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Eco-friendly and economic method for knoevenagel condensation by employing natural catalyst of guava leaves (*Psidium guajava*)

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Abstract
The antimicrobial potential of guava (*Psidium guajava*) leaf extracts against two gram-negative bacteria (*Escherichia coli* and *Salmonella enteritidis*) and two gram-positives bacteria (*Staphylococcus aureus* and *Bacillus Cereus*) which are some of food borne and spoilage bacteria. The guava leaves were extracted in four different solvents of increasing polarities (hexane, methanol, ethanol and water).
The guava (*Psidium guajava*) is a Phytotherapic plant used in folk medicine that is believed to have active components that help to treat and manage various diseases. The challenges in organic synthesis are develop convenient process. Reaction media conditions and utility of material based on the design of green chemistry is one of the important issues in the chemical society in resent strong synthesis effort.

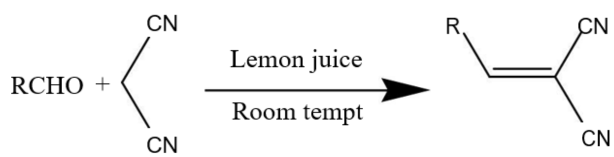
Keywords: cement emissions, environmental pollution, atmospheric changes, human health

Introduction
Chemistry is undeniably a very prominent part of our daily lives. However chemical development also bring new environmental problems and harmful unexpected site effect considering a growing need for more environmentally acceptable process in the chemical industry. The challenges in organic synthesis are develop convenient process. Reaction media conditions and utility of material based on the design of green chemistry is one of the important issues in the chemical society in resent strong synthesis effort are done to use of approaches that are beneficial to industry as well as the environment [1].

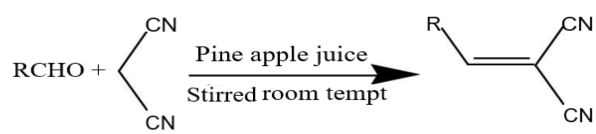
Green chemistry
Green chemistry is basically environmentally begin chemical synthesis and is useful to reduce environment pollution. Green chemistry efficiently utilised raw materials, eliminated waste, and avoid the use of toxic or hazardous reagent and solvent in the manufacture and application of chemical products.
The twelve basic principles of green chemistry have been formulated.
1. It is better to prevent waste than to treat or clean up waste after it is formed.
2. Synthetic materials should be designed to maximize the incorporation of all materials used in the process into the final product.

Natural Catalyst
Some of the knoevenagel condensation employing natural catalyst such as Henna leaves, Clay, natural phosphates, Animal bone, Calcined eggshell (CES), and various fruit juices are reported due to acidic natural aqueous fruit juice like Lemon [37], Pineapple [38], Tamarind Indica [39], Star fruit juice [2], and also biocatalyst etc.

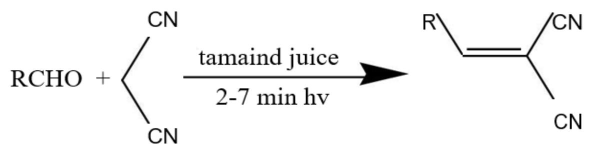
M.B. Deshmukh *et al.* [37] Have reported the knoevenagel condensation of active methylene compound with aromatic aldehyde in the presence of lemon juice.



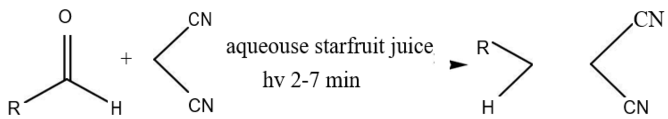
Suresh and Patil *et al.* [38] have introduced simple eco-friendly and economic method for knoevenagel condensation of substituted aromatic as well as hetero aromatic aldehyde with malononitrile catalyzed by pineapple Juice at room temperature in the absence of any organic solvent is described.



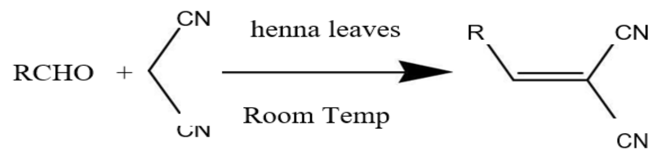
Rammohan pal *et al.* [39] have introduced Visible light induced a highly efficient and environmentally friendly Knoevenagel condensation of various aliphatic and aromatic aldehyde with malononitrile has been achieved in excellent yield in presence of aqueous tamarind Juice.



Rammohan pal, *et al* [2] have introduced a aqueous star fruit Juice catalyzed a simple and efficient knoevenagel condensation of aromatic aldehyde with malononitrile has been developed under visible light. The synthesis of intermediate such a coumarin derivative which are useful in perfumes.



Pravin chavan *et al*. [58] have introduced a simple green method for condensation of substituted aromatic aldehyde with malononitrile catalyses by extract of henna leaves at room temperature in absence of any chemical reagent. The knoevenagel condensation by Henna juice Catalyst with good yield.



Preparation of extract of guava leaf

Guava leaf were collected and washed with water [fig.2]. The were dried and powdered by using morter. 5g of the Powder and 50ml of methanol were taken in 250ml iodine flask and it was stirred by mechanical stirrer for one hour. The extract was filtered using filter paper and then it was used as catalyst for all reactions.

Fig 1: guava leaves extract

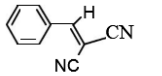
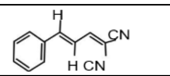
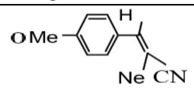
Results and Discussion

The fresh leaves are used for treating gastrointestinal problems, then also used to control blood pressure. Guava leaf extract has analgesic, anti-inflammatory, antimicrobial, hepatoprotective and antioxidant activities. The dried guava leaves are considered as waste material, it cannot be feeded for animals. But we are using the waste materials as Natural catalyst for our chemical reaction. This natural catalyst gives a good yield in the knoevenagel condensation reaction.

Kim *et al*. reported that the guava leaves contain ascorbic acid, citric acid, acetic acid, epicatechin, xanthine, protocatechuic acid, glutamic acid, asparagine, malonic acid, trans-aconitic acid, maleic acid and cis-aconitic acid. As guava leaves extract is acidic in nature it will be worked as a acid catalyst for knoevenagel condensation Hence we using for Knoevenagel condensation of active methylene compound with aromatic aldehydes in the presence of guava leaf extract (*Psidium guajava*) as a natural catalyst.

Fig 2: guava leaves

Table 1: Knoevenagel condensation of aldehydes with malononitrile catalyzed by Sweet lime peel extract.

Compound	Product	Color & nature of product	Yield (%)	Time (min)	Melting Point(c)	
					Observed	Reported
1.		White crystal	90	2	81	80-82
2.		Yellow Crystal	80	5	127	126-128
3.		Green Crystal	88	5	114	112-114

At room temperature the high yield were obtained with in few minutes by using magneticstirrer. Their actions were monitor edbythin layer chroma to graphic techniques. Theme lting of the all the compounds are good agree with literature.

IR-Spectral Analysis

Table 2: IR data of compound (1-3)

Compounds	CN (cm-1)	Other Frequencies (cm-1)
1	2226	1591,3032,614,1220,1448
2	2226	3032,1605,1448,1227,863,685
3	2218	3032,1883,1555,1448,934,834

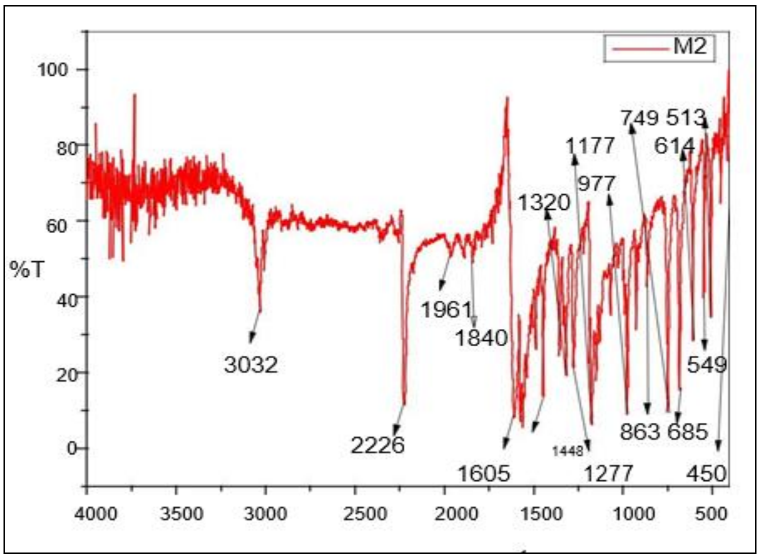


Fig 3: Wave Number (cm) IR spetrum of compound-1

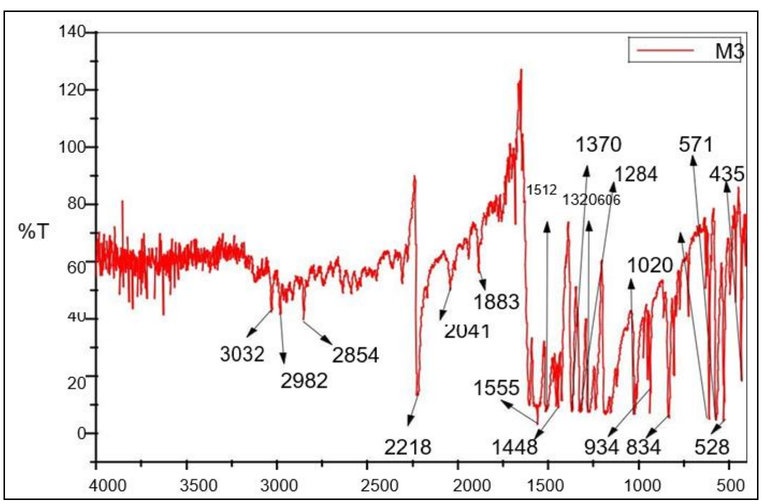


Fig 4: Wave Number (cm) IR spetrum of compound-3

1H-Nmrspectralanalysis

1H-NMR spectroscopy is an important tool in the hand so fan organic chemist for getting structural information from the spectrum fanun known compound. It also helps in study in g the stereochemical details with in the molecule. Al though important, it cannot replace other tech niquessuc has ultraviolet, in frared, massetc. Leaving aside the functional groups, alarge part of anorganic mole culecons is ts of carbon-hydrogen skele ton and this tool is most use fulin the invest negation of this structural feature of the molecule-rather than the complete structure.

1H NMR spectra recorded in CDCl3 for the 2 (pheny lmethylene) malononitrile. The data is good agree with literature.

Table 3: The data are listed in the.

Compound	CH proton	Aromatic protons		
		Ortho	Meta	Para
2(phenyl methylene)malononitrile	7.8	7.91(ppm	7.56(ppm)	7.6(ppm)

1H-spectrum of compound 2(phenyl methylene) malononitrile

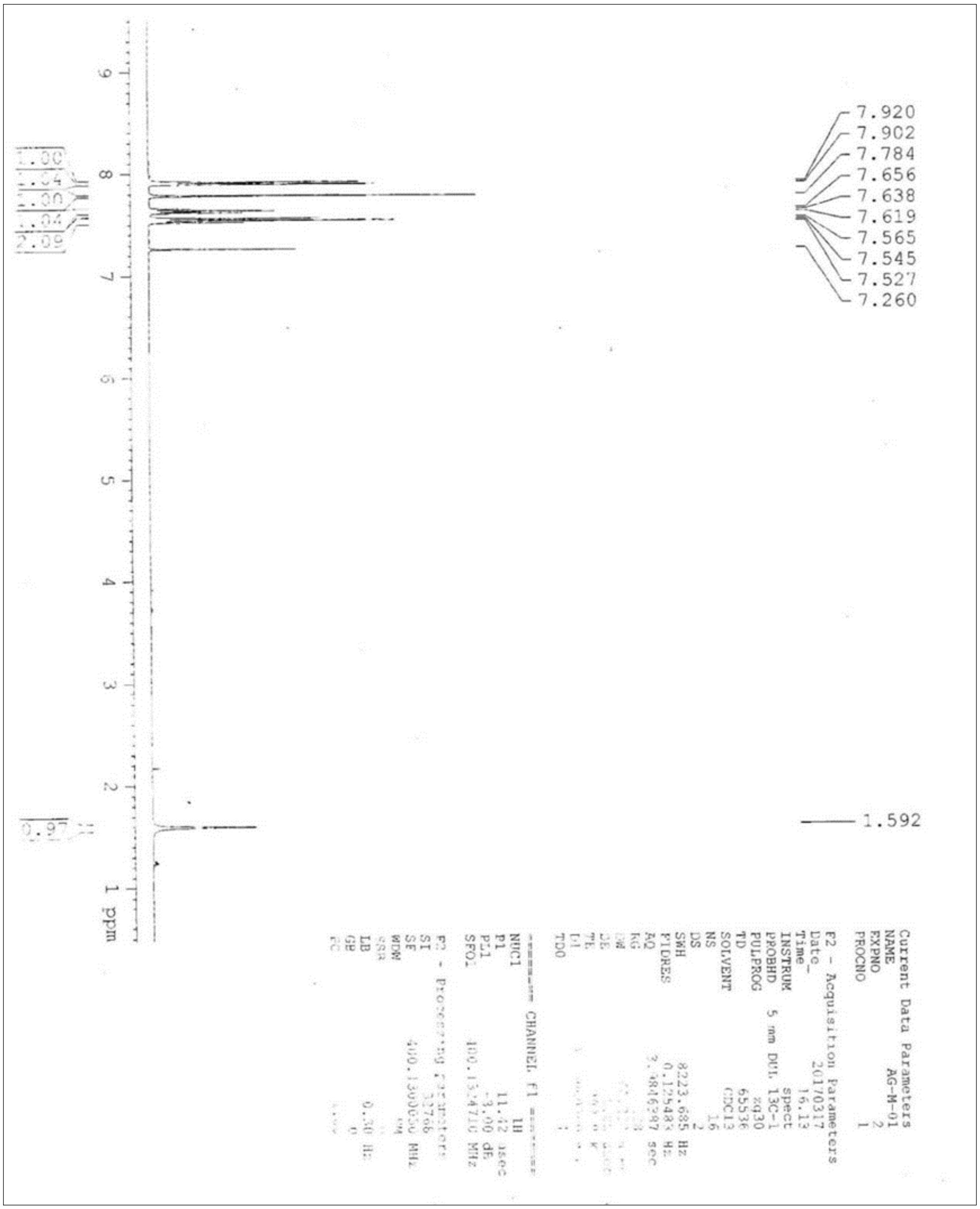


Fig 5

C13nmrspectraanalysis

13C NMR is an important tool in chemical structure elucidation in organic Chemistry. 13CNMR detects only The 13 cisotope of carbon, who's natural Abundance is only1.1%, because the main carbon isotope, 12c, is not detec table by NMR since it has zero net spin. 13C chemical hifts follow the same principles as those of1H, although the typical range of chemical shifts is much larger thanfor1H (by a factor of about 20). The chemical shift references tandard for13C is the carbons in tetramethy lsilane (TMS), [1] whose chemical shift is considered to be0.0 ppm13C NMR spectrarecorded inCDCl3forthe 2 (phenylmethylene) malononitrile. The data are listed in the table -4.

Compound	CH proton	Aromatic protons		
		Ortho	Meta	Para
2(phenyl methylene)malo nonitrile	7.8	7.91(ppm)	7.56(ppm)	7.6(ppm)

1H-spectrum of compound 2 (pheny methylene) malononitrile

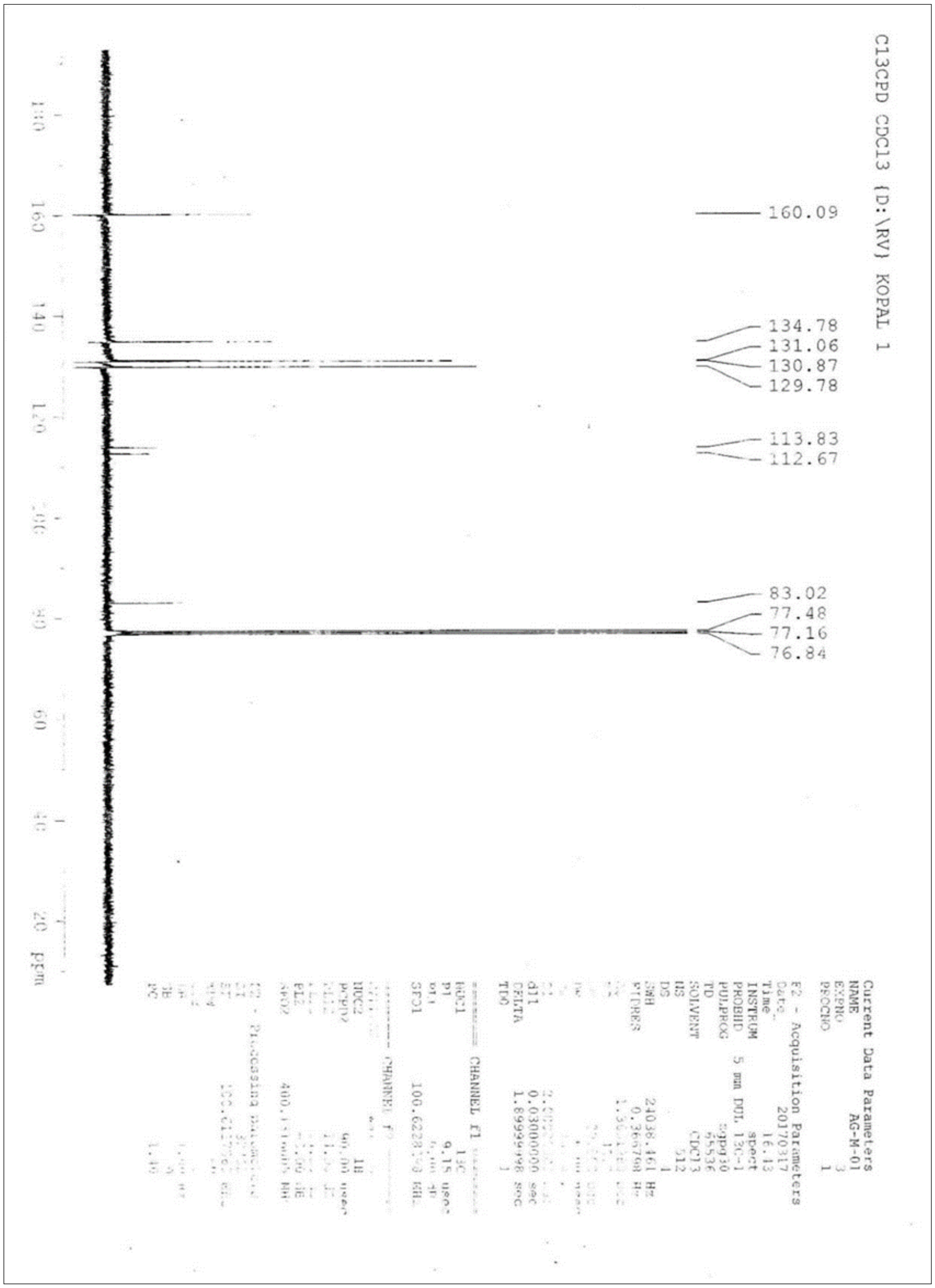


Fig 6

Conclusion

We have establish ed and potentially efficient absolute lyclean and high yieldingeco-friendly methodology for the knoevenage lconde nsation of various aromatic aldehyde with malononitrile eusing sweet lime peel devoid of any toxic catalyst /solvent. Solid support and surfactant and may be considered as an excellent improvement are the existing method. The most attractive features of this protocol are its good converstions easy work up and short reaction time smakingit useful practical method forth a synthesis of adducts. This solvent free approach is based on green chemistry principle and do not cause any harm to environment. Inadditionit involves mild reaction condition and simple work up.

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