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NATURAL ACID CATALYSED SYNTHESIS OF SCHIFF'S BASES FROM 1-(1-PHENYL-ETHYLIDENE) SEMICARBAZIDE

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ABSTRACT: The natural acid like lemon juice provides mild acidic state which used to catalyzed reaction of primary amine and aldehyde in green solvent like ethanol at room temperature reflux for 1.5 hour gives Schiff bases in good yield. Schiff bases have attracted considerable attention of us due to their significant biological activities [1] like anticancer, antitumor, anti inflammatory agents [4], insecticidal, antibacterial [5], antituberculosis, antimicrobial [2-3], antifungal [5], anti-HIV and metal corrosion inhibition activities of Schiff bases, besides wide range of pharmacological activities. Natural acid is non-polluting and does not employ any lethal materials, quantifying if as a green approach for the synthesis of Schiff bases. Schiff bases also have several types of biological actions such as analgesic and antimalerial [6]. They are working as Ligands for complexes of metal ions. Organosilicon complexes with Schiff bases are found to be beneficial in various agricultural applications like fungicides, bactericides, herbicides, acaricides and antifeedants [7]. The metal complex of Schiff bases are also of principal significance in analytical chemistry and chemotherapy [8].

INTRODUCTION: The mechanism of transformation of aldehyde and amines into Schiff bases are possible by two synthetic approaches are possible. In first method nucleophilic attack of primary amine on carbonyl carbon that gives hydroxyl compound which on dehydration gives Schiff bases. While in the second method the formation of Schiff bases in the second step largely depends upon the rate of removal of water from reaction mixture. Originally, the classical synthetic route for synthesis to Schiff bases was reported by Schiff [9] that, which involves condensation of primary amines with carbonyl compounds under azeotropic distillation with the simultaneous removal of water [10].

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Various eco-friendly methods have been given for the production of Schiff bases, Hossein et al (2006), have reported the synthesis of Schiff base catalysed by P_2O_5 / Al_2O_3 in solvent less condition that gives quantitative yields of the product. Bendale et al (2011) [11] has reported UV chamber, sonicator and also by grinding method are useful for synthesis of Schiff base. As reported by Patil et al (2012) have reported a mild and selective imine formation of aryl aldehyde and aromatic primary amine using lemon juice (*Citrus limonium* species) at room temperature in 25-300 minute showed good to admirable yields. The study revealed that electron withdrawing groups that are attached to aromatic aldehyde and electron donating groups attached to aromatic amine enhances the reaction. However no result was obtained when condensation was carried without employing lemon juice. The role of lemon juice was to catalyze the reaction was demonstrated by the lack of Schiff base formation when the reaction hat was carried out in the absence of catalyst.[1, 12, 14]

The Knoevenagel condensation [12] of aldehydes with active methylene compounds is an important method used for the synthesis of pharmaceutically important organic compounds. Deshmukh et al (2012) [13] showed that lemon juice can act as an efficient homogeneous acid catalyst for the knoevenagel condensation reaction under solvent-free environment. Thus, when various aldehydes and malononitrile were mixed with lemon juice followed by stirring of mixture at room temperature for 5-120 min minute lead to formation of condensation product in good yields.

The new approach for knoevenagel condensation by lemon juice was non-polluting and does not employ any lethal material, quantifying it as a green method. Also Patil et al (2011) [14] reported that aldehyde, 1,3-dicarbonyl compound and urea treated under solvent free condition using extract of lemon juice as natural catalyst form three constituent leaded Biginelli type syntheses of dihydropyrimidinone. This procedure gives better yield, non-polluting and green aproch for biocyclocondensation reaction. A similar type of work done by Pal et al (2014) [15] confers the yields of bis-, &tris (indolyl) methanes using lemon juice as a catalyst. Some major species of citrus family are *Citrus aurantium, Citrus indica, Citrus limonium* which are commonly known as lemon. In India it is also cultivated in home gardens. For the present work, we used extract of citrus limonium species of lemon. It has played role as a natural catalyst for synthesis of Schiff bases.

The lemon juice contain85% moisture, 0.5% Vitamin-C, 5-7% citric acid, 1%protein, 11.2% carbohydrates, 1.6 % fibres, 0.9% fat, 0.3 % minerals and also contain organic acids. As lemon juice provides acidic condition pH 2-3 and percentage of citric acid 5-7% is more, hence it Works as natural acid catalyst for Formation of Schiff's bases [1, 12]. As per the results revealed by enormous experiments, a laboratory test was conducted for synthesizing Schiff bases from various substituted aldehydes and semicarbazone by employing lemon juice as green or eco-friendly catalyst.

MATERIALS AND METHODS: A mixture of Acetophenone (**A**) and semicarbazide hydrochloride (B) was taken in iodine flask Using water as a solvent followed by the catalyst sodium acetate to the reaction, with shaking it for 10 min. After that the reaction mixture was poured on crushed ice followed by separation and filtration of solid compound obtained. It was dried and recrystallize using aqueous ethanol. The precursor1-(1-phenylethylidene) semicarbazide (C) Was used for further reactionfor various substituted aldehydes. (**Fig.1**) The M. P. of the recrystallised product was determined. (178^0C)

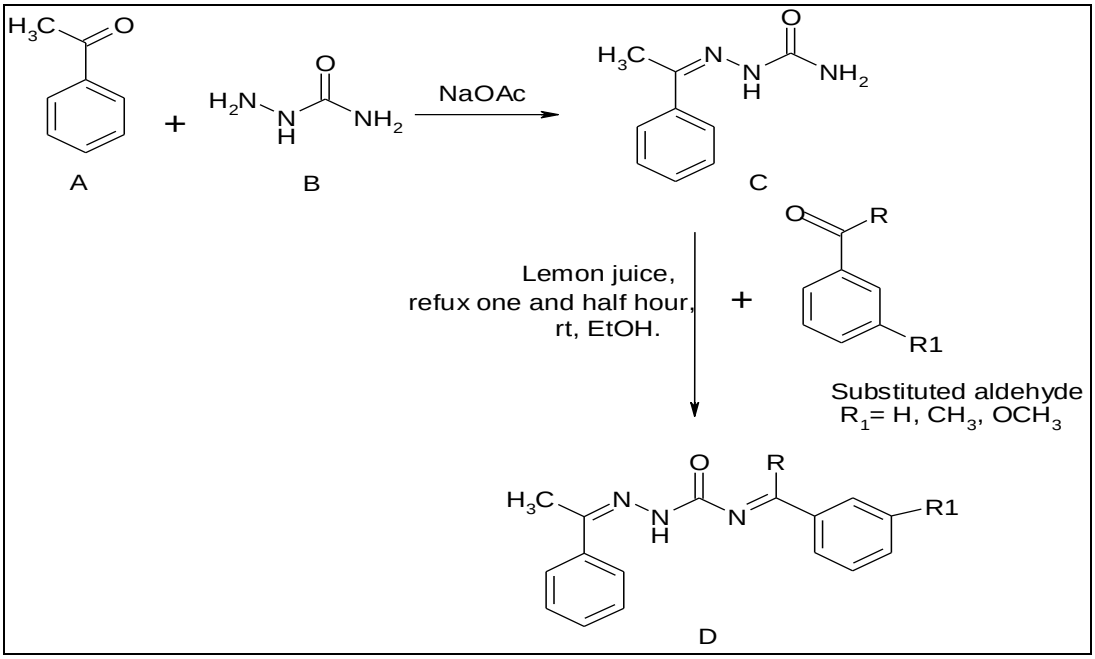


FIG. 1: SYNTHESIS OF SCHIFFS BASES REACTING WITH FROM VARIOUS SUBSTITUTED ALDEHYDE.

The reaction of precursor and various substituted aldehydes using lemon juice as a natural acid catalyst in alcoholic solvent like ethanol, reflux at room temperature for 1.5 hour gives the product Schiff bases (**D**), (as shown table 3.1) from o-nitro benzaldehyde, p-dimethyl amino benzaldehyde, m-nitro benzaldehyde, anisaldehyde, m-hydroxy benzaldehyde and p-hydroxybenzaldehyde to form 4-(2-nitrobenzylidene)-1-(1-phenyl ethylidene) semicarbazide, 4-(4-(dimethylamino)benzyliclene)-1 - (1-Phenylethylidene) semicarbazide, 4 - (3-nitrobenzylidene)-1-(1-Pheny-lethylidene) semi carbazide, 4 - (4-methoxybenzylidene) – 1 - (1-Phenylethylidene) semicarbazide, 4 – 4 (3-hydroxybenzylidne) – 1 - (1-Phenylethylidene) semicarbazide and 4-(4-hydroxybenzylidene) -1-(1-Phenylethylidene)semicarbazide respectively.

RESULT AND DISCUSSION:

Formation of Schiff's bases by using natural acid and ethanol as solvent was monitored by thin layer chromatography (TLC). The spectra of known compound have been identified by comparison of spectral data (Infra Red). The Melting points (MP ^{o}C) were determines by open capillary tube and are uncorrected. The percentage yield is calculated by the formula.

$$\%\,Yeild = \frac{\text{Experimental Yield of product}}{\text{Theoretical Yield of product}} X\ 100$$

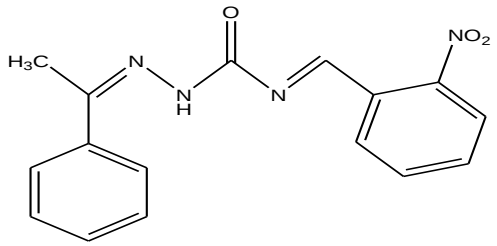
The Percent atom Economy is calculated by the formula,

$$\%\,AtomEconomy = \frac{\text{Molecular weigh of desired product}}{\text{Mol. wt.of desired product} + \text{ mol. wt of by product}} X\ 100$$

Spectroscopic Interpretation:

1. 4-(2-nitrobenzylidene)-1-(1-phenyl ethylidene) semicarbazide:

Structure:

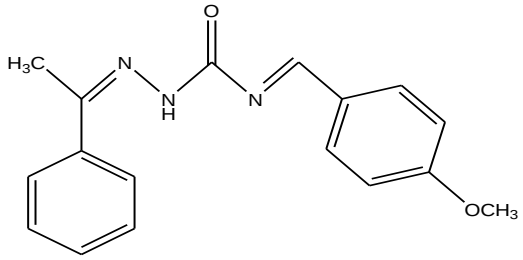


(1*Z*,4*E*)-4-(2-nitrobenzylidene)-1-(1-phenylethylidene)semicarbazide

IR spectra founds C=Nstr. (1690-1640 cm^{-1}) found at 1719 cm^{-1}, C=O str. (1680-1630 cm^{-1}) found at 1596 cm^{-1}, Ortho disubstituted ring (~750 cm^{-1}) found at 756cm^{-1}, $–NO_2$ group Asymmetric str(1550-1490 cm^{-1}) found at 1507cm^{-1}, Symmetric str (1355-1300cm^{-1}) found at 1340 cm^{-1}, N-H str 2^{0} amines(3500-3100cm^{-1}) found at 3429cm^{-1}.from above spectral interpretation the compound 4-4(3-hydroxy-benzylidne) – 1 - (1-Phenyl-ethylidene) semicarbazide will be form during the reaction of 1-(1-phenylethylidene) semicarbazide and o-nitro benzaldehyde.

2. 4-(4-methoxy benzylidene) -1-(1- phenyl ethylidene) semicarbazide:

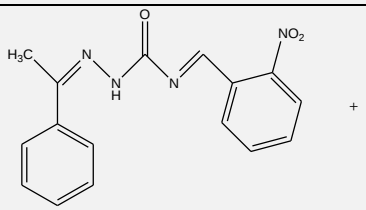
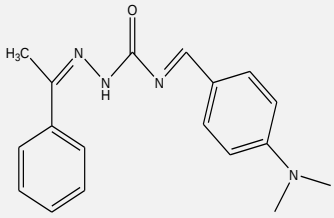
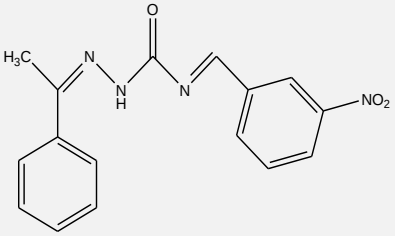
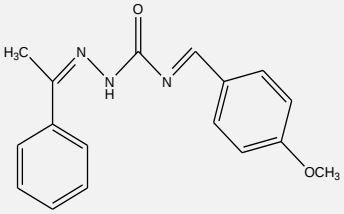
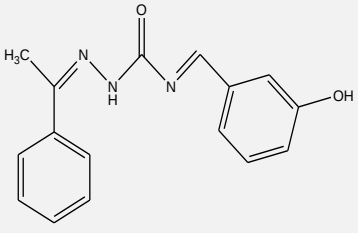
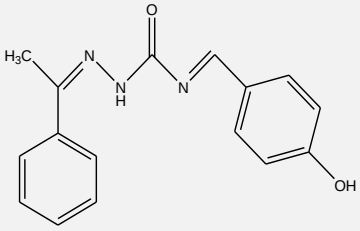
Structure:



(1*Z*,4*E*)-4-(4-methoxybenzylidene)-1-(1-phenylethylidene)semicarbazide

IR spectra founds C=N str. (1690-1640 cm^{-1}) found at 1642 cm^{-1}, C=O str. (1680-1630 cm^{-1}) found at 1596 cm^{-1}, Para di-substituted ring (800-850cm^{-1}) found at 831 cm^{-1}, N-H str 2^0 amines (3500-3100cm^{-1}) found at 3451 cm^{-1}, Ar-H Str.(3150-3050cm^{-1}) found at 3064 $cm^{-1}$from above spectral interpretation the compound 4-(4-methoxy-benzylidne)-1-(1-Phenyl-ethylidene) semicarbazide will be form during the reaction of 1-(1-phenylethylidene) semicarbazide and Anisaldehyde. The various characterizations of products are describe in the **Table 1**.

TABLE 1: CHARACTERIZATION OF VARIOUS PRODUCTS AND THEIR PROPERTIES

Sr. N.	Chemical Reagent	Compound Structure	MP (0C)	Yield%	Atom economy %
1	o-Nitro Benzaldehyde	 (1*Z*,4*E*)-4-(2-nitrobenzylidene)-1-(1-phenylethylidene)semicarbazide	230^0C	94	94.51
2	p-dimethylamino Benzaldehyde	 (1*Z*,4*E*)-4-(4-(dimethylamino)benzylidene)-1-(1-phenylethylidene)semicarbazide	86^0C	93	94.48
3	m-Nitro Benzaldehyde	 (1*Z*,4*E*)-4-(3-nitrobenzylidene)-1-(1-phenylethylidene)semicarbazide	220^0C	90	94.51
4	Anisaldehyde	 (1*Z*,4*E*)-4-(4-methoxybenzylidene)-1-(1-phenylethylidene)semicarbazide	181^0C	89	94.25
5	m-Hydroxy Benzaldehyde	 (1*Z*,4*E*)-4-(3-hydroxybenzylidene)-1-(1-phenylethylidene)semicarbazide	187^0C	81	93.98
6	p-Hydroxy Benzaldehyde	 (1*Z*,4*E*)-4-(4-hydroxybenzylidene)-1-(1-phenylethylidene)semicarbazide	185^0C	69	93.97

CONCLUSION: The study revealed a new and ecofriendly route for the formation of Schiffs bases using lemon juice as a catalyst and other appropriate Lemon juice acts as a Natural acid that is non-polluting and does not employ any lethal materials, quantifying if as a green approach for the synthesis of Schiff bases. From this study, it is clearly conferred that the natural acid is having enough acidic medium for preparation of Schiff bases in a good quantity. The method used in the present study is cleaner, safer and more eco-friendly, Involving mild reaction conditions and required very simple experimental setup leading to the formation of satisfactory products.

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CONFLICT OF INTEREST: There is no conflict of interest regarding the publication of the Manuscript.

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