ash content analysis data of the six samples

Serial No.	Sample (location)	Total ash (Mean±SD)	Water insoluble ash (Mean±SD)	Water soluble ash (Mean±SD)
1	***Ricinus communis* (Kerala)**	1.759±0.0628 g	0.147±0.0317 g	1.612±0.0332 g
2	***Ricinus communis* (Maharashtra)**	1.769±0.0712 g	0.146±0.0678 g	1.623±0.0634 g
3	***Carica papaya* (Maharashtra)**	1.665±0.0682 g	0.240±0.0785 g	1.425±0.0705 g
4	***Carica papaya* (Kerala)**	1.623±0.0504 g	0.086±0.0220 g	1.537±0.0277 g
5	***Tamarindus indica* (Kerala)**	1.800±0.0149 g	0.152±0.0572 g	1.648±0.0351 g
6	**Biochar**	1.772±0.0321 g	0.154±0.0174 g	1.618±0.0481 g

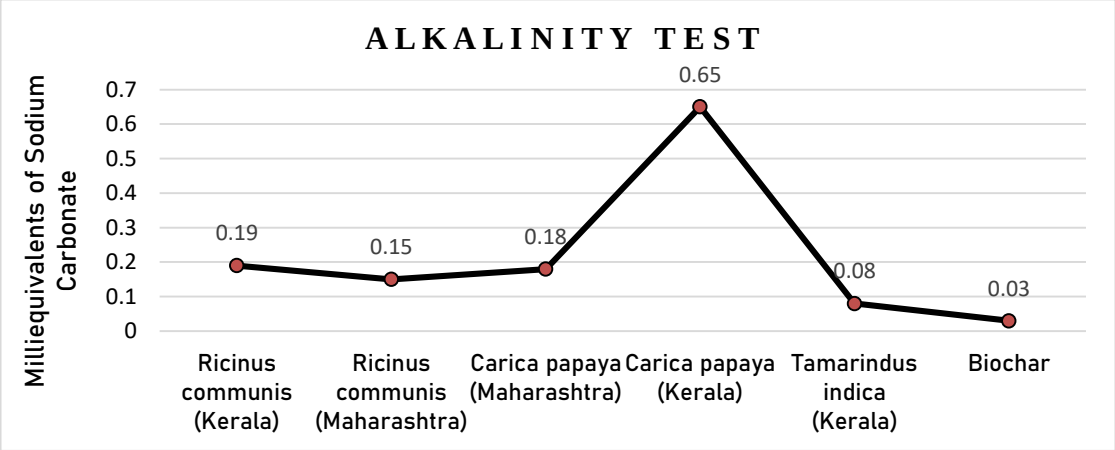


Graphical Representation of Ash content analysis

The alkalinity of the water-soluble ash content was evaluated using titrimetric analysis and the readings were tabulated with respect to milliequivalents of Sodium carbonate.

Table 4: Alkalinity Test

Sample (location) (10mL)	Volume of H_2SO_4 (in mL) (Constant Burette Reading)	Milliequivalents of Na_2CO_3 w.r.t constant value
Ricinus communis **(Kerala)**	1.9	0.19
Ricinus communis **(Maharashtra)**	1.5	0.15
Carica papaya **(Maharashtra)**	1.8	0.18
Carica papaya **(Kerala)**	6.5	0.65
Tamarindus indica **(Kerala)**	0.8	0.08
Biochar	0.3	0.03



Graphical Representation of Alkalinity of the Samples

In Chemical Analysis the tests for Magnesium and Calcium elemental analysis were performed but these elements as they are present in only trace amounts in the limited amount of the samples under observation, did not give appropriate results in the aqueous extraction of the samples in small quantities.

V. CONCLUSION

The above tests and related analysis revealed various structural and chemical changes and variations that can be observed between various species of leaves and also the changes occurring due to the regional factors in leaves of the same species obtained from different states of India.

These changes in the properties can be experimentally attributed to factors such as change in soil type which includes their mineral content, water content, atmospheric changes etc. Method of drying also has been experimentally proved to alter the parameters such as Ash and moisture content in samples. Ash content is instrumental in determining the amount of total mineral content in the leaves which is further quantitatively established by elemental analysis using various methods. Ash content was observed to be similar for the same species of samples obtained from two different states but moisture content results showed great fluctuations.

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