

# Anti-microbial Activity and FT-IR Analysis of Ethanol and Chloroform Extract from *Musa paradisiaca*

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## Abstract

*The second most important fruit crop in India, which is full yearly available covering major states, belongs to the family of Musa species. Among which, Musa paradisiaca, mostly grown in tropical and subtropical areas all over the country, is having nutritional values. Fruit as well as other parts of plant have significant interaction with human health, since from civilization. This work tries to reveal important components (phytoconstituents) of above mentioned species, with the usage of extraction, separation, biochemical and analytical techniques. The result of this work gave some useful phytochemicals which act as nutrient supply and show some biological activity (antimicrobial activity).*

**Keywords:** *Musa paradisiaca, anti-microbial activity, distillation, qualitative analysis, phytochemical*

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## INTRODUCTION

*Musa* is a genus, over 50 of tropical monocot tree-like plants, important for food, fiber, and ornamentals. It includes bananas and plantains as the fourth most cultivated food crop in the world; comparatively, bananas are more nutritious than apples, rich in potassium, have five times more vitamin A and iron and have two times more carbohydrates and three times as much phosphorous (Figure 1). Banana is a very versatile plant where all of its parts provide its respective health benefits as used in traditional herbal medicine. Many parts of *Musa* species are used in traditional medicine as drugs, food supplements and cosmetics. The banana peel is used as an astringent in foot care, the unripe fruit is used to treat diarrhea and, the ripe fruit is used as tonic. Banana has mechanism of action in disease prevention in many aspects like hypoglycemic effect, gastro protective health benefits, antioxidative activity, anti-hypercholesterolemia, etc. [1–3].

Phytochemicals are naturally occurring in the medicinal plants, leaves, vegetables and roots that have defense mechanism and protect from various diseases. Phytochemicals are primary and secondary compounds (Figure 2). Chlorophyll, proteins and common sugars are included in primary constituents and secondary compounds have terpenoid, alkaloids and

phenolic compounds [4]. Terpenoids exhibit various important pharmacological activities i.e., anti-inflammatory, anticancer, anti-malarial, inhibition of cholesterol synthesis, anti-viral and anti-bacterial activities [5].



**Fig. 1:** *Musa paradisiaca*.

## OBJECTIVES

- To collect the *Musa* species from different sources and its part-identification for extraction.
- To extract phytochemicals from *Musa* species.
- To analyze phytochemicals through biochemistry.
- To determine and identify anti-microbial activity and functional groups using FT-IR respectively.

## MATERIALS AND METHODS

- *Musa paradisiaca* fruit.
- Solvents-ethanol and chloroform.
- Distillation unit.
- FT-IR analysis unit.
- Microorganisms (*Escherichia* spp, *Salmonella* spp, *Staphylococcus* spp).

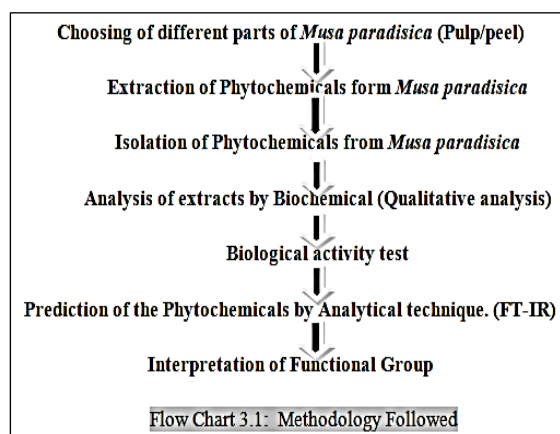


Fig. 2: *Musa paradisiaca* Peel Extracts.



Fig. 3: *Musa paradisiaca* Pulp Extracts.

## RESULT AND DISCUSSION

From the *Musa paradisiaca*, the extracts were collected using ethanol and chloroform (Figure 3). The extractions were qualitatively tested using different methods of qualitative analysis [6].

### Anti-Microbial Activities

Some of the extractions show the antimicrobial property on three different strains namely, *Salmonella* spp, *Escherichia* spp, *Staphylococcus* spp. which showed some good zone of inhibition (Figure 4).

### FT-IR Result Analysis

The FT-IR analysis shows that the extractions contained functional group (Figure 5–10). This functional group is mostly basic structure of organic components, acidic type compounds and esters [7, 8].

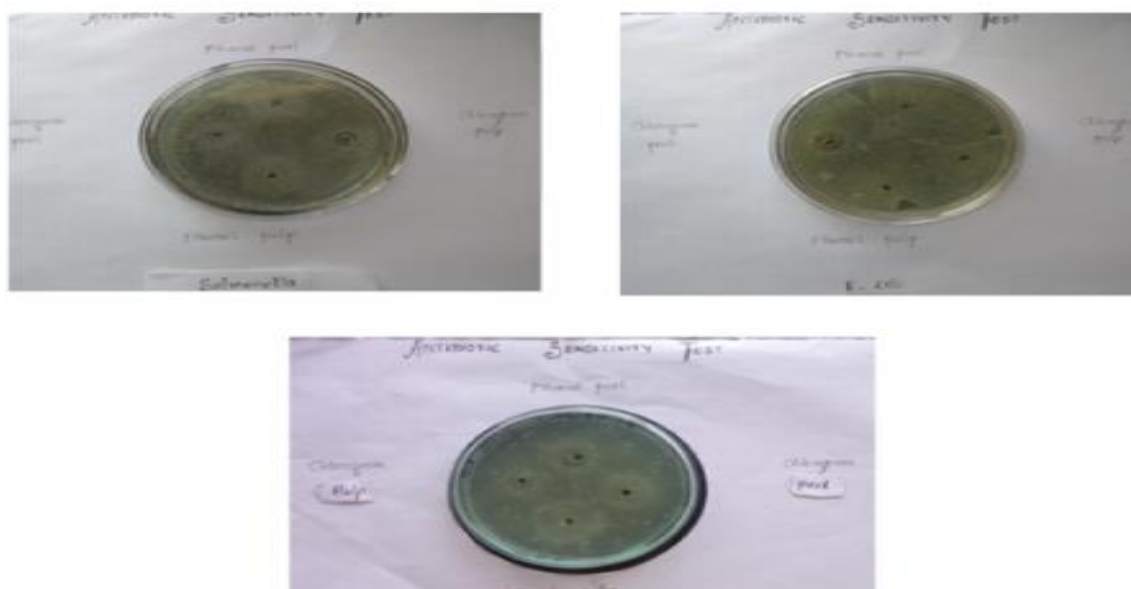


Fig. 4: Zone of Inhibition for Antimicrobial Activity.

**Table 1:** Showing the Method of Extraction and Parts of Fruit Used.

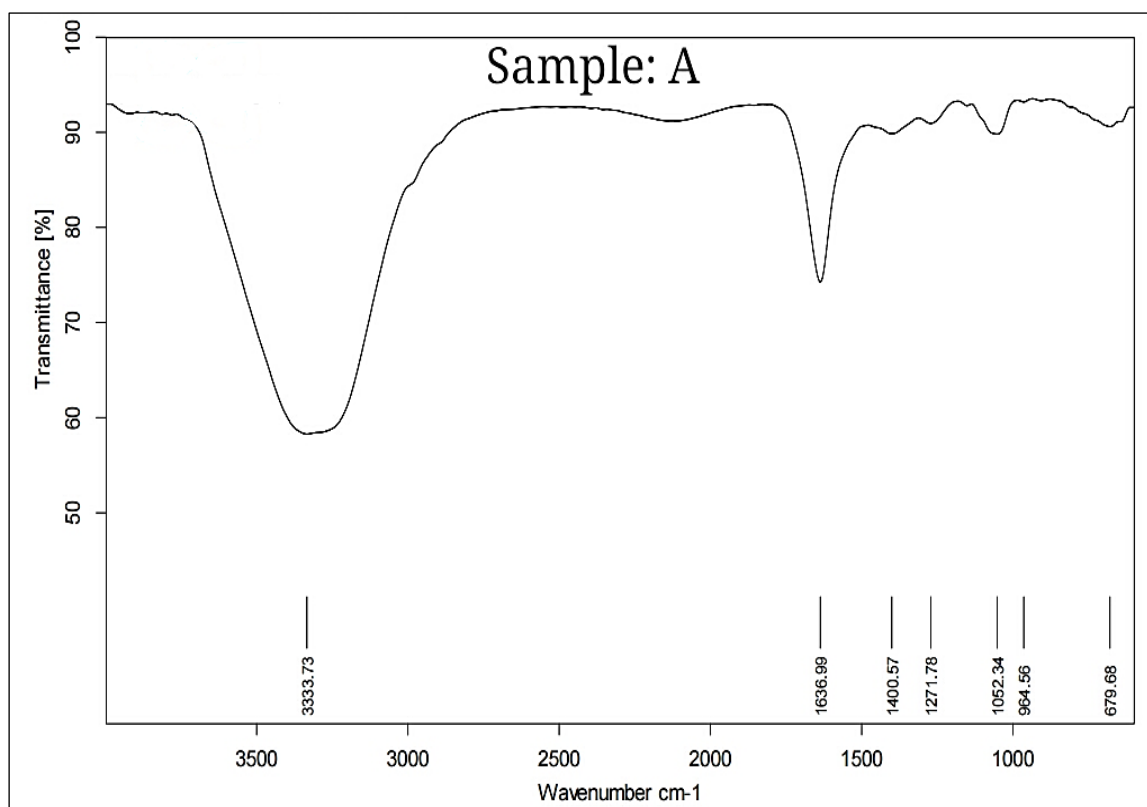
Plant	Part Used	Methods of Extraction	Solvents	Color and Composition	
<i>Musa paradisiaca</i>	Pulp	Simple distillation	Chloroform	Pulp	Dark brown and sticky with oil mass
				Peel	Light Creamy color
<i>Musa paradisiaca</i>	Peel	Simple distillation	Ethanol	Pulp	Creamy orange and sticky
				Peel	Dark brown

**Table 2:** Showing the Qualitative Analysis Result.

Qualitative Analysis	Chloroform		Ethanol	
	PULP	PEEL	PULP	PEEL
Alkaloids	+	+	+	+
Tanins	+	+	+	+
Saponins	+		+	-
Terpenoides	+	+	+	-
Cardiac Glycosides	+	-	+	-
Carbohydrates	+	+	+	+
Phytosterols	+	+		+
Flavonoids	+	+	+	+
Phenols	+	+	+	+
Reducing Sugars	+	+	+	+

**Table 3:** Zone of Inhibition Observed in Agar Gel Plate (cm).

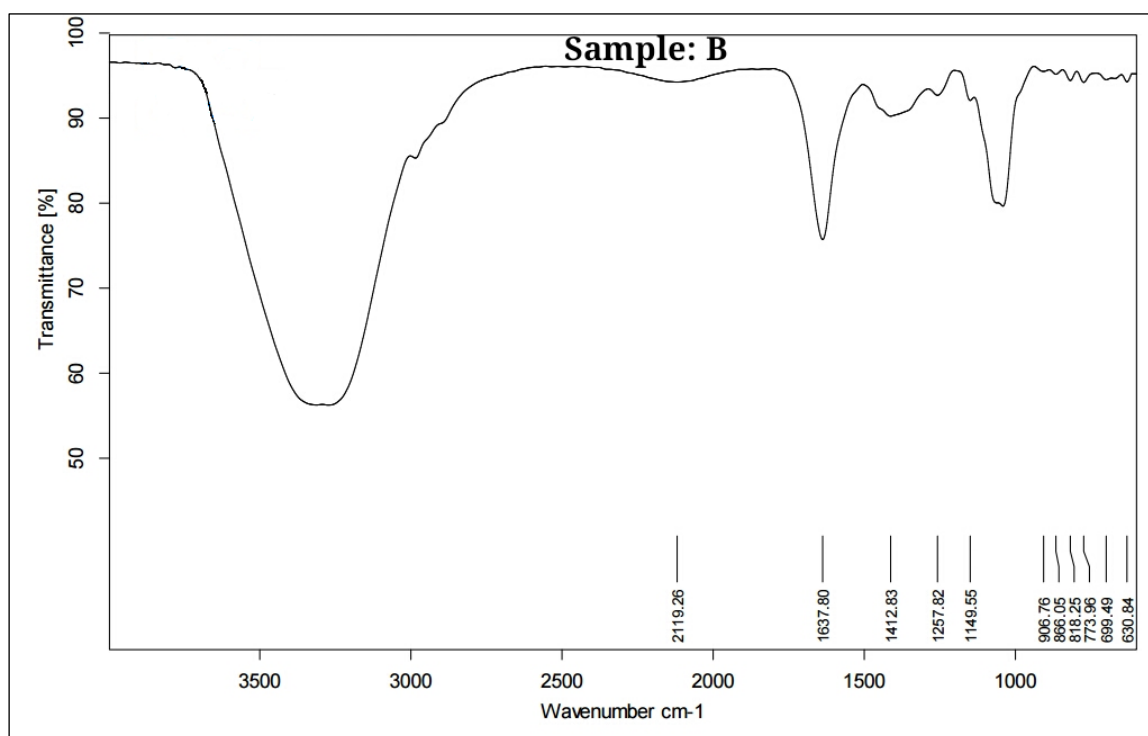
Microorganisms	Chloroform		Ethanol	
	Pulp (cm)	Peel (cm)	Pulp (cm)	Peel (cm)
<i>Salmonella spp</i>	0.4	0.275	-	-
<i>Escherichia spp</i>	-	0.35	-	-
<i>Staphylococcus spp</i>	0.175	-	-	0.325



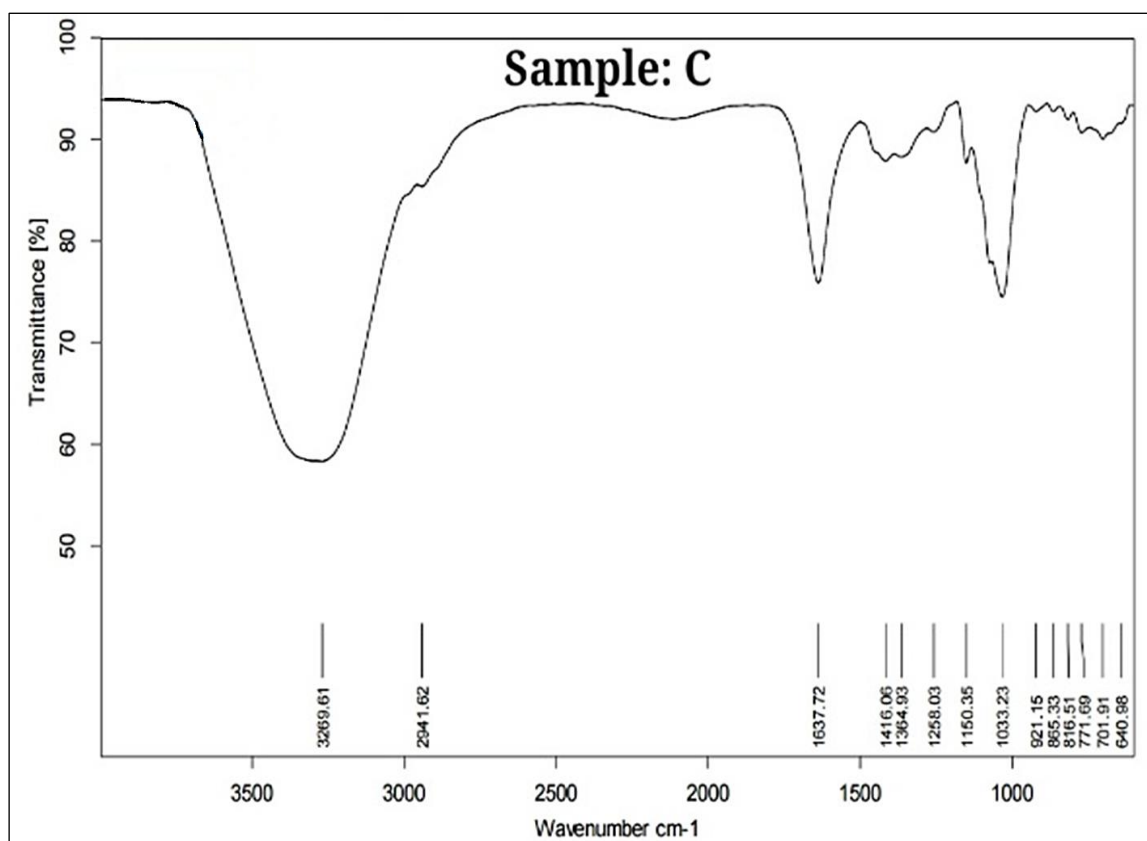
**Fig. 5:** FT-IR Spectrum Showing the Percentage of Transmittance of the Sample A: Chloroform Peel.

**Table 4:** Sample: A: Chloroform Peel Showing Frequency and Functional Groups.

Group Frequency	Functional Groups
3333.73	Hydroxyl groups
1636.99	Primary amines
1400.57	Aromatic groups
1271.78	Hydroxyl groups
1052.34	Carbonyl groups, Alkanes,
964.56	Alkanes, Carbonyl groups
679.68	Alkynes

**Fig. 6:** FT-IR Spectrum Showing the Percentage of Transmittance of the Sample B Ethanol Pulp Upper Layer.**Table 5:** Sample B: Ethanol Pulp Upper Layer Showing Frequency and Functional Groups.

Group Frequency	Functional Groups
3333.33	Hydroxyl groups, Phenolic groups
2119.26	Alkynes
1637.80	Esters
1412.83	Aromatic groups
1257.82	Nitro compounds
1148.55	Alkyl halides
906.76	Aliphatic amines
818.25	Aliphatic amines
773.96	Alkyl halides



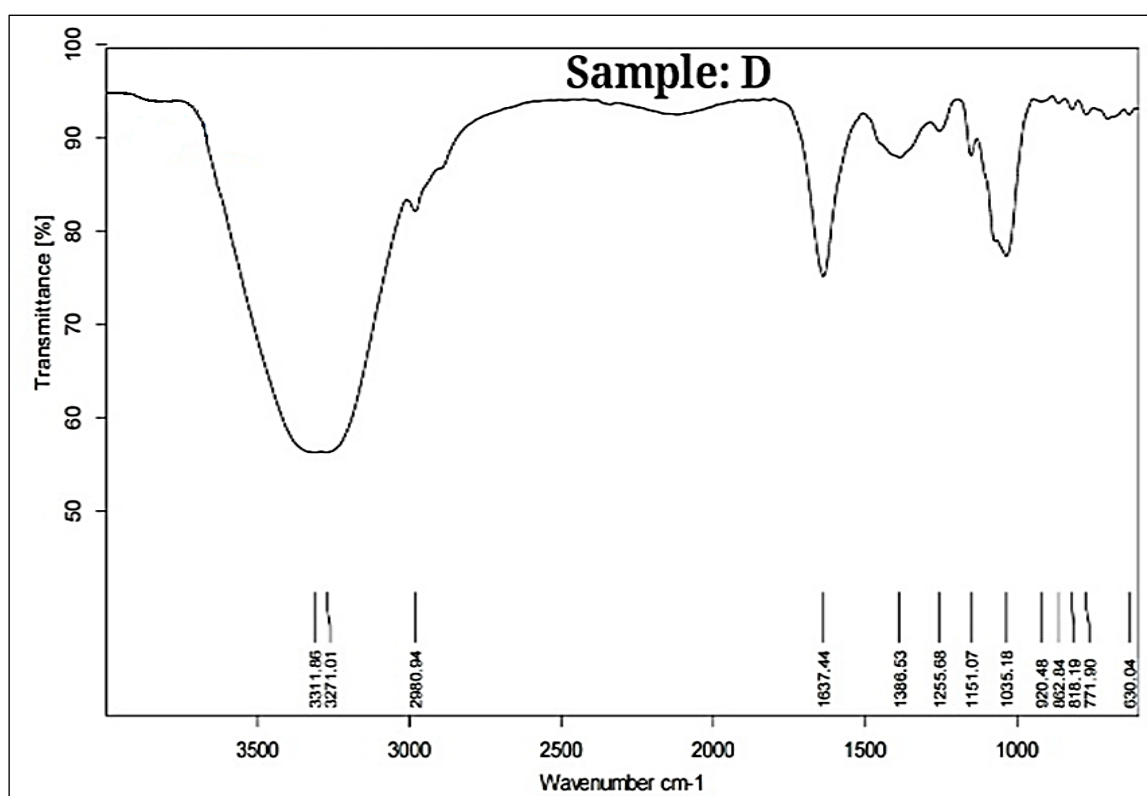
**Fig. 7:** FT-IR Spectrum Showing the Percentage of Transmittance of the Sample C: Ethanol Pulp Lower Layer.

**Table 6:** Sample C: Ethanol Pulp Lower Layer Showing Frequency and Functional Groups.

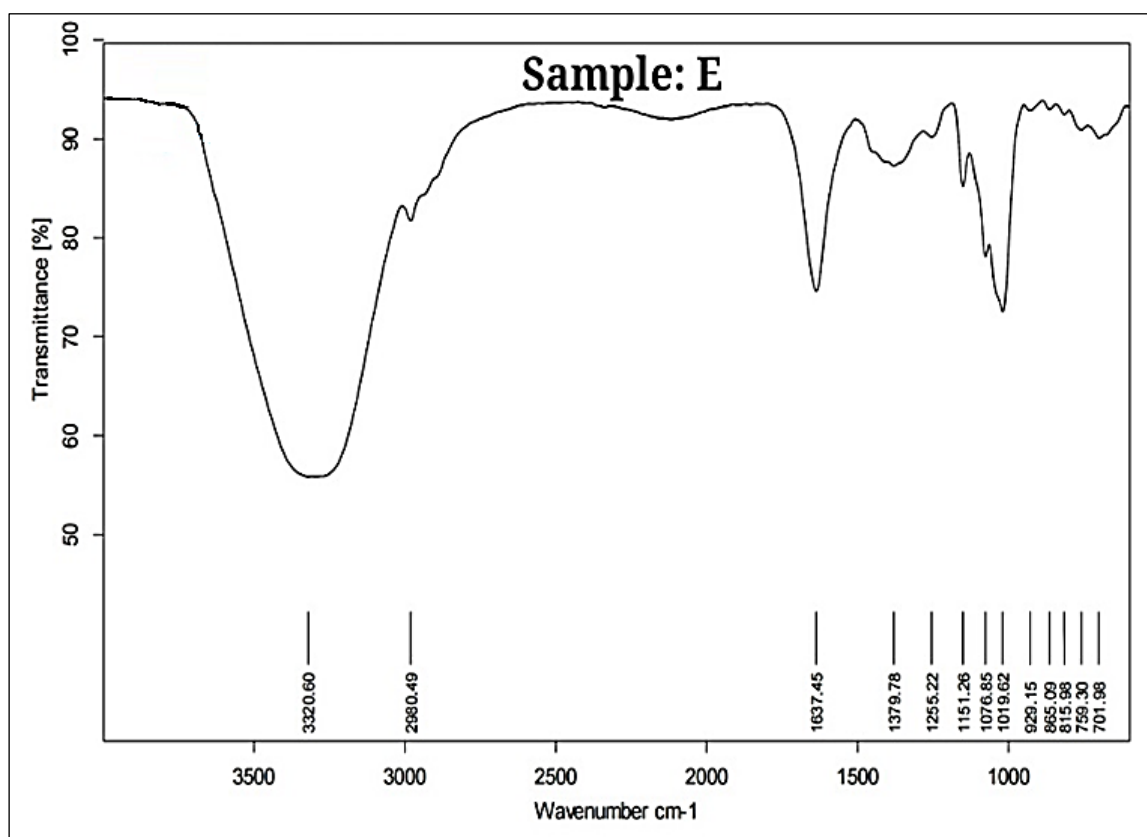
Group Frequency	Functional Groups
3269.61	Hydroxyl groups
2941.62	Alkanes
1637.72	Esters
1416.06	Aromatics
1364.93	Alkanes
1258.03	Alkyl halides
1033.23	Aliphatic amines
816.51	Aliphatic amines
771.69	Alkyl halides
640.98	Alkynes

**Table 7:** Sample D: Chloroform Pulp Upper Layer Showing Frequency and Functional Groups.

Group Frequency	Functional Groups
3311.85	Hydroxyl groups
2980.94	Alkanes
1151.18	Alkyl halides
771.90	Alkyl halides
630.04	Alkynes



**Fig. 8:** FT-IR Spectrum Showing the Percentage of Transmittance of the Sample D: Chloroform Pulp Upper Layer.

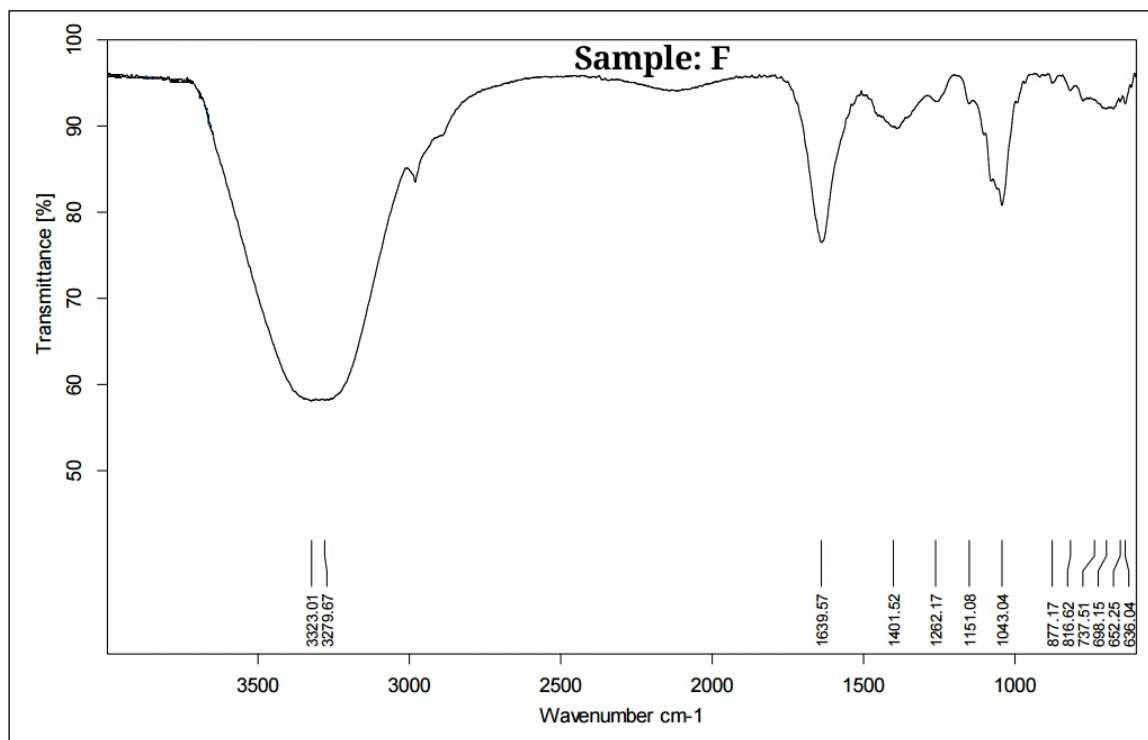


**Fig. 9:** FT-IR Spectrum Showing the Percentage of Transmittance of the Sample E: Chloroform Pulp Lower Layer.



**Table 8: Sample E: Chloroform Pulp Lower Layer Showing Frequency and Functional Groups.**

Group Frequency	Functional Groups
3320.0	Hydroxyl groups
1151.26	Alkyl halides
1076.85	Aliphatic amines
1019.62	Aliphatic amines



**Fig. 10: FT-IR Spectrum Showing the Percentage of Transmittance of the Sample F: Ethanol Peel.**

**Table 9: Sample F: Ethanol Peel Showing Frequency and Functional Groups.**

Group Frequency	Functional Groups
3323.01	Hydroxyl groups
3279.67	Hydroxyl groups
1401.52	Aromatics
1151.08	Alkyl halides
1043.04	Aliphatic amines
818.62	Aliphatic amines
737.51	Alkyl halides
636.04	Alkynes

### Interpretation of FT-IR Analysis

The C-H bonds where the hydrogen is attached to carbon signify bonded everything else it absorbs somewhere in the range 964.56/cm. This bond is present in most “organic compounds” (Table 1–5). The other really useful bond is O-H. This absorbs differently depending on its environment. It is easily recognized in an “acidic type compounds” producing the range 2500–3300/cm giving the

results for ethyl acids (e.g. ethyl ethanolate). Ester group compounds are absorbed in range 1689/cm (1690–1720/cm) frequency (Table 6–9). Higher frequency means a “Stiffer bond”, where stiffer bonds are bound by C=O [9, 10].

### CONCLUSION

The functional group identification of *Musa paradisiaca* can be further explored for drug discovery and drug designing field from the

structure searching approach of already available chemical structure covering the functional group through effective “substructure searching technique” in the field of chemo-informatics and computational medicinal chemistry; thus revealing huge number of 2D-chemical structures which could be reduced by applying some effective structure screening techniques to potential ligand molecules possible to show good biological activity.

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### Cite this Article

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