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NUTRITIONAL AND PHYTOCHEMICAL COMPOUNDS OF HIBISCUS HERBAL TEA POWDER

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ABSTRACT

Background: “World Health Organization” has exposed that traditional health and common drug systems are authenticated to be more effective in health complications worldwide. *Hibiscus rosa sinensis* Linn is certain to emerge in the adjacent upcoming as a major participant in the growing field of herbal health supplements and medicines both in daily self-care and in professionally managed health care system. Traditionally, *Hibiscus* flowers have been reported to possess antitumor properties, as well as have been used as analgesic, antipyretic, anti-asthmatic, and anti-inflammatory agents. Several studies have proved the presence of antioxidant, anti-fungal, and antimicrobial properties in flowers of *Hibiscus rosa-sinensis*. **Results:** This hibiscus tea powder was analyzed by Nutrients, Phytochemicals and FESEM. It indicates that the predominant compounds are 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- (1.94%), 5-Hydroxymethylfurfural (3.17%), 1,2,3-Benzenetriol (89.55%), α -D-Glucopyranoside, O- α -D-glucopyranosyl-(1,6-darw.3)- β -D-fructofuranosyl (3.09%), β -D-Glucopyranose, 1,6-anhydro- (2.25%). **Conclusions:** Thus each compound identified in Hibiscus Tea powder has its own biological importance and further study of phytochemicals present in this Hibiscus tea

powder can prove its medicinal importance in future and can be an effective and efficient drug source in cheaper rate as it has better availability.

Keywords: *Hibiscus rosa sinensis*, Amla, Tea powder, phytochemicals and Nutrients

1. Background:

Hibiscus rosa sinensis is an herbaceous shrub that belongs to the family of Malvaceae. “World Health Organization” has exposed that traditional health and common drug systems are has authenticated to be additional effective in health problems worldwide. *Hibiscus rosa sinensis* Linn Is certain to emerge in the adjacent upcoming as a major participant in the growing field of herbal health supplements and medicines both in daily self-care and in professionally managed health care system [1].

The flowers have been reported in the ancient Indian medicinal literature to have valuable effects in heart diseases, mostly in ischemic disease and used in folklore medicine as refrigerant, emollient, brain tonic and cardio tonic. A decoction of flowers is also useful in Menorrhagia, bronchial catarrh, and fertility control [2].

Traditionally, *Hibiscus rosa sinensis* flowers has been described to possess antitumor properties, along with have been used as antipyretic, analgesic, anti-asthmatic and anti-inflammatory agents. Some readings have shown the presence of Anti-oxidant,

Anti-fungal, and Antimicrobial properties in flowers of *Hibiscus rosa-sinensis* [3].

Emblica officinalis (Amla) has been used as an Ayurvedic medicine owed to its therapeutic properties. Almost all herbal parts of amla can be used as a traditional medicine, but the fruit is largely used for healing many human disorders. Amla fruit has been shown to contain many phytoconstituents such as, Phenolics, Alkaloids, Flavonoids, Terpenoids, Flavone glycosides, and Carbohydrates. Amla has displayed antioxidant, antibacterial, antitumor, anti-diabetic, anti-inflammatory and immuno-stimulatory potential [4]. Consequently, there is a rising demand for those natural foods which are rich in antioxidants, because these antioxidant compounds are known to help defend human body against many ailments, such as heart disease, inflammatory conditions, hardening of the arteries, digestive and visual problems, arthritis, rheumatism, Cancer and Diabetes [5].

Current scientific literature proposes that more than 50% of today’s clinical medications were of natural product origin. Many of them must play a significant part in

pharmacological industry and in developing improved therapies for various diseases. This Hibiscus Tea powder is economically very essential owing to the herbal products and medicinal uses.⁶ Because of insufficient current pharmacological information, there is not much scientific research or clinical trials conducted on the chemical extracts of *Hibiscus rosa-sinensis* and *Amla* that could be critical in discovering its fast potential therapeutic applications [3].

Therefore, we identified the active molecules present in this medicinally valuable Hibiscus Tea powder using simple solvent extraction followed by Nutritional values, GC–MS separation and FESEM.

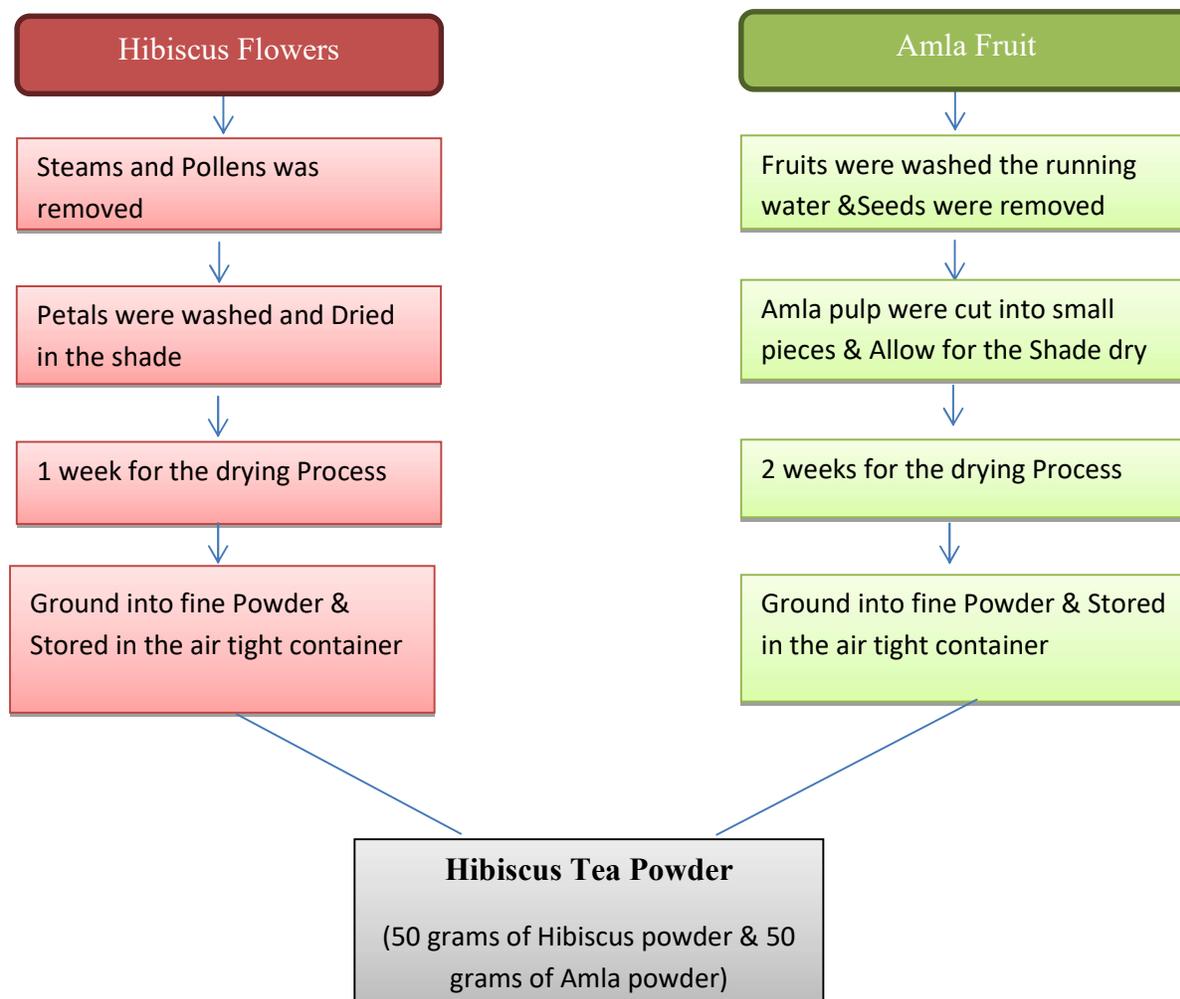
2. METHODS

2. 1. PLANT COLLECTION AND AUTHENTICATION:

The plant *hibiscus rosa sinensis* flowers and *Embllica officinalis* (Amla) were obtained from the southern part of India (Theni District, Tamil Nadu). The plant was identified and authenticated by TamilNadu agriculture university, Southern Regional Centre, Coimbatore district, Tamil Nadu, India and a voucher specimen has been deposited at the herbarium for further reference (BSI/SRC/5/23/2016/TECH/1112).

2. 2. PREPARATION OF HIBISCUS TEA POWDER

The Hibiscus rosa sinensis flowers and Amla fruits were selected carefully without any damage or insect infestation for processing in **Flow chart 1**.

Flowchart 1: Preparation of *Hibiscus* Tea

2.3. Analysis of Nutritive Value

In the present study, the nutritive value of dry powder made from the hibiscus flower and amla such as Energy, Proteins, Fat, Carbohydrate, Fiber, Moisture, Ash, Vitamin-C, Iron and were analyzed quantitatively.

2.4. Gas chromatography–mass spectrometry analysis

Sample was extracted with ethyl acetate and analyzed through Gas

Chromatography – Mass Spectrometry/ Mass Spectrometry for identification of different compounds.

GC Programme

Column Rtx-5MS (5% Diphenyl / 95% Dimethyl poly siloxane), 30m x 0.25mm ID x 0.25µm df Equipment Scion 436-GC Bruker ,Carrier gas 1ml per min, Split 101, Detector TQ Quadrupole Mass Spectrometer ,Software MS Work Station 8, Sample injected 1µl, Oven temperature

Programme - 110° C hold for 3.50 min ,Up to 200° C at the rate of 10 ° C/min-No hold ,Up to 280 ° C at the rate of 5° C / min- 12 min hold ,Injector temperature 280° C ,Total GC running time 40.50 min

MS Programme

Library used NIST Version-2011, Inlet line temperature 290° C Source temperature 250 ° C Electron energy 70 eV, Mass scan (m/z) 50-500 amu, Solvent Delay 0 - 3.5 min, Total MS running time 40.50 min.

2.5. Field Emission Scanning Electron Microscope (FESEM)

Field Emission Scanning Electron Microscope (FESEM) to perceiveminor structures (as small as 1 nanometer = one billion of a millimeter) on the superficial of cells and material. It is used to imagine very minor topographic particulars on the superficial or whole or fractioned objects. This is completed by covering them with an very thin layer (1.5 - 3.0 nm) of gold More onsubstances must be able to withstand the high vacuum.

3. RESULTS

3.1. Nutrient Content of Hibiscus Tea Powder (Table 1).

3.2. Compounds Identified in the HRST Powder

Five compounds were identified in the ethyl acetate extract of *Hibiscus Tea Powder* by GC-MS analysis. The active principle, molecular formula (MF), molecular weight (MW), concentration (peak area %), and retention time (RT) are present in **Table 2**.

It indicates that the predominant compounds are 4H-Pyran-4-one, 2,3-dihydro-3,5- dihydroxy-6-methyl- (1.94%), 5 Hydroxymethylfurfural (3.17%), 1,2,3- Benzenetriol (89.55%), α -D-Glucopyranoside, O- α -D-glucopyranosyl-(1.fwdarw.3)- β -D-fructofuranosyl (3.09%), β -D-Glucopyranose, 1,6-anhydro- (2.25%) are present in **Table 3**.

3.3. GC- MS/MS Chromatogram

Herbals have several aromatic compounds existing naturally in native state or formed while processing the tea powder. GC-MS is exclusively used for the analysis of esters, fatty acids, alcohols, aldehydes, terpenes etc (**Figure 1**).

3.4. Field-Emission Scanning Electron Microscope (FESEM)

The Field Emission Scanning Electronen Microscope (FESEM) to observed small structures on the surface of the Hibiscus tea Powder (**Figure 2**).

3.5. Energy Dispersive X-Ray Spectroscopy (EDX) (Figure 4).

Figure 1 is a GC- MS/MS Chromatogram of Hibiscus tea powder and **Figure 2** is a Field Emission Scanning Electron Micrograph of Hibiscus tea powder, which shows surface

morphology of Hibiscus tea powder. **Figure 3** is a Element Over layof the Hibiscus Tea Powder. **Figure 4** EDX result shows that Carbon, Oxygen, Aluminum, Potassium, Chlorine, Calcium, Iridium were Present in the **Table 4**.

Table 1: Nutrient Content of Hibiscus Tea Powder

S. No.	Parameter Analyzed	Method of Analysis	Results (g/100g)
1.	Energy (Kcal)	Food Labeling – Requirements for FDA Regulated products, by James L. Vetter, E. M. Melran, Ed., AIB International. Manhattan, K.S, 2007	329.06
2.	Protein	AOAC, 21st Edn, 2019, 984.13, Cha,4.2.09, Vol I, Pg: 31	5.48
3.	Fat	AOAC, 21st Edn, 2019, 2003.05; Cha, 4.5.05; Vol I; Pg: 41.	4.14
4.	Carbohydrate	Biochemical Methods by S. Sadasivam, <i>et. al.</i> , Revised Second Edition; 2005; pg. 8-9	67.47
5.	Moisture	AOAC, 21st Edn, 2019, 925.10; Cha, 32.1.03; Vol II; Pg: 1.	12.08
6.	Crude Fiber	AOAC, 21st Edn, 2019; 962.09; Cha 4.6.01; Vol I; Pg: 44	7.24
7.	Ash	AOAC, 21st Edn, 2019, 923.03; Cha 32.1.05; Vol II; Pg: 2.	3.59
8.	Iron (mg/100g)	AOAC, 21st Edn, 2019, 923.03; Cha 32.1.05; Vol II; Pg: 2	1.3 mg
9.	Vitamin C (mg/100g)	Helmenstine, Anne Marie, Ph.D. "Vitamin C Determination by Iodine Titration." ThoughtCo, Aug. 27, 2020, thoughtco.com/vitamin-c-determination-by-iodine-titration-606322.	19.05 mg

Table 2: Compounds detected in the ethyl acetate extract of Hibiscus Tea Powder

No	RT (min)	Name of the compound	Molecular Formula	Molecular Weight	Peak Area %
1	4.64	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	C ₆ H ₈ O ₄	144	1.94
2	5.804	5-Hydroxymethylfurfural	C ₆ H ₆ O ₃	126	3.17
3	8.09	1,2,3-Benzenetriol	C ₆ H ₆ O ₃	126	89.55
4	9.25	α -D-Glucopyranoside, O- α -D-glucopyranosyl-(1.fwdarw.3)- β -D-fructofuranosyl	C ₁₈ H ₃₂ O ₁₆	504	3.09
5	9.81	β -D-Glucopyranose, 1,6-anhydro-	C ₆ H ₁₀ O ₅	162	2.25

Table 3: Activity of phytochemicals identified in the ethyl acetate extract of Hibiscus Tea Powder

No	Name of the compound	Peak Area %	Activity
1	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	1.94	Mutagen antimicrobial, anti-inflammatory, and antioxidant capacity.7,8
2	5-Hydroxymethylfurfural	3.17	Antioxidant and specific anti-cancer agents, cardioprotective activity, anti-anemia activity, Treatment of sickle cell anemia, hypoxia, anti-allergen, anti-hypertensive.9,10,11.
3	1,2,3-Benzenetriol	89.55	Antimicrobial, Anti-inflammatory, Antioxidant, Analgesic, Insecticide, Anticancer, Cytotoxic 12
4	α -D-Glucopyranoside, O- α -D-glucopyranosyl-(1.fwdarw.3)- β -D-fructofuranosyl	3.09	Cardioprotective, neuroprotective, antidiabetic, antiosteoporotic Activity Antiinflammatory, Antistress. 13
5	β -D-Glucopyranose, 1,6-anhydro-	2.25	Anti-human immunodeficiency virus and blood anticoagulant activities.14

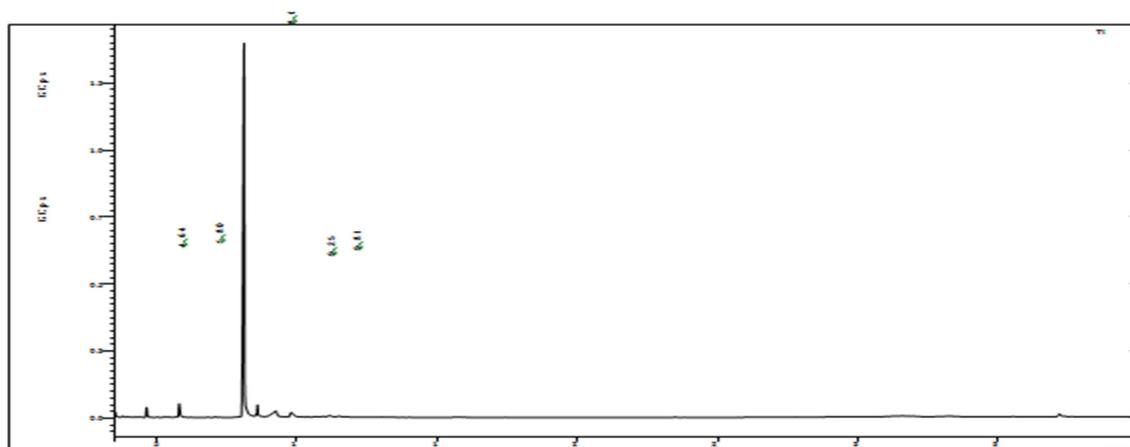


Figure 1: GC- MS/MS Chromatogram of Hibiscus tea powder

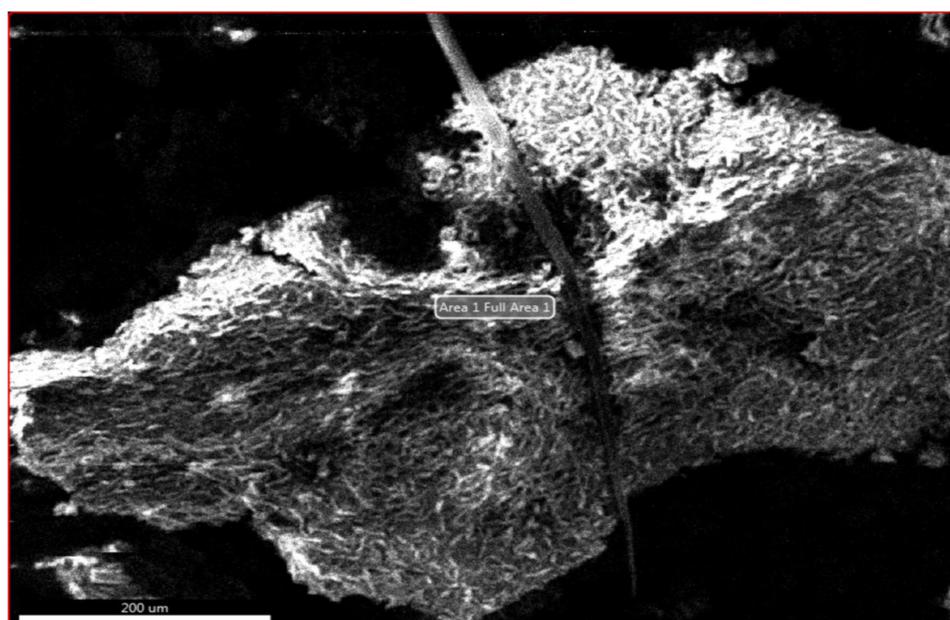


Figure 2: Scanning Electron Microscopy Structure of Hibiscus Tea Powder

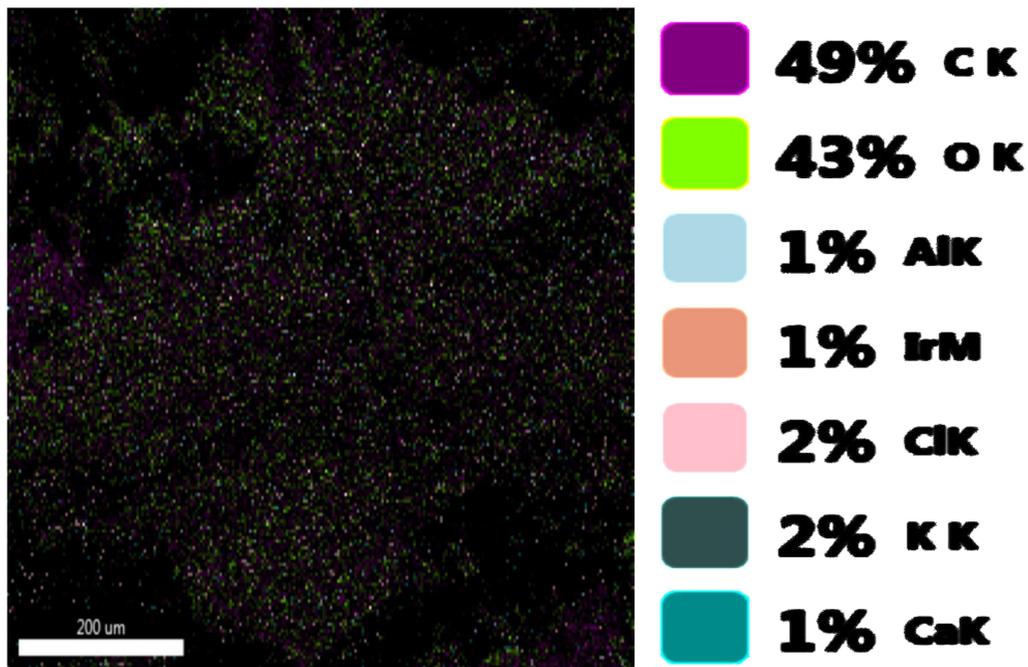


Figure 3: Element Over lay of the Hibiscus Tea Powder.

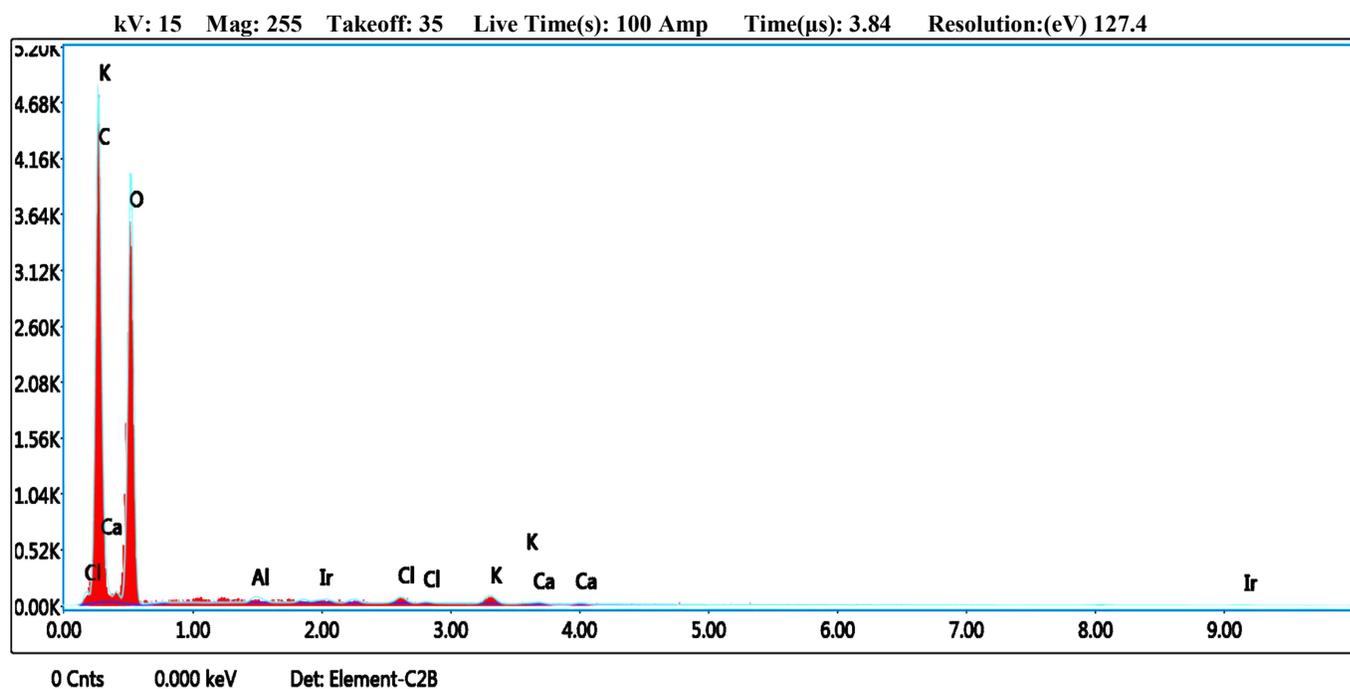


Figure 4: Energy Dispersive X-Ray Spectroscopy of Hibiscus Tea Powder

Table 4: Smart Quant Results of Hibiscus Tea powder

Element	Weight %	Atomic %	Error %
C K	45.05	53.06	5.95
O K	51.9	45.89	9.01
AlK	0.28	0.15	23.09
IrM	0.45	0.03	25.07
ClK	0.68	0.27	19.51
K K	1.28	0.46	13.59
CaK	0.37	0.13	35.12

CK- Carbon , OK- Oxygen , Al- Aluminum, K-Potassium, Cl- Chlorine, Ca-Calcium, Ir- Iridium.

4. DISCUSSION

In the present study *Hibiscus* tea powder contains good amounts of Nutritional compounds like protein 5.48gm, Carbohydrate 67.47gm, Crude Fiber 7.24gm, Iron.1.3mg, Vitamin C- 19.05mg (Table 1) and Five Phytochemical compounds were identified from the ethyl acetate extract of *Hibiscus Tea Powder* using GC-MS analysis. The presence of various bioactive compounds justifies the use of the Hibiscus Tea Powder. Among the identified phytochemicals, 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- possess Mutagen antimicrobial, anti-inflammatory, and antioxidant capacity properties. 5-Hydroxymethylfurfural possess Antioxidant and specific anti-cancer agents, cardio protective activity, anti-anemia activity, Treatment of sickle cell anemia, hypoxia, anti- allergen, anti-hypertensive properties. 1,2,3-Benzenetriol responsible for the Antimicrobial, Anti-inflammatory, Antioxidant, Analgesic, Insecticide, Anticancer, Cytotoxic properties. α -D-Glucopyranoside, O- α -D-

glucopyranosyl-(1.fwdarw.3)- β -D-fructofuranosyl possess Cardioprotective, neuroprotective, antidiabetic, antiosteoporotic Activity Antiinflammatory, Antistress. β -D-Glucopyranose, 1,6-anhydro having the Anti-human immunodeficiency virus and blood anticoagulant activities. FESEM and EDX results shows that some elements like Potassium, chlorine and Calcium were present in the sample.

CONCLUSION

Now a days herbal product have received high attention due to their good amounts of Nutritional and phytochemical compounds. Thus each compound identified in Hibiscus Tea powder has its own biological importance and further study of phytochemicals present in this Hibiscus tea powder can prove its medicinal importance in future and can be an effective and efficient drug source in cheaper rate as it has better availability.

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Abbreviations

CK- Carbon , OK- Oxygen , AI- Aluminum, K-Potassium, Cl- Chlorine, Ca-Calcium, Ir- Iridium.

5. REFERENCE

- [1] V. M. Jadhav, R. M. Thorat ,V.J. Kadam & N. S. Sathe., *Hibiscus rosa sinensis* Linn – “Rudrapuspa”: A Review, ISSN: 0974-6943 ,*Journal of Pharmacy Research* 2009, 2(7),1168-1173.
- [2] M.P. Prasad, *In vitro* Phytochemical Analysis and Antioxidant Studies of Hibiscus Species., International Journal Of Pure & Applied Bioscience., ISSN: 2320 – 7051., 2 (3): 83-88 (2014).
- [3] Asmaa Missoum., An update review on *Hibiscus rosa sinensis* phytochemistry and medicinal uses, *Journal of Ayurvedic and Herbal Medicine* 2018; ISSN: 2454-5023 4(3): 135-146.
- [4] Anterpreet K Chahal, Gourav Chandan, Rakesh Kumar, Anil Kumar Chhillar, Adesh K. Saini, Reena V. Saini., Bioactive constituents of *Embllica officinalis* overcome oxidative stress in mammalian cells by inhibiting hyperoxidation of peroxiredoxins., *Journal of Food Biochemistry.*, Accepted: 18 November 2019 .
- [5] Dina Alkandari, Humaira Sarfraz1, Jiwan S. Sidhu., Development of a functional food (pan bread) using amla fruit powder, *Journal of Food Scientists & Technologists (India)*, Accepted: 8 March 2019.
- [6] Udo IJ, Ben MG, Etuk CU, Tiomthy AI. Phytochemical, proximate and antibacterial properties of *Hibiscus rosa-sinensis* L. Leaf. *Journal of Medicinal Plants Studies*. 2016; 4 (5): 193–195.
- [7] Hiramoto K, Nasuhara A, Michikoshi K, Kato T, Kikugawa K. DNA strand-breaking activity and mutagenicity of 2,3-dihydro-3,5- dihydroxy-6-methyl-4H-pyran-4-one (DDMP), a Maillard reaction product of glucose and glycine. *Mutat Res Genet Toxicol Environ Mutagen* 1997; 395: 47-56.

- [8] Yu X, Zhao M, Liu F, Zeng S, Hu J. Identification of 2,3-dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one as a strong antioxidant in glucose-histidine Maillard reaction products. *Food Res Int* 2013; 51: 397-403.
- [9] Ali Hussein Al-Marzoqi, Mohammed Yahya Hadi and Imad HadiHameed., Determination of metabolites products by *Cassia angustifolia* and evaluate antimicrobial activity, *Journal of Pharmacognosy and Phytother.*, Vol.8(2). pp. 25-48, February, 2016.
- [10] G Wölkart, A Schrammel, C N Koyani, S Scherübel, K Zorn-Pauly, E Malle, B Pelzmann, M Andrä, A Ortner and B Mayer, Cardioprotective effects of 5-hydroxymethylfurfural mediated by inhibition of L-type Ca²⁺ currents., *British Journal of Pharmacology*, (2017), 174, 3640–3653.
- [11] An-Shen Lin, Keduo Qian, Yoshihide Usami, Li Lin, HidejiItoKawa, Charleson Hsu, Susan L. Morris-Natschke, Kuo-Hsiung Lee., 5-Hydroxymethyl-2-furfural, a clinical trials agent for sickle cell anemia, and its mono/di-glucosides from classically processed steamed *Rehmanniae Radix.*, *J Nat Med* (2008) 62: 164–167.
- [12] G. Gnana Priyanka Beulah et.al. GC-MS Determination of Bioactive Compounds of *Dendrophthoe Falcata (L.F) Ettingsh: An Epiphytic Plant* International Journal of Health Sciences & Research (www.ijhsr.org) 264 Vol. 8; Issue: 11; November 2018
- [13] Neepallmtair Al-Gara, awi et al. 2019. Analysis of bioactive phytochemical compound of (*Cyperus alternifolius* L.) By using gas chromatography –mass spectrometry *IOP Conf. Ser.: Mater. Sci. Eng.* **571** 012047.
- [14] Takahashi K, Satoh H, Satoh T, Kakuchi T, Miura M, et al. (2009) Formation kinetics of levoglucosan from glucose in high temperature water. *Chemical, Engineering Journal.* 153(1-3): 170-174.