Assessment of Locally manufactured Tea products collected from selected areas of Meghalaya

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Abstract- **Tea is one of the most important functional foods. Tea is one of the famous drinks, a non-alcoholic beverage which nearly every part of the world consumes. Tea comes from the family belonging to the *Theaceae.* known as *Camellia sinensis.* This study aims to summarize the microbial contaminations, chemical content, and trace elements of the tea sample collected. Three tea samples from different area of Meghalaya were collected viz, Nongpoh, Umran, and Riangdo. The assessment was carried out at the State Food Testing Laboratory under the Commissionerate of Food Safety, Pasteur Hills, Shillong. Three samples were then tested for the presence of microbial contamination- *Escherichia coli*, *Salmonella*, *Staphylococcus aureus, and Yeasts and Moulds* all three samples did not show any bacterial growth which indicates that the three samples were safe. Chemical analysis like Moisture content, Alkalinity of Ash, Water soluble ash, Total Ash, and Acid Insoluble Ash (AIA) was also performed in all three tea samples and all these samples conform to the prescribed standards as per the Food Safety and Standards Act, 2006. It was also observed that the samples tested for the heavy metals are below the Limit of Quantity (LOQ) which displays that the three tea samples show no interference of trace elements.**

***Keywords*: Beverage, Tea (*Camellia sinensis)*, trace elements, Acid Insoluble Ash, Limit of Quantity.**

INTRODUCTION

Tea (*Camellia sinensis*), belonging to the Theaceae family, was considerably cultivated in Asian, African, Latin American, and Oceanian countries, (Cherotich, L. et.al, Katoh, Y *et.al*) which was believed to appear from northeast India, north Myanmar, and southwest China (Bora, D.K *et.al*). Tea trees are generally divided into three types shrubs, screens, and minor screens. Wild tea trees can reach indeed 10 m high, and cultivated tea trees are short because they're pared. The white flowers with a periphery of 4 cm do independently or dyads, and they contain five sepals and five – nine petals for each flower. The brownish-green fruits contain one – four globular or flattened seeds. The splint size is varied in different tea kinds, ranging in length from to 25 cm. Tea leaves may be serrated, bullate, or smooth, stiff or squooshy; the splint disguise ranges from erect to pendant, and the degree of pubescence varies extensively from factory to factory. also, the kids and youthful leaves contain a considerable number of trichomes, which drop significantly as the leaves develop. In the crop season, the shoot removed generally includes the cub and the two youthful leaves. Tea can grow from tropical climates to tropical climates, generally taking considerable moisture and downfall during the growing season (Berry, D *et.al*). nearly all of the commercially managed tea colonies are located in the mounds and on hill pitches, where the natural drainage is good. The ideal relative moisture for tea planting was maintained above 70 during the growing season. High moisture, fog, and dew are suitable for the growth of kids and youthful leaves. Maintaining an average periodic temperature of 18-21^0 degrees Celsius was of great significance to the growth and development of tea. The cultivated taxa of tea are composed of three main natural mongrels *C. sinensis* (L.) *O. Kuntze* (also named China type), *C. assamica* (also named Assam type), and *C. assamica* sub sp. *Lasiocalyx* (Planchon ex Watt.) (also named Cambod or Southern type)(Mondal, T.K. *et.al*). Tea shops have frequently been classified into green, albino, unheroic, and 'Zijuan', grounded on the content of chlorophyll and anthocyanin present. also, six types of tea (black tea (BT), green tea (GT), oolong tea (OT), white tea (WT), dark tea (DT), and unheroic tea (YT)) with different flavor and aroma biographies were created through different processing ways (Camargo, L.E.A *et.al*). Different types of tea could meet the individual requirements of guests and promote tea assiduity.

Meghalaya Tea is famous among the Meghalayan and the three tribes namely; Khasi, Jaintia and the Garos; as people in this region usually consume tea in their everyday life. Tea in Meghalaya is superior in quality rich and fragrant in

aroma and powerful in liquor. There are two types of tea Red/Black tea (Shasaw) and Milk tea (Shadud) in which they use to take with their famous traditional dish. Meghalaya is known for its richness in biodiversity and traditional festivals and also Meghalaya is also good for tea plantation owing to its climate conditions, altitude and landscape (MEG TEA). As compared to Assam and Darjeeling the two highly producing tea of good quality, Meghalaya also having a good comparison due to its high quality of tea production. Some of the tea plantation centres of Meghalaya consists of Upper Shillong & Sohryngkham (East Khasi Hills), Nongpoh, & Umsning (Ri Bhoi), Riangdo (West Khasi Hills), Tebronggre (West Garo Hills). Some of the locally manufactured tea in Meghalaya are MegTea, Anderson Tea, Meghalaya Tea, Durama Tea etc. Meghalaya tea civilization has spread to all corners and elevations of the state, and the teas it produces are fleetly earning a character in India and abroad as superior in quality, rich and ambrosial in aroma and important in liquor. Encouraged by the eventuality of Tea civilization in the State, the Meghalaya Agriculture Department launched MEG TEA in the time 2014. Their tea is organic pukka, and the Tea Colonies & Processing Units(manufactories) are located in Umsning and Upper Shillong. Meg Tea is one of the loftiest suppliers of black tea green tea and oolong tea from Meghalaya. The present position of tea colony in the State, has grown by hops and bounds, where; in terms of the statistics the total realty now, has increased to further than 2000 Hectare with over 1500 small farmers and some Private auditoriums now produce CTC and Orthodox variety Tea of good quality. In the 19th Century, East India S Company transferred a prospecting platoon to explore the eventuality of tea civilization in the region. It was only in 1977, that experimental auditoriums were set up for the tea transplantation in colorful corridor of Meghalaya- in Ri Bhoi District, in Tebronggre and in Riangdo. Meghalaya's terrain, altitude, and climatic condition makes it a perfect place to produce high- quality upland tea and so, is one of the voguish tea producing countries of India. Meghalaya tea grows in elevations of over 1,500 m (4,900 ft) above ocean position. utmost high- quality teas are cultivated at this or above this elevation. Excellent quality upland tea grows in the advanced altitude of Meghalaya of 3000 to 5,500 bases. These tea colonies areas are on abecedarian, pristine land. The growers of Meghalaya still rehearsed traditional styles of husbandry. They don't use fungicides in their land. numerous of the tea auditoriums in Meghalaya are also organic certified. The age of the tea factory is immature compared to Assam or Darjeeling, which is also one of the reasons for its superior quality. Tea auditoriums in Meghalaya are lower compared to Assam or West Bengal. The tea processing unit is set up in a truly short distance from the tea theater. This makes it possible to exercise high quality green tea. The major challenge with big tea estates is that from the time the tea leaves are plucked and reached the processing unit, the tea leaves have formerly oxidized, and this degrades the quality of the green tea. Tea is one of the most important functional foods. Tea holds alternate position in consumption among all potables. Tea has been obtained from leaves of factory Camellia sinensis for nearly 50 centuries agone. The factory of tea was began from Southeast Asia and is now being cultivated in further than 30 countries. About 3 billion kilograms of tea is produced and consumed yearly. Tea has been distributed into three main types on the base of processing during manufacturing. Of the tea produced worldwide, 78 is black tea, which is generally consumed in the Western countries, 20 is green tea, which is generally consumed in Asian countries, and 2 is oolong tea which is produced (by partial turmoil) substantially in southern China.

Tea is the most common libation after water. It's consumed in different forms, videlicet, oolong, green, black and Ilex tea depending on post-harvest treatment and chemical factors. Being rich in natural antioxidants, tea is reported to be used in the operation of colon, esophageal, and lung cancers, as well as urinary gravestone, dental caries, etc (Alexis, A. et. al). Tea, coming to water is the cheapest libation humans consume. Drinking the libation tea has been considered a health- promoting habit since ancient times. The ultramodern medicinal exploration is furnishing a scientific base for this belief. The substantiation supporting the health benefits of tea drinking grows stronger with each new study that's published in the scientific literature. Tea factory Camellia sinensis has been cultivated for thousands of times and its leaves have been used for medicinal purposes. Tea is used as a popular libation worldwide and its constituents are now chancing medicinal benefits. Encouraging data showing cancer- preventative goods of green tea from cell- culture, beast and mortal studies have surfaced. substantiation is accumulating that black tea may have analogous salutary goods. Tea consumption has also been shown to be useful for forestallment of numerous enervating mortal conditions that include conservation of cardiovascular and metabolic health. colorful studies suggest that polyphenolic composites present in green and black tea are associated with salutary goods in forestallment of cardiovascular conditions, particularly of atherosclerosis and coronary heart complaint. In addition, anti-aging, antidiabetic and numerous other health salutary goods associated with tea consumption are described. substantiation is accumulating that catechins and theaflavins, which are the main polyphenolic composites of green and black tea, independently, are responsible for utmost of the physiological goods of tea. This composition describes the attestations from clinical and epidemiological studies in the forestalment of habitual conditions like cancer and cardiovascular conditions and general health creation associated with tea consumption (Sun *et. al*., 2006). Natural substances called polyphenols are set up in both caffeinated and herbal teas. These substances are antioxidants, composites that may help reduce the threat of certain habitual conditions. During processing, some polyphenols in tea are destroyed. therefore, tea maquillages, decaffeinated teas and bottled tea drinks may not offer the same health benefits. also, exploration suggests that green teas offer a lesser antioxidant punch

compared to utmost other kinds. This study aims to summarize the microbial contaminations, chemical content, and trace elements of the tea sample collected from Nongpoh, Umran and Riangdo.

MATERIALS AND METHODS

Microbiogical Analysis

For this study, locally manufactured tea samples were collected from selected areas of Meghalaya to analyse the microbial growth presence in tea samples.

2. Procedure for Sampling:

The locally manufactured tea samples were used for analysis in this study. These samples were collected from three different sources of Meghalaya, India namely; Nongpoh, Umran and Riangdo.

The samples were analysed at the State Food Testing laboratory, Pasteur Hills, Shillong, Meghalaya. An inoculum for the test was prepared in a culture tube where 1 gram of the sample was taken and 9 ml of Milli Q water was added. The culture tube was vortexed for 1 minute and further enumeration of the different microbial count was performed using the following methods:

a) Enumeration of Total Viable Count: Standard Plate Count (SPC) test can be used to measure the bacteriological quality of tea streaking method was used for inoculating the sample into the designated media**.** After sample inoculation, the plates were sealed and incubated for 24 hours at 37°C. Examine the number of colonies growth is reported that the present of bacteria into the tea sample.

b) Enumeration of *Yeasts and Moulds* Count: For this particular analysis Chloramphenicol Yeast Glucose Agar (CYGA) was used as the media. For this test, 3 numbers of petri plates were sterilized and 30 ml of the media was poured in each plate, after the media has solidified, the cultured samples were streaked into the media. After this, the plates were kept in an inverted position, aseptically sealed and incubated at 22-25°C for 48 hours.

c) Enumeration of *Salmonella*: For analysis of *Salmonella*, Xylose Lysine Deoxycholate (XLD) was used. The samples were streaked on the selective media and were incubated at 35-37˚ C for 24 hours.

d) Enumeration of *Staphylococcus aureus*: For analysis of *Staphylococcus aureus*, Mannitol Salt Agar (MSA) was used. The samples were streaked on the selective media and were incubated at 35-37˚ C for 24 hours.

Chemical Analysis

1. Moisture content

The sample is grinded in a grinder to pass through No. 30 mesh sieve. Mixing well to get a homogenous sample. The sample is stored in a tightly stoppered bottle, withdraw portions for analytical determinations. It is accurately weighted of about 5 g of sample in a pre-weighed aluminium dish. The sample is then dried in an air oven at 100 ±2 °C for 5 to 6 hours and cooled in a desiccator and weighted. Dried again for 30 min, cooled in a desiccator and weighted. The process is repeated by the heating and cooling in a Desiccator until the difference in two successive weighing is less than 1 mg. The lowest weight is then recorded and the analysis is carried out in duplicate. (IS: 3077 –2009(A Specification for Roasted and Ground Coffee)

Calculation:

$$\text{Moisture content (\% by mass)} = \frac{W_1 - W_2}{W_1 - W} \times 100$$

Where,

M= Moisture content (% by mass).

W = Weight in g, of empty Aluminium dish.

W_1= Weight in g, of empty Aluminium dish + sample before drying.

W_2= Weight in g, of empty Aluminium dish + dried sample.

2. Total ash

The sample is grinded in a grinder to pass through No. 30 mesh sieve. Mixing well to get a homogenous sample. The sample is stored in a tightly stoppered bottle, to withdraw portions for analytical determinations. It is accurately weighted of about 5 g of sample in a tarred silica / platinum dish. The material is charred carefully on a burner. (Instead of Bunsen burner, hot plate can also be used for charring of samples). The dish is then transferred to a muffle furnace and ash at a temperature of 550 ± 10 °C until the ash is free of Carbon. The dish is heated again at 550 ± 10 °C for 30 min. The dish is cooled in a desiccator and weighed. This process of heating is repeated for 30 min, cooling in a desiccator and weighted until the difference between two successive weighing is less than 1 mg. The lowest weight is recorded. (Note: –Preserve the dish containing this ash for the

determination of acid insoluble ash).{I S: 3077 – 2022(A Specification for Roasted and Ground Coffee Appendix F), I S 13854: 1994 (ISO 1575: 1987) Tea – Determination of Total Ash}

Calculations:

$$\text{Total ash (\% on dry weight)} = \frac{(W2 - W) \times 100 \times 100}{(W1 - W) \times (100 - M)}$$

Where,
W1= Weight in g of empty Silica dish. + sample
W2= Weight in g of empty Silica dish + ash
W = Weight in g of empty Silica dish

3. Acid insoluble ash

About 15 – 25 mL of HCl solution is added to total ash of sample and boil for 10 min in the boiling water bath, the dish is covered with a watch glass to prevent spattering. The contents of the dish are filtered through the ash less filter paper. The dish and the filter paper are washed with hot water until the washings are free from hydrochloric acid (about 6 to 8 times). The Absence of hydrochloric acid is tested with silver nitrate solution. (Note: Lack of turbidity when a portion of silver nitrate solution is
added to the filtrate indicates absence of hydrochloric acid). The filter paper with is returned to the dish and it is evaporated on water bath and ignite it in the Muffle furnace at 550 ± 25°C for 1 h (or until the ash is carbon free). When carbon-free ash is obtained, the dish is transferred to desiccator, cool to 25 ± 2 degree and weigh immediately. The operation is repeated of igniting, cooling and weighing until the difference between successive weighing does not exceed 0.001 g.

CALCULATION:

$$\text{Acid insoluble ash (\% by mass)} = \frac{(W2-W0)}{(W1-W0)} \times 100$$

Where,
W0 =mass of empty dish in g
W1 = mass of dish and test portion in g
W2 = mass of dish and acid insoluble

4. Alkalinity of Ash

The filtrate is reserved during the determination of water soluble ash and 3-4 drops of methyl orange indicator (0.1% in water)is added. It is then titrated with 0.1 N hydrochloric acid to an orange end point and the titre value is noted. {I S 13856: 1993 (ISO 1578: 1975) Tea Determination of Alkalinity of Water soluble ash}.

Calculations:
Express the result as KOH(m/m) on dry basis:

$$\text{Alkalinity of soluble ash \%} = \frac{0.0056 \times \text{titre value} \times \text{Normality HCl} \times 100 \times 100}{\text{Weight of sample} \times 0.1 \times (100 - \text{moisture \%})}$$

5. Water soluble Ash

The total ash is transfered with the aid of about 25 mL distilled water into a beaker. It is covered with a watch glass and boiled for 5 min and filtered through an ash less filter paper (Whatman No. 42 or its equivalent). The filtrate is then collected in a 150 mL beaker, the filter paper is washed 4 -5 times with hot water until the filtrate no longer turns red litmus blue and washings is collected in the same beaker. (Note: Reserve the entire filtrate for the determination of alkalinity of soluble ash. The ash less paper is dried with residue in an oven in a silica dish and transfer to muffle furnace and ignite at 550 °C for 2 hours and cooled in a desiccator and weigh (W3).The process is repeated till the difference in two consecutive weighing is less than 1 mg. The lowest weight is recorded.{ IS: 3077: 2022 (A Specification for Roasted and Ground Coffee), IS 13855 : 1993 (ISO 1576:1988) Tea - Determination of Water soluble ash and Water insoluble Ash}.

Calculations:

$$\text{Water in-soluble ash on dry wt. basis (\%)} = \frac{(W_3-W) \times 100 \times 100}{(W_1-W) \times (100-M)}$$

Where,

W3= Weight in g of Silica dish + water insoluble ash.
W = weight in g of empty dish.
W1 = weight in g of Silica dish with material.
M = Percentage of Moisture
Water soluble ash percent by wt = A – B
Where,
A = Total ash percent by wt
B = Water insoluble ash percent by wt

Water soluble ash of total ash = $\frac{\text{Water soluble ash}}{\text{Total ash}} \times 100$
(Percent by wt)

High End Equipment

1. **Inductively Coupled Plasma Mass Spectrometry (ICPMS) (AOAC Official method 2015.01) Apparatus used:**
   a) Instrument and equipment: ICPMS, Peristaltic pump, chiller, exhaust fan, PC, microwave digester, fume hood, weighing machine, homogeniser, and vortex.
   b) Standards: Pb, Cd, Hg, As, Sn, Cu)
   c) Acids and Reagents: Nitric Acid, HCL, Hydrogen peroxide and tune solution.
   d) Milli Q water, centrifuge tubes (50ml and 15ml), pipettes (1ml, 200µl, 110µl, and 20µl), sample (turmeric), tissue and baking paper.

   SOP for standard preparation:
   a) Gold solution is prepared by using 2% Nitric acid for 50ppm concentration.
   b) Internal standards are reduced to 10ppm concentration.
   c) Individual stock concentrations are prepared in 10ml tubes.
   d) Intermediate standards (mixed standard) is prepared in 50ml tube. Final volume is made up to 25 ml using distilled water.
   e) Standards 1 to 6 are prepared along with reagent blank for preliminary run.
   f) After vortexing each standard keep them in a standard rack.
   g) 2% nitric solution is used for rinsing.

   Sample Preparation:
   a) Take the microwave vessels and label them as reagent blank, sample blank and spike.
   b) Weigh 0.2 gms of the homogenised sample for sample blank and spike.
   c) Spike with the known concentration in spike sample.
   d) Add the required volume of nitric acid, hydrogen peroxide, HCL and gold solution in all the vessels.
   e) For vessels used for balancing, add water with the same volume as others.
   f) Keep the sample for pre digestion in fume hood for 30 minutes
   g) Set the microwave digester program as
      - Ramp time: 40 minutes
      - Holding time: 30 minutes
      - Temperature: 210 degrees Celsius
      - Power: 1500 W
   h) After 30 minutes pre-digestion, keep the sample in the microwave digester reaction.
   i) Exhaust fan should always be kept switched on.
   j) Add 100µ of prepared internal standard into 50ml centrifuge tubes.
   k) Transfer the sample into the tubes and fill with mill Q- water up to the make-up volume and vortex.
   l) Transfer the clear solution into the 10 ml tubes and keep in the sample rack for analysis.

RESULTS AND DISCUSSION:

MICROBIOLOGICAL ANALYSIS:

Table 1. Microbiological status of locally manufactured tea samples collected from selected areas of Meghalaya

Sl no.	Parameters	Media used	Tea samples collected from selected areas of Meghalaya		
			Nongpoh	Umran	Riangdo
1.	*Standard Plate Count*	Plate Count Agar (PCA)	Absent	Absent	Absent
2.	*Salmonella*	Xylose Lysine Deoxycholate Agar (XLD)	Absent	Absent	Absent
3.	*Yeast and Mould*	Yeast Glucose chloramphenicol Agar (CYGA)	Absent	Absent	Absent
4.	*Staphylococcus aureus*	Mannitol Salt Agar (MSA)	Absent	Absent	Absent

Discussion

From the above table, it can be reported that there are no significant growths observed from all the samples of tea collected from selected areas of Meghalaya, which they are grown or cultured in their respective culture media(fig.1). According to the limits put forth by the Food Safety and Standards Act, 2006 for tea samples showed that there should be less than or no significant growth per g. Thus, the samples can be considered safe, in a hygienic condition, and without risk level for the public's health.

The results observed showed that the locally manufactured Tea samples from selected areas of Meghalaya indicate hygienic handling of the spices before and during their storage. Fungal counts are absent which showed that there is no fungal contamination. The absence of pathogens like Salmonella is quite encouraging as this could be due to the antimicrobial effects of beverages or the inhibitory action of some dominant flora over the others. Faster drying methods, processing, proper packaging and hygienic, dry storage conditions, decontamination treatments in the wholesale and retail shops all can lead to beverages of improved microbial quality.

CHEMICAL ANALYSIS

Table 2: Parameters and Chemical Analysis of locally manufactured Tea samples from selected areas of Meghalaya

Sl no.	Parameters	Tea samples collected from selected areas of Meghalaya			
		Nongpoh	Umran	Riangdo	
1.	**Moisture**	5.81%	6.32%	6.51%	Not more than 10%
2.	**Total Ash**	6.07%	5.89%	5.97%	Not less than 4%
3.	**Acid Insoluble Ash**	0.84%	0.61%	0.28%	Not more than 1%
4.	**Alkalinity of Ash**	0.38%	0.40%	0.41%	Not more than 3%

5.	**Water Soluble Ash**	51.89%	56.87%	56.62%	Not less than 45%

Discussion

The results obtained in the analysis of Tea samples collected from selected areas of Meghalaya is summarized in Table 2. The parameters determined are moisture content, total ash, acid insoluble ash, alkalinity of ash and water-soluble ash.

Moisture: The determination of moisture content of beverages is of importance for many scientific reasons. Water occurs in foods essentially in two forms, as bound water and as available free water. Bound water includes water molecules chemically or hydrogen bonded to ionic and polar groups whereas free water is that which is not physically linked to the food matrix and which is freezable and easily lost by evaporation or drying. Most of the foods are heterogeneous mixture of substances; they may contain varying proportions of the two types. The moisture content of tea samples analysed ranged between 5.8% - 6.5%.

Total ash and Acid insoluble ash: It is observed that results vary from sample to sample. However, levels of moisture, acid insoluble ash, were not consistent in all the samples. The quality of tea samples can also be assessed by considering the Total ash value and acid insoluble ash value. The ash of beverages is the inorganic residue remaining after the organic matter has been burnt away. The ash content can be regarded as a general measure of the quality or grade of the material under investigation and often is a useful criterion in identifying the authenticity of a food. When a high ash figure suggests the presence of an inorganic adulterant, it becomes necessary to also determine the Acid –insoluble ash. The results of total ash and acid Insoluble ash are summarized in Table 2. It is observed that all the samples have the minimum ash levels which indicate that these samples are of better quality or grade than the other sample analysed which means that if the total ash is higher it indicates the presence of carbonates, phosphates, silicates in the sample. The acid insoluble ash is a measure of sandy material in the beverages and the limit Prescribe by FSSAI manual is 1% on dry basis.

Alkalinity of Ash and Water Soluble Ash: The ash content in many tea ranges between 5 and 6%. In fresh tea the proportion of ash may be as high as 10%. As per BIS standards, A tea must contain 4 to 8% (by mass) total ash and minimum 40% of which must be (water soluble ash in spent tea, however, the ash drops) below 3% and the ash itself is high in calcium. In genuine tea about 50% of the ash is water soluble ash and is found in the range of 3 to 3.5% whereas in exhausted teas (spent) it drops to about 0.5%. The major element in tea minerals is potassium which is half the total mineral content. Thus, the soluble ash obtained from spent tea will have lower alkalinity value. The results of alkalinity of ash and water soluble ash are summarized in Table 2. It is observed that all the samples have the minimum ash levels which indicate that these samples are of better quality or grade, which means that if the alkalinity of ash is higher it indicates the presence of calcium and potassium in the sample. The water soluble ash is a measure of sandy material in the beverages and the limit Prescribe by FSSAI manual is more than 40% on dry basis.

HIGH END EQUIPMENTS:

1. Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Sl no.	Name of the Metal	Method Used	Tea samples collected from different areas of Meghalaya			Maximum Residue Limits (MRL)
			Nongpoh	**Umran**	**Riangdo**	
1.	**Copper (as Cu)**	**FSSAI MANUAL**	Below LOQ	Below LOQ	Below LOQ	**150**
2.	**Arsenic (as As)**		Below LOQ	0.1	0.1	**1**
3.	**Cadmium (as Cd)**		Below LOQ	Below LOQ	Below LOQ	**1.5**
4.	**Tin (as Sn)**		Below LOQ	Below LOQ	Below LOQ	**250**
5.	**Mercury (as Hg)**		Below LOQ	Below LOQ	Below LOQ	**1**

6.	**Lead (as Pb)**	Below LOQ	Below LOQ	Below LOQ	**10**

Table 3: Table representing the presence of heavy metals in the tea sample collected.

*LOQ- Limit of Quantification

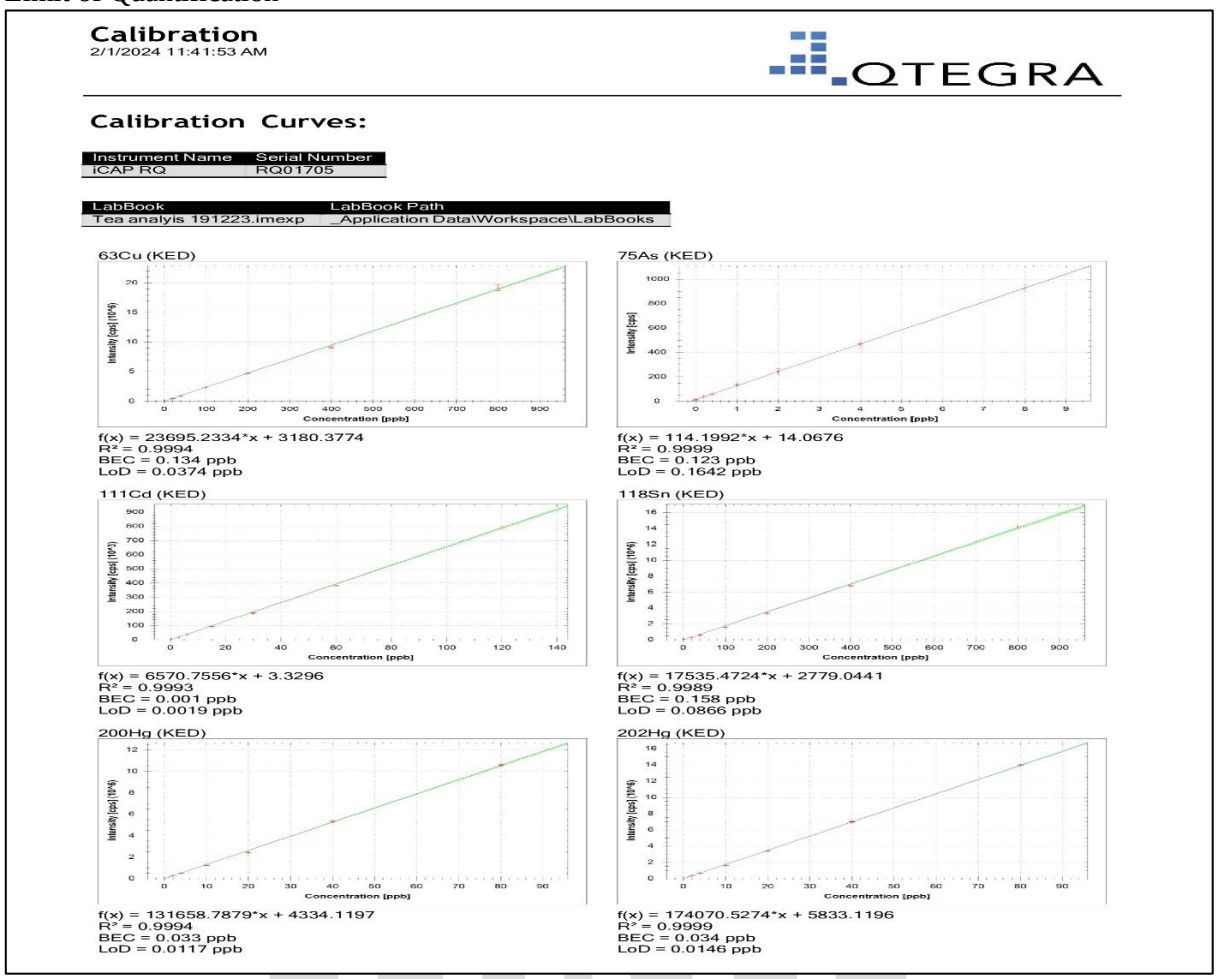


Figure: ICPMS Profile of trace elements in locally manufactured Tea samples.

Discussion

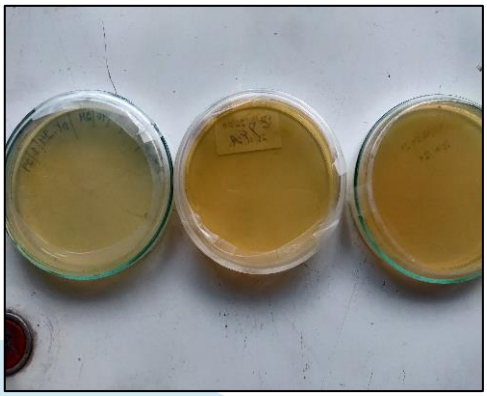
The three samples of tea samples were digested and analysed, due to fraudulent practices in the food industry it has become the first and foremost concern. Therefore, analytical strategies have been developed for authentication of the origins of agricultural products. ICPMS is a robust, accurate and highly sensitive technique for determining the traceability of heavy metals in food stuff. From the above table, the presence of heavy metals such as Copper, Arsenic, Cadmium, Tin, Mercury and lead was analysed using the Inductively Coupled Plasma Mass Spectrometry (ICPMS), the methods used is put forth by the FSSAI manual, and from the results we can conclude that the presence of heavy metals falls below the Maximum Residue Limit (MRL) which is considered safe.

Conclusion

Based on this research, we conclude that the locally manufactured tea samples collected from selected areas of Meghalaya shows absence of bacterial, chemical and heavy metal contaminants. All the tea samples collected and analysed were within the prescribed standards as per the Food Safety and Standards Act, 2006 Rules 2011 Sub-regulation 2.10.1 based on the tested parameters of microbiological, chemical and trace elements respectively. The findings depict that 'Meghalaya Tea' is one of the upcoming tea producers in the North Eastern Region of India in comparison with Assam and Darjeeling Tea. The study also shows that 'Meghalaya Tea' is of utmost high-quality tea cultivated due to its traditional styles of farming employed with no use of fungicides, organics composts and fertilizers. There is an urgent need to promote the locally manufactured tea from Meghalaya by increasing its import -export chain so as to uplift the livelihood of our people.

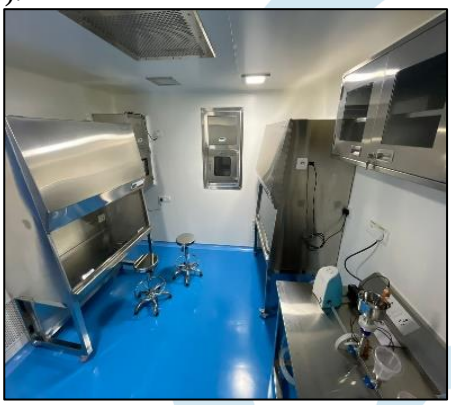
MICROBIOLOGICAL ANALYSIS:

(a)

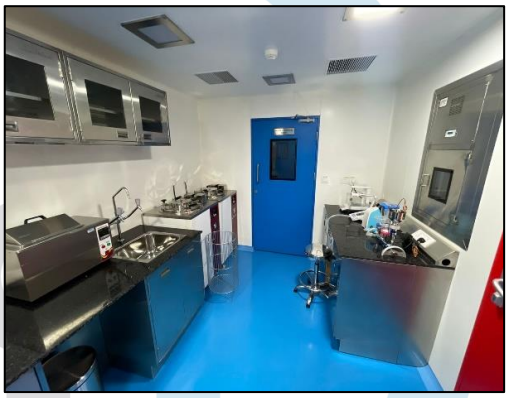


(b)

Figure1: Figure a & b shows absence of bacterial growth in all the three tea samples (i.e, Umran, Nongpoh and Riangdo).



(1)



(2)

Figure 2: Analysis Room (1), Media preparation room (2).

CHEMICAL ANALYSIS:

(1)

(2)

(3)

Figure 3: Hot Air Oven (1), Moisture cup (2), Muffle furnace (3).

HIGH END EQUIPMENTS:

(1)

(2)

Figure 4: Microwave Digester (1), Inductively coupled plasma- mass spectrometry(2).

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