



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: II Month of publication: February

DOI: <http://doi.org/10.22214/ijraset.2019.2134>

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Extraction and Characterization of Anacardic Acid from Mango Peel

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Abstract: In this article the study on extraction of anacardic acid (derivatives of salicylic acid) was done with the solvent extract of peel of *Mangifera Indica* (mango). The extract was prepared using petroleum ether and the extraction of anacardic acid was done by reduction of calcium hydroxide to calcium anacardate which was then dried on anhydrous sodium sulphate in order to obtain anacardic acid. The extracted anacardic acid was characterized under UV-VIS spectrophotometer showing the absorbance peak between at 280 to 300 nm. The FT-IR analysis of anacardic acid carried out between spectrum range 4000 cm^{-1} to 400 cm^{-1} report showed the chemical binding of AA to that of other compounds.

Keywords: Anacardic acid, Uv-Vis spectrophotometer; FT-IR; Calcium hydroxide

I. INTRODUCTION

Anacardic acid (2-hydroxyl-6-pentadecyl benzoic acid) is a bioactive phenolic phytochemical substance found highly in the cashew nut (*Anacardium occidentale*) shell liquid, few amount in mango (*Mangifera indica*) and in pelargonium. It is the derivatives of salicylic acid with alkyl chain of 15 to 17 carbon atom. Anacardic acid is the mixture of both saturated and unsaturated compounds. They are partially miscible in ethanol and nearly immiscible in water. Anacardic acid is a white powder with the molecular weight of 348.52. Anacardic acids are soluble in DMSO, acetonitrile, petroleum ether, hexane. The optimum temperature for the storage of anacardic acid is -20°C .

Majorly anacardic acid is present in cashew nut shell liquid (CNSL). CNSL are widely used in polymer industries for the synthesis of chemicals.

The cashew nut shell is of about 1/8 inch thick, with a soft structure, which has dark brown liquid (CNSL). CNSL is widely useful in brake lining, primers, foundry industry, chemicals, and coating and in paints. CNSL also have biological activity like molluscidal activity, anti-tumor, prostaglandin synthetase inhibition activity and anti-microbial activity.

Anacardic acid a derivative of salicylic acid, is active against acne, tuberculosis, against some insects and against methicillin resistance staphylococcus aureus (MRSA). In industries these anacardic acid is widely useful for the production of cardanol which is used for coating, resin and for frictional process. Cardanol produced from anacardic acid is widely used for make phenalamines, used for curing durable coating used on concrete floors.

II. MATERIAL AND METHODS:

A. Sample Collection

The raw unripe mangoes were collected from the local market urapakkam, Chennai. The collected fruit were washed with sterile water and the peel was removed carefully without any flesh and dried for a week in shade at normal room temperature. The completely dried peel was then blended into fine powder. The fine powder was then packed and transferred to the laboratory for the analysis.

B. Preparation of Extract

The extract was prepared using various solvents such as petroleum ether, hexane and methanol. 25grams of powdered mango peel was weighed and mixed with 250ml of solvent and stirred under rotary shaker for overnight. After overnight stirring the extract was filtered with filter paper and the filtrate was then stored at room temperature for extraction process.

C. Reduction Of Calcium Hydroxide To Calcium Anacardate

30 ml of filtrate was taken in a round bottom flask and 60 ml of acetone was added to it and mixed well. To the above mixture calcium hydroxide (6grams) were added to stir continuously for 3½ hours using rotary shaker. After the incubation the white colored powder starts to precipitate at the bottom was said to be calcium anacardate. The precipitate was filtered, washed with 85 ml of acetone and dried for 2 hours under hot air oven at 50°C .

D. Calcium Anacardate To Anacardic Acid

The dried calcium anacardate was then treated with 200ml of sterile distilled water and 11M HCL and stirred for half an hour. The solution was then treated with 200ml of petroleum ether or n-hexane and the obtained solution was dried over anhydrous sodium sulphate. After complete drying the pure white crystalline anacardic acid was obtained, characterized under UV-VIS spectrophotometer and Fourier transform infrared spectrometer (FT-IR).

III. CHARACTERIZATION OF ANACARDIC ACID

A. Ultraviolet-Visible Spectrophotometer (UV-DRS)

The UV- visible absorption spectra of extracted anacardic acid were recorded using Ultraviolet-visible spectrophotometer Hitachi U-2400PC, with the peak ranging from 200 to 800 nm using ultra-violet spectrum with a absorbance speed of 5nm per minutes.

B. Fourier Transform Infrared Spectrometer (FT-IR)

The chemical binding of extracted anacardic acid were analyzed using FT-IR. Instrumental model spectrum 2 (101146) with the resolution 4 and scanning speed of 0.2. The powdered mixture were analyzed between the spectrum range of 4000- 400cm⁻¹.

IV. RESULT

The anacardic acid powder was successfully extracted from the mango peel extract and the characterization was further analyzed.

A. UV-VIS Spectrophotometer

The extracted anacardic acid was confirmed as anacardic acid using ultraviolet visible spectrophotometer. The anacardic acid showed an absorbance range between 280nm to 300nm.

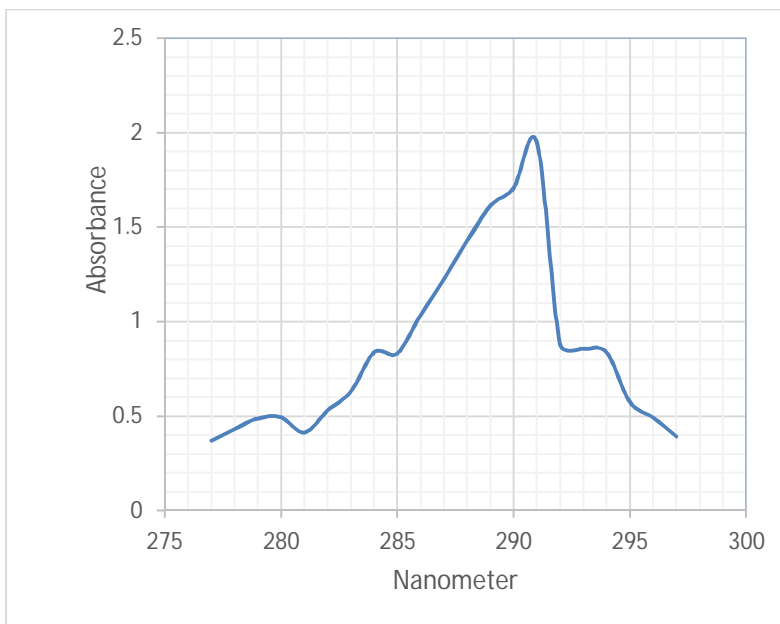


FIG.5.1.a. UV-VIS spec peak between 280 to 300nm.

B. Fourier Transform- Infrared Spectroscopy (Ft-Ir)

The functional groups of extracted anacardic acid from mango peel (*Mangifera indica*) were identified using the peak assignments. Anacardic acid shows a strong broad peak at 3462.65cm⁻¹ which was assigned to aromatic O-HH bonded in phenol group and a varying peak which was assigned to O-H stretch in alcohol group. It also possesses a strong peak at 1795.32cm⁻¹ which was assigned to C=O stretch of class acid chloride. The medium peak at 1427.97cm⁻¹ shows the aromatic C-C stretch in aromatic class. The two strong peak were observed at 1128.09cm⁻¹ which was assigned to C-N and C-F stretch with amines and alkyl halides group respectively. It also shows a weak peak with phenol group with P-H bond. At 874.44cm⁻¹ shows a moderate peak which was assigned to C-H out of plane related to aromatic group with structure 1, 2, 4, trisub. Two moderate peaks were observed at 712.89cm⁻¹ in which both =CH stretch appears out of the plane with alkenes and aromatic compound respectively.

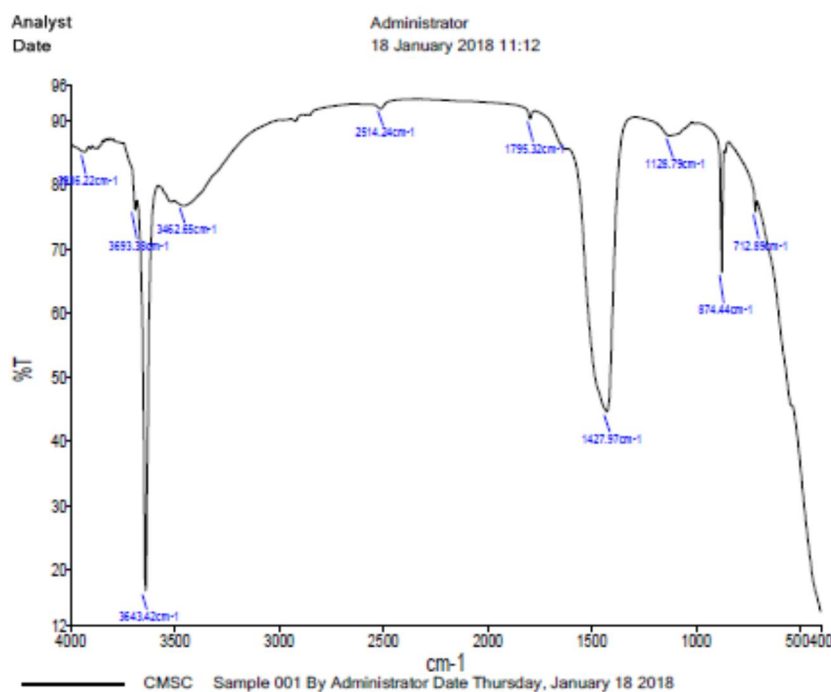


FIG. 5.2.a., FT-IR spectrum range from 4000 to 400 cm^{-1}

V. DISCUSSION

The solvent extraction method using petroleum ether for extracting anacardic acid using mango peel (*Mangifera indica*) has been successfully done. The preliminary conformation was successfully completed from the UV- VIS spectroscopy which showed the absorbance peak at 292 nm and a broad peak from 410 to 415 nm. The FT-IR analysis of extracted anacardic acid was carried out between the range 4000-400 cm^{-1} showed varying strong, medium and weak peak at different ranges 3693.38, 3462.65, 1795.32, 1427.96, 1128.09, 874.44, 712.89 cm^{-1} . This shows that the extracted anacardic acid have broad range of interaction between the other organic compounds.

VI. FUTURE PERSPECTIVE

The extracted anacardic acid can be studies for structural analysis its side chain analysis. Its emerging medicinal roles such as anti-tumor activity, anti-parasitic activity, anti-obese activity, HAT medium inhibition activity can be analyzed and studied.

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