Journal of Ayurveda & Holistic Medicine

www.jahm.co.in

eISSN-2321-1563

ORIGINAL RESEARCH ARTICLE (EXPERIMENTAL STUDY) OPEN ACCESS

AN ANALYTICAL STUDY ON HONEY PROCURED FROM VARIOUS *DESHA*

AMRUTHESHWARI CH[1*] PRAVEEN B S[2] SUBRAHMANYA PADYANA[3]

ABSTRACT

Background: Honey is the excretions of insects sucking on the living parts of plants. It is used as *Pathya*, *Anupana* and medicine in treating various diseases. Moreover, this is also utilized in preparing various Ayurveda formulations. Ayurveda has enlisted various varieties of Honey based on origin and collecting honey bees. The properties of them are also depicted which enables the physician to select each variety of Honey in different clinical conditions. In an era of adulteration, various methods are available to detect good quality honey. However, place from where the Honey is collected and time of collection might impact on physico-chemical properties of collected Honey. **Aims and Objectives**: This study was planned to ascertain the changes in physico-chemical properties collected from various *Desha* viz. *Jangala, Anupa* and *Sadharana Desha*. **Materials and methods:** Honey was collected from Bidar (*Jangala Desha*), Shivamogga (*Sadharana Desha*) and Dakshina Kannada (*Anupa Desha*) of Karnataka state for physico-chemical analysis. **Result:** The study revealed that total sugar, moisture content, electrical conductivity, total ash and sediment content were highest in the honey collected from *Anupa desha*. Whereas, Protein, pH, colour intensity, optical density, viscosity, total bacterial count and total fungal count were found highest in *Jangala desha* honey. **Conclusion:** The study revealed that physico-chemical parameters of honey changes according to the place it is collected. Hence it can be concluded that, the diseases of *Anupa Desha* can be successfully treated with honey collected from *Jangala Desha* and vice versa due to contradictory physicochemical properties.

Key words: Honey, *Anupa, Jangala, Sadharana Desha*, physico-chemical parameters, floral origin

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INTRODUCTION:

Honey is defined as the excretions of insects sucking on the living parts of plants. Honeybees are the most well-known plant-sucking insects and can collect and transform honey, and deposit, dehydrate, store and leave honey in the honeycomb to ripen and mature. Honeybees collect pollen and nectar from a variety of flowering plants and convert it into the wax and honey. It is a golden amber coloured liquid. It contains high levels of monosaccharides, fructose and glucose. In general, nutritional compositions of honey are fructose (21.82 to 39.46%), glucose (26.13 to 46.94%), water (14.73 to18.32%), lactose (3.17 to 7.13%), carbohydrate (4.2%), sucrose (1.34 to 3.59%) and ash (0.23 to 2.33%). It also contains traces of minerals and vitamins and its pH value is 3.4 to 6.1.[1]

Ayurveda has emphasized on use of honey in healthy as a part of *Ruthucharya* and *Dinacharya.* It is considered as best drug for *Shleshma-Pitta Prashamana*.[2] Due to *Yogavahi* property, honey is believed to cure many diseases. Honey is used as a major ingredient in preparing *Niruha*, *Vamana* and *Virechana* formulations*. Pauttika, Bhramara, Kshaudra, Makshika, Chatra, Aarghya, Audhalaka* and *Dala* are various varieties of Honey explained in Ayurveda.[3] Zoology classifies honey bees as four types. They are *Apies dorsata*, *Apies indica*, *Apies florea*, Melipona or Trigona species. *Apies dorsatafabr* is commonly known as Rock bee.[4] Honey is one of the oldest remedy in skin care management. It is used for eye cosmetics, vaginal irrigation due to anti-bacterial activity. So it is used in skin moisturizer, lip softener, face mask and hair dye.[5] Honey feeding suppresses cisplatin induced acute kidney injury.[6] The antimicrobial activity in most honeys is due to the enzymatic production of hydrogen peroxide, high osmolarity and low pH. Its high viscosity helps to provide a protective barrier to prevent infection, hence helps in wound healing process.[7] Honey serves as a source of natural antioxidants, which play an important role in food preservation and human health by combating damage caused by oxidizing agents, namely reducing the risk of heart disease, cancer, immune-system decline, cataracts, different inflammatory processes. It has an osmotic effect on microorganisms due to the increased sugar content and low amount of water.[8] Cyclitols are important antioxidant, anti-cancer and anti-inflammatory agents present in honey. Moreover, cyclitols are responsible for the cell's good functioning, cell wall formation, phosphate storage, and osmoregulation.[9] Honey interacts with the cellular interaction and promotes

angiogenesis, granulation, and epithelialization; enhances phagocytosis; expresses tissue repair markers; stimulates lymphocytes; and triggers epithelial-mesenchymal transition in keratinocytes.[10] There are many tests to identify the adulterated honey. Purity of honey can be tested by physico-chemical analysis of honey.

Properties and composition of honey depend on its geographical floral origin, season, environmental factors and treatment of beekeepers. Some studies revealed that quality of honey keep on changing depending on the place. It is because of the composition of soil, variety of plants, moisture in the environment, handling by the beekeepers and exposure to temperature or light. The botanical and geographical origins of honey effect its concentration of proteins. The floral origin of honey affects the concentration and type of polyphenolic compounds present in honey. Water content also depends on the floral origin of honey. Water content affects characteristics such as crystallization, specific gravity, viscosity, colour, flavour and taste. Electrical conductivity depends on the concentrations of mineral salts, organic acids, and proteins, which all depend on the honey's floral origin.[11]

Desha is a unique concept explained in Ayurveda. It is believed that characteristic of a *Dravya* depends on the place where it is grown.[12] Person hail from *Anupa Desha* are more prone to diseases compared to *Jangala Desha.*[13] The physicochemical properties of Honey also may vary based on the place of collection due to varieties of floral origin and other factors. Hence it is necessitated to ascertain the physico-chemical changes of Honey procured from different *Desha.* So, the study is undertaken to analyse honey procured from *Anupa, Jangala* and *Sadharana Desha.*

OBJECTIVES:

Physico chemical analysis of Honey procured from various *Desha* viz. *Anupa, Jangala and Sadharana*

MATERIALS AND METHODS:

Source of Honey:

Honey samples were collected from different places of Karnataka viz. Bidar(*Jangala Desha)*, Shivamogga (*Sadharana Desha)* and Mangalore (*Anupa Desha)*.

Figure 1: Honey collected from different sources

Methodology:

The Physico-chemical analysis is done at Sneha Testing Laboratory, Bengaluru.

The following tests were carried out.

Sediment content:

10 grams of honey was dissolved in 20ml of warm distilled water (40°C). The solution was centrifuged for 10 minutes at 2500g. The solution was poured into a small tube and centrifuged again for 10 min. The entire sediment was put on a slide and spread out over an area about 20×20 mm, after drying by slight heating at 40°C. The sediment was mounted with glycericgelatine, liquefied by heating in water bath at 40°C (Melissopalynology method).

pH and Electrical conductivity:

A pH meter (Hanna instrument) was used to measure the pH of 10% (w/v) solution of honey prepared in distilled water. To calculate electrical conductivity 20% (w/v) honey solution prepared in distilled water; it was measured at 20°C using a conductivity meter (Bogdanov method).

Moisture content:

5g of honey was kept in oven, its initial and final weight was compared to determine the moisture content.

Colour analysis:

Homogeneous honey samples devoid of air bubbles were transferred into a curette with 10 mm light path until the curette was approximately half full. The curette was inserted into a colour photometer. Colour grades were expressed in millimeter Pfund grades when compared to an analytical-grade glycerol standard.

Colour intensity:

Honey samples were diluted to 50% (w/v) with warm (45-50°C) distilled water, and the resulting solution was filtered using a 0.45 µm filter to remove large particles. The absorbance was measured at 450-720 nm using a spectrophotometer, and the difference

in absorbance was expressed as mAU (Method of Berretta et al. (2005)).

Optic density:

One gram of honey was diluted with 9ml of distilled water and centrifuged for 10 min at 3000g. The absorbance of the filtrate supernatant was measured at 530 nm against distilled water as a blank using a spectrophotometer.

Ash content:

It is determined according to method of AOAC, 1999. 5g of honey was placed in combustion pots, which required preheating to darkness with a gas flame to prevent honey foaming. Then, the samples were incinerated at high temperature (550°C) in a burning muffle for 5 hr. After cooling at room temperature, the obtained ash was weighed.

Total protein content:

It can be calculated by Lowry's method. Sample was diluted to 10% and small amount was taken in a test tube. Sodium potassium tartarate-sodium hydroxide solution was added and incubated at room temperature for 10min. Copper sulphate was added and incubated at room temperature for 10 minutes. Freshly prepared Folin reagent was added, then the reaction mixture was mixed and incubated at 50°C for 10 min. Optical density was determined using calorimetry at 650nm. Calculation was done to determine the protein content.

Sugar analysis:

It was done by phenol sulphuric method. 1ml of 10% honey sample was taken, to that 0.5 ml 5% phenol was added. Then 5ml of 96% sulphuric acid was added. After 10 min the tubes were shaked well and placed in a water bath at 25-30°C for 20 min. It was determined using calorimetry at 490 nm. Calculation was done to determine the total sugar.

Microbiological quality:

Total fungal count, total coliform count, total bacterial count, were investigated. Thu, 10g of each sample was homogenized in 90 ml of sterile distilled water and serial decimal dilutions (10^{-1} and 10^{-2}) were made with the same solvent. For total Coliform, 1 ml of each decimal dilution (10^{-1} and 10^{-2}) was poured aseptically into sterile plates. Purple crystal, bile-lactose neutral red agar (VRBL), melted and cooled in a water bath at 45°C, was added to the inoculum at a rate of 15 ml per dish. The mixture was then homogenized by rotatory movements. After solidification of the first layer, a second 5 ml layer of VBRL was added. Control of the sterility of the medium was carried out in a Petri dish with approximately 15 ml of VBRL. The total coliform count was done directly after incubation at 30°C for 24–48 hours. Fecal coliforms are characterized by a small mass of fluorescent colonies with a diameter of 0.5

mm. For the total fungal count, poured plates were prepared using a specified selective medium and a specified quantity of test sample; it was kept for aerobic incubation of the plates at 25°C for 4 days. Then fungal count was calculated from the number of colonies obtained on plates chosen at dilution levels so as to give a significant result. For the bacterial count, poured plates were incubated aerobically at 30°C for 72 hours. The number of microorganisms per millilitre of sample is calculated from the number of colonies obtained on selected plates.

Viscosity and water solubility:

Viscosity was calculated using Viscometer. Water solubility was determined by mixing the sample with the water.

RESULTS:

Protein content of the Mangalore Shivamogga and Bidar honey were 8.7%, 9%, 16.7% respectively. Sugar content of the Mangalore, Shivamogga and Bidar honey were 75.25%, 73.25% and 69.87% respectively. Moisture content of the Mangalore honey was 1.65%, Shivamogga honey was 1.2% and Bidar honey was 0.82%. pH value of the Mangalore honey was 2.80, Shivamogga honey was 3.37 and Bidar honey was 3.42. Electrical conductivity of the Mangalore, Shivamogga and Bidar honey were 217mV, 202mV and 197mV respectively. Sediment content of the honey collected from Mangalore was 55mg/l, Shivamogga was more than 3mg/l and Bidar was 35mg/l. Among the three samples Bidar honey is dark brown and other two are light brown. Colour intensity of the Mangalore, Shivamogga and Bidar honey were 1242mAU, 1488mAU and 2150mAU respectively. Optical density of the Mangalore honey was 0.27%, Shivamogga honey was 0.26% and Bidar honey was 1.22%. Viscosity of the honey collected from Mangalore, Shivamogga and Bidar were 2154mm^2/s, 2270mm^2/s and 2980mm^2/s respectively. Among the three honey samples Bidar honey was partially soluble and other two are soluble in water. Total bacterial count of the Mangalore honey was 170Cfu/g, Shivamogga honey was 240Cfu/g and Bidar honey is 300Cfu/g. Total coliform count of the all the three samples were more than 10Cfu/g. Total fungal count of the Mangalore, Shivamogga and Bidar honey were 35Cfu/g, 30Cfu/g and 40Cfu/g respectively. Total ash content of the honey collected from Mangalore, Shivamogga and Bidar were 0.48%, 0.42% and 0.39% respectively.(Table No-1)(Table-2)(Table-3)

Table-1: Results of Physico-chemical analysis

Parameters	**Mangalore**	**Shivamogga**	**Bidar**
Protein (%)	8.7	9	16.7
Total sugar (%)	75.25	73.25	69.87
Moisture content (%)	1.65	1.2	0.82
pH	2.80	3.37	3.42
Electrical conductivity (mV)	217	202	197
Sediment content (mg/l)	55.0	<3.0	35
Colour	light brown	light brown	dark brown
Colour intensity (mAU)	1242	1488	2150
Optical density (%)	0.27	0.26	1.22
Viscosity (mm^2/s)	2154.0	2270.0	2980.0
Water solubility	Soluble	Soluble	partially soluble
Microbiological quality (Cfu/g)	total bacterial count:170 total coliform count:<10 total fungal count:35	total bacterial count:240 total coliform count:<10 total fungal count:30	total bacterial count:300 total coliform count:<10 total fungal count:40

Table-2: Percentage of Ash of different samples

Description	**Mangalore**	**Shivamogga**	**Bidar**
Total Ash	0.48%	0.42%	0.39%
Percentage of Acid insoluble Ash of the drugs	0.074%	0.066%	0.062%
Percentage of Water Soluble Ash of the drugs	0.12%	0.92%	0.88%

Table-3: Ash Analysis

Sl. No.	Tests	Mangalore	Shivamogga	Bidar
1.	**Test for Carbonates**	Negative	Negative	Negative
2.	**Test for Fluorides**	Negative	Negative	Negative
3.	**Test for Chlorides**	Negative	Negative	Negative
4.	**Test for Sulphate**	**Positive**	**Positive**	**Positive**
5.	**Test for Chromate**	Negative	Negative	Negative
6.	**Test for Phosphate**	Negative	Negative	Negative
7.	**Test for Potassium**	**++Positive**	**++Positive**	**++Positive**
8.	**Test for Sodium**	**Positive**	**Positive**	**Positive**
9.	**Test for Aluminum**	Negative	Negative	Negative
10.	**Test for Calcium**	**Positive**	**Positive**	**Positive**

DISCUSSION:

Honey is considered as one of the potent medicine which is used to treat many diseases. The physico- chemical study has revealed that the properties of each variety differ in various parameters. pH of honey depends on its botanical source, the pH of nectar, soil or plant association, and the concentration of different acids and mineral such as calcium, sodium, potassium and other ash constituents. Low pH inhibits the growth and multiplication of microorganisms; therefore, pH value of honey influences its texture, stability and shelf life. Out of the 3 samples honey collected from Bidar is having highest pH which belongs to *Jangala Desha*. Honey collected from Mangalore is having comparatively low pH which belongs to *Anupa Desha*. The sample collected from Mangalore is more potent to be used in managing *Vata* disorder because of its extreme acidity compared to other.

Electrical conductivity of honey is closely related to the concentration of mineral salts and organic acids in honey. It changes according to the nectar source also. In these 3 samples Mangalore honey is having highest electrical conductivity which might enable the honey to act fast. Moreover, *Ayurveda* has emphasized on *Yogavahi* property of honey.

Moisture in honey depends on the climatic condition, harvesting technique and its floral origin. Among the three samples the moisture content is high in honey collected from Mangalore. It may be because of more moisture in the *Anupa Desha*. The honey collected from Bidar had least moisture content. Hence it can be inferred that *Drava*

Guna is more in Honey of Mangalore and Least in Honey of Bidar. So, it can be inferred that, the honey collected from Bidar has potent action on *Kapha* and *Pitta* disorders and *Santarpana Vikara*. Whereas, honey collected from Mangalore might have potent action on disorders of *Vata*.

Colour intensity of honey depends on the floral origin, mineral content, contamination of heavy metals and exposure high temperature or light. Honey from Bidar is dark and highest colour intensity compared to other 3 samples. It may be due to the less moisture content in the sample. Optical density varies according to its colour of the sample. It is found highest in Bidar honey. Ash represents the mineral residue of the honey after incineration. This parameter can be utilized in the determination of floral origin. Total ash content is more in honey collected from Mangalore.

Protein content in a honey sample explains its origin and types of pollen. Honey of Bidar is having highest protein almost double the amount found in Mangalore honey. Sugar is more in honey collected from Mangalore and least in Bidar honey. This confirms that *Madhura Rasa* is more in Honey procured from Mangalore. Viscosity of honey depends on the amount of water and sugar content in it. As water content increases viscosity decreases, as sugar content increases viscosity also increases. Honey from Bidar is having highest viscosity. The viscosity of the sample depicts *Sandra* and *Picchila Guna*. Moreover, the water solubility is less in Bidar Sample. Microbiological quality depends on the moisture content, pH and temperature. Bidar honey is having relatively high microbiological count.

Considering all the variation in the physico-chemical parameters of various samples, the extreme variations are seen in certain parameters. This knowledge of variation may be implemented clinically. The person hails from *Anupa Desha* suffers generally with *Kapha* and *Santarpana* diseases which may be treated successfully by using Honey of *Jangala Desha*. Whereas, the person hails from *Jangala Desha* suffers generally with *Vata* dominant *Apatarpana Vikara* which may be well treated by using honey procured from Anupa Desha. Due to the dual action and *Yogavahi* property of honey, it can be used well by considering the pathology of disease and accordingly the honey can be used for the treatment both for *Shamana* and *Shodhana*. It is also interesting to note that extreme variations are observed in Honey samples procured from *Jangala* and *Anupa Desha.* Honey sample procured from *Sadharana Desha* has intermediate values in all the parameters.

CONCLUSION:

Physico-chemical study of different samples of honey procured from *Jangala, Anupa* and *Sadharana desha* differ in various parameters. Highest protein content, pH value, colour intensity, Optical density, viscosity, Total bacterial count and fungal count was found in the honey collected from Bidar*(Jangala desha)* when compared to other samples. Whereas, Sugar content ,Moisture content, electrical conductivity Sediment content, Ash content are more in honey collected from Mangalore *(Anupa desha)*.

Hence it can be concluded that physico-chemical parameters of honey changes due to different origin and pollen content. It is essential to consider the place of collection of honey prior using it therapeutically.

ACKNOWLEDGMENT:

Authors are thankful to Director, Advanced Research Wing, Rajiv Gandhi University of Health Sciences, Karnataka, Bengaluru for introducing, encouraging UG students into the field of Research and helping us with the grants. Authors also thankful to Principal Alva's Ayurveda Medical College, Moodabidri, Karnataka for the help throughout the study. Conveying gratitude towards Rama Bhat, Professor, Dept. of PG studies in Biotechnology, Alva's College, Moodbidire.

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CITE THIS ARTICLE AS

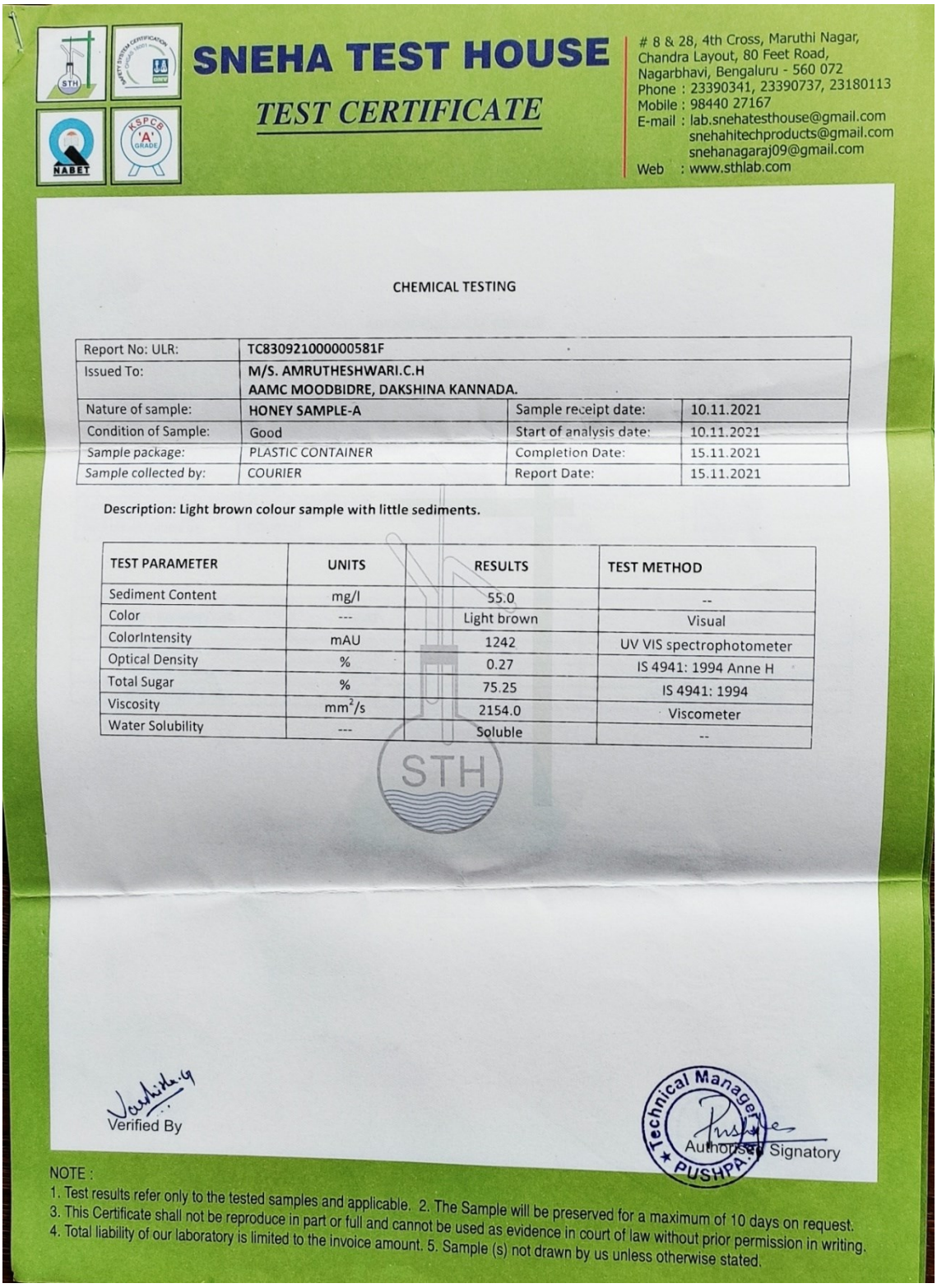
Amrutheshwari Ch, Praveen B S, Subrahmanya Padyana. An analytical study on honey procured from various *Desha*, *J of Ayurveda and Hol Med (JAHM)*. 2021;9(6):12-28

Source of support: Nil

Conflict of interest: None Declared

Supplementary matter

Analytical Reports



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CHEMICAL TESTING

Report No: ULR:	TC830921000000581F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
Nature of sample:	HONEY SAMPLE-A	Sample receipt date:	10.11.2021
Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

Description: Light brown colour sample with little sediments.

TEST PARAMETER	UNITS	RESULTS	TEST METHOD
Sediment Content	mg/l	55.0	--
Color	---	Light brown	Visual
ColorIntensity	mAU	1242	UV VIS spectrophotometer
Optical Density	%	0.27	IS 4941: 1994 Anne H
Total Sugar	%	75.25	IS 4941: 1994
Viscosity	mm^2/s	2154.0	Viscometer
Water Solubility	---	Soluble	--

Verified By

Technical Manager PUSHPA

Authorised Signatory

NOTE :
1. Test results refer only to the tested samples and applicable. 2. The Sample will be preserved for a maximum of 10 days on request.
3. This Certificate shall not be reproduce in part or full and cannot be used as evidence in court of law without prior permission in writing.
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MICROBIOLOGICAL TESTING

Report No: ULR:	TC830921000000581F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
Nature of sample:	HONEY SAMPLE-A	Sample receipt date:	10.11.2021
Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

TEST PARAMETER	UNIT	RESULT	TEST METHOD
Total Bacterial Count	Cfu/g	170	IS:5402:2012 RA 2018
Total Coliform Count	Cfu/g	<10	IS : 5401 (Part 1) : 2002 RA 2018
Total Fungal Count	Cfu/g	35	IS:5403:1999 RA 2018

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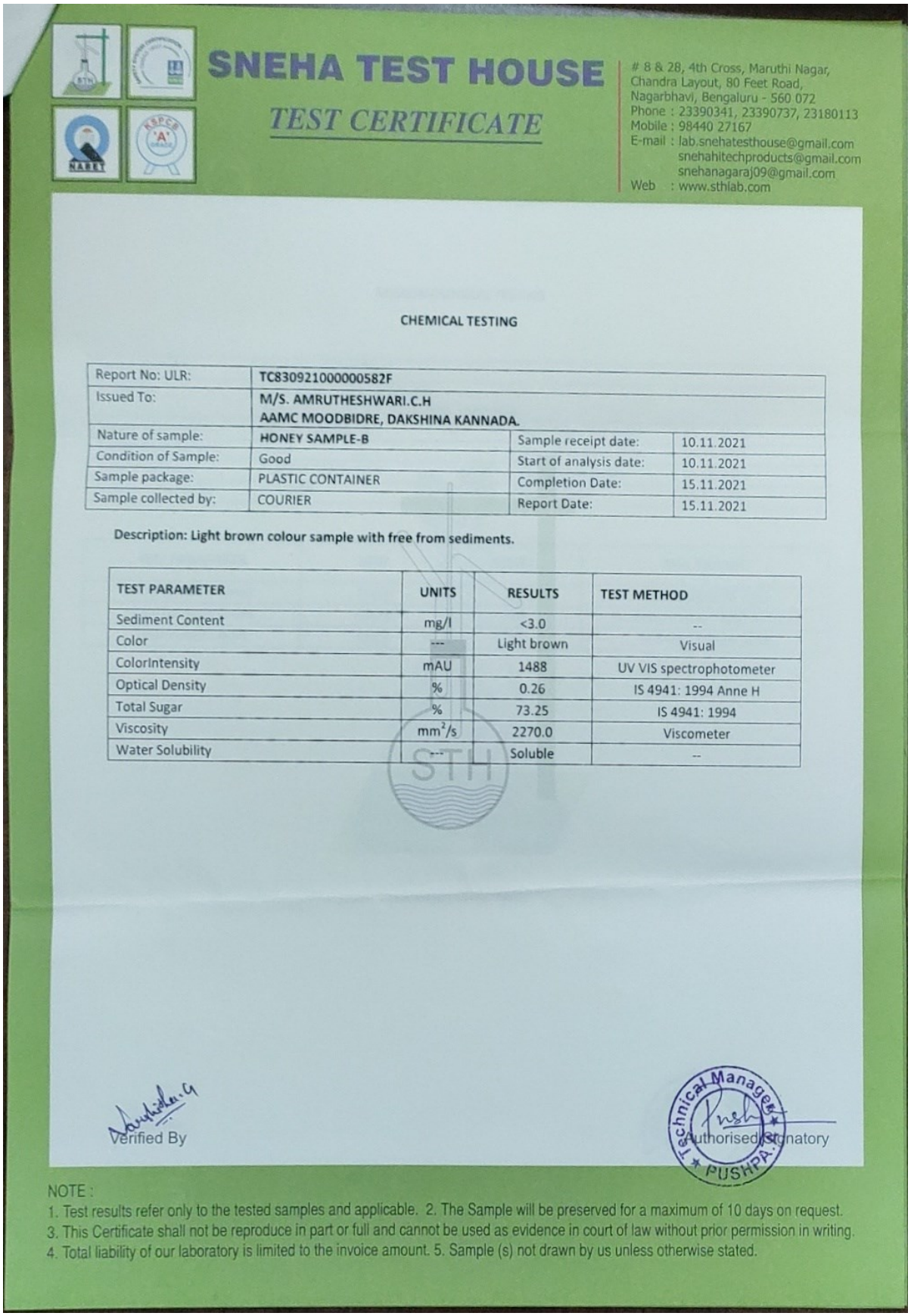

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CHEMICAL TESTING

Report No: ULR:	TC830921000000582F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
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Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

Description: Light brown colour sample with free from sediments.

TEST PARAMETER	UNITS	RESULTS	TEST METHOD
Sediment Content	mg/l	<3.0	--
Color	---	Light brown	Visual
ColorIntensity	mAU	1488	UV VIS spectrophotometer
Optical Density	%	0.26	IS 4941: 1994 Anne H
Total Sugar	%	73.25	IS 4941: 1994
Viscosity	mm^2/s	2270.0	Viscometer
Water Solubility	---	Soluble	--

Verified By

Technical Manager PUSHPA

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NABL Accredited Laboratory
Recognised by MoEF and CC under
EPA 1986, Govt. of India

TEST REPORT

8 & 28, 4th Cross, Maruthi Nagar,
Chandra Layout, 80 Feet Road,
Nagarbhavi, Bengaluru - 560 072
Phone : 23390341, 23390737, 23180113
Mobile : 98440 27167
E-mail : lab.snehatesthouse@gmail.com
snehahitechproducts@gmail.com
snehanagaraj09@gmail.com
Web : www.sthlab.com

MICROBIOLOGICAL TESTING

Report No: ULR:	TC830921000000582F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
Nature of sample:	HONEY SAMPLE-B	Sample receipt date:	10.11.2021
Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

TEST PARAMETER	UNIT	RESULT	TEST METHOD
Total Bacterial Count	Cfu/g	240	IS:5402:2012 RA 2018
Total Coliform Count	Cfu/g	<10	IS : 5401 (Part 1) : 2002 RA 2018
Total Fungal Count	Cfu/g	30	IS:5403:1999 RA 2018

Verified By

Technical Manager
SUBHASHINI B

Authorised Signatory

NOTE :
1. Test results refer only to the tested samples and applicable. 2. The Sample will be preserved for a maximum of 10 days on request.
3. This Certificate shall not be reproduce in part or full and cannot be used as evidence in court of law without prior permission in writing.
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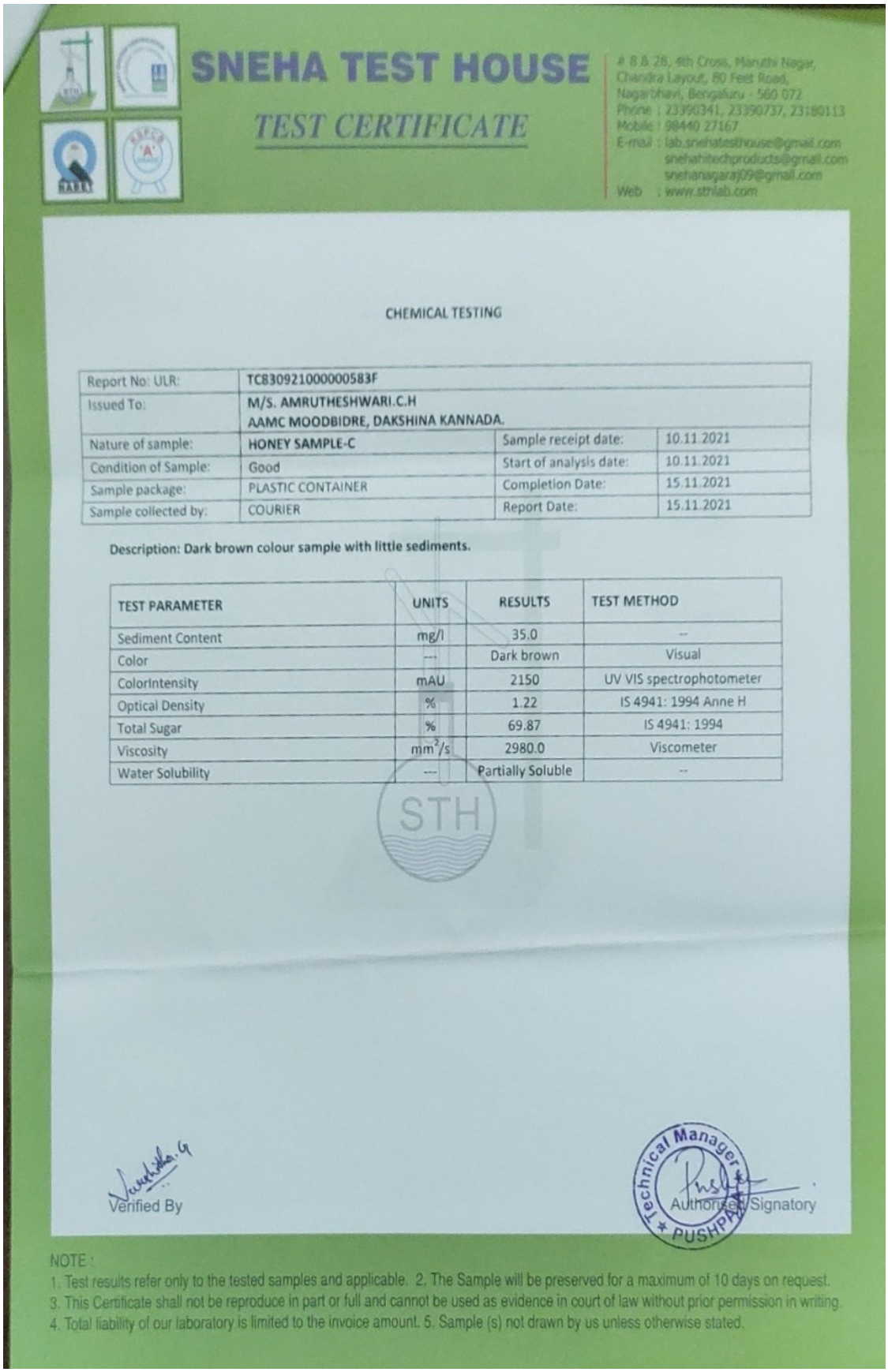

SNEHA TEST HOUSE

TEST CERTIFICATE

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Web : www.sthlab.com

CHEMICAL TESTING

Report No: ULR:	TC830921000000583F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
Nature of sample:	HONEY SAMPLE-C	Sample receipt date:	10.11.2021
Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

Description: Dark brown colour sample with little sediments.

TEST PARAMETER	UNITS	RESULTS	TEST METHOD
Sediment Content	mg/l	35.0	--
Color	---	Dark brown	Visual
ColorIntensity	mAU	2150	UV VIS spectrophotometer
Optical Density	%	1.22	IS 4941: 1994 Anne H
Total Sugar	%	69.87	IS 4941: 1994
Viscosity	mm^2/s	2980.0	Viscometer
Water Solubility	---	Partially Soluble	--

Verified By

Technical Manager * PUSHPA

Authorised Signatory

NOTE :
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MICROBIOLOGICAL TESTING

Report No: ULR:	TC830921000000583F		
Issued To:	M/S. AMRUTHESHWARI.C.H AAMC MOODBIDRE, DAKSHINA KANNADA.		
Nature of sample:	HONEY SAMPLE-C	Sample receipt date:	10.11.2021
Condition of Sample:	Good	Start of analysis date:	10.11.2021
Sample package:	PLASTIC CONTAINER	Completion Date:	15.11.2021
Sample collected by:	COURIER	Report Date:	15.11.2021

TEST PARAMETER	UNIT	RESULT	TEST METHOD
Total Bacterial Count	Cfu/g	300	IS:5402:2012 RA 2018
Total Coliform Count	Cfu/g	<10	IS : 5401 (Part 1) : 2002 RA 2018
Total Fungal Count	Cfu/g	40	IS:5403:1999 RA 2018

Verified By

Technical Manager
SUBHASHINI B V

Authorised Signatory

NOTE :
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