AMERICAN JOURNAL OF PHARMTECH RESEARCH

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Green Synthesis of 2-Substitutedimino-4-Amino-6-Ethylformamidino-1,3,5-Thiadiazines

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ABSTRACT

"Non-conventional" synthetic method has shown broad applications as a very efficient way to accelerate the course of many organic reactions, producing high yields, higher selectivity and lower quantities of side products consequently easier work-up and purification of the products. One-pot two-component condensation of 1-formamidino-5-ethylformamidonothicarbamide **(llla)** with various isocyano-dichlorides**(Xla-g)** were carried out in presence of lemon juice as a biocatalyst respectively to synthesize a novel series of 2-substitutedimino-4-amino-6-ethylformamidino-1,3,5-thiadiazines **(Xlla-g)** which are neither to unknown. The structures were confirmed by conventional chemical characterization, elemental analysis and spectral studies.

Keywords: Lemon Juice, various isocyanodichlorides, 1-formamidino-5-ethylformamidonothicarbamide

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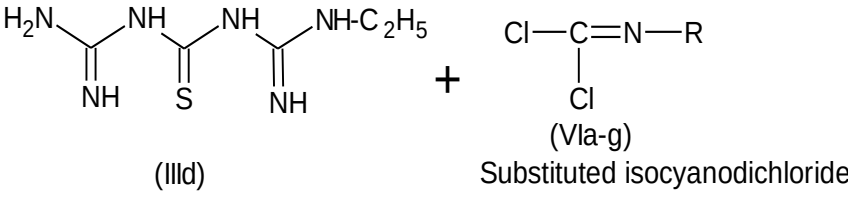
Received 25 December 2016, Accepted 25 January 2017

Please cite this article as: Tayade DT *et al*., Green Synthesis of 2-Substitutedimino-4-Amino-6-Ethylformamidino-1,3,5-Thiadiazines. American Journal of PharmTech Research 2017.

INTRODUCTION

In recent years the chemical research has been focused on the ecofriendly, environmentally, benign process to reduce the impact of environmental pollution. Green Chemistry[1-4] is placed in the frontier areas in this regard which involves the design, development and implementation of the performance criterion. So the 'greening' of conventional reactions is done to meet the ever increasing demands of selectivity in modern synthesis[5]. Sonochemical methods of synthesis use non classical forms of energy to modify the time duration and product yield by avoiding the undesired side products[6,7]. Microwave heating and sonochemical methods have emerged as a powerful energy and time saving techniques to promote a variety of chemical reactions[8-12]. These reaction methods, under solvent-free conditions are eco-friendly by reducing pollution and offer low cost, facile, safe and reproducible experimental procedures[13]. Therefore by using lemon juice as a biocatalyst[14-15]technique has gained popularity in past decade as a powerful tool for rapid, economic and efficient synthesis of variety of compounds.

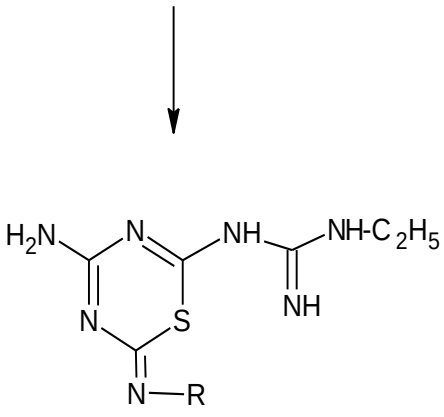
Literature survey reveals example of specific reactions, which do not occur under conventional conditional heating, but could be possible by lemon juice[19] with good product yields. The present work describes suitable, convenient and somewhat direct method for the synthesis of 2-substitutedimino-4-amino-6-ethylformamidino-1,3,5-thiadiazines depicted below,



(IIId) (VIa-g)

Substituted isocyanodichloride

1-Formamidino-5-ethylformamidinothiocarbamide



(XIIa-g)

2-Substitutedimino-4-amino-6-ethylformamidino-1,3,5-thiadiazines

General remarks

All reagents were purchased from commercial suppliers and used without further purification. Dry methanol and diethyl ether were purchased from Aldrich and were used as such. All reactions were run in oven-dried round bottom flask or vial containing a teflon-coated stir bar and sealed with septum. Analytical thin layer chromatography was carried out on silica pre-coated glass plates (Silica gel 60 F254, 0.25 mm thickness) and visualized with UV light at 254 nm. ^{1}H NMR spectra were recorded on Bruker 400-MHz Ultrashield Advance II 400 model (400 and 100 MHz, respectively) at ambient temperature with $CDCl_3$ or DMSO-d6as solvents. $CDCl_3$ (δ 7.26 ppm), DMSO-d6 (δ 2.50 ppm) or with tetramethylsilane (TMS, δ 0.00 ppm) as the internal standard. Chemical shifts (δ) were reported as part per million (ppm) in δ scale downfield from TMS.

Result and Discussion

General procedure for the synthesis of 2-ethylimino-4-amino-6-ethylforma- midino-1,3,5-thiadiazine (Xlla)

A mixture of 1-formamidino-5-ethylformamidonothiocarbamide (0.1M)**(IIIa),** ethy lisocyanodichloride (0.2M) **(Xla)** freshly extracted lemon juice (20 ml) was taken in round bottom flask. It was tightly sealed and the reaction mixtures were kept in sun light for 50 hours. Then the reaction mixture was poured on ice cubes with vigorous stirring, iveroy crystals were obtained these were washed several times with water. Recrystalised from ethanol. Yield 96%, melting point 174^{0}C.

Properties of (XI):

It is brown colour crystalline solid having melting point 210^{0}C. It gave positive test for nitrogen and sulphur. It was desulphurized by alkaline plumbite solution which clearly indicate the presence of C=S group. It was soluble in water, ethanol, DMSO-d_6 while insoluble in carbon tetrachloride, chloroform, benzene, petroleum ether. It formed picrate having melting point 180^{0}C.

Elemental analysis:

[C: 38.37% (found), 39.00% (calculated)], [H: 04.85% (found), 05.50% (calculated)], [N: 41.17% (found), 41.17% (calculated], [S: 13.20% (found), 14.68% (calculated)].

IR Spectrum:

The IR spectrum was carried out in KBr-pellets. The important absorptions are correlated as (cm^{-1}): 3358.29 N–H stretching, 2920.64 C-H stretching, 1665.78 N=C-N stretching, 1150.99 C-N stretching.

NMR Spectrum:

The NMR spectrum was carried out in DMSO-d_6 and $CDCl_3$ This spectrum distinctly displayed the signals due to Ar-H protons at δ 7.3241-6.0145 ppm, -NH proton at δ 3.6237-3.6582 ppm, -CH_2 protons at δ 2.3251-2.6063 ppm, -CH_3 protons at δ 1.2437 ppm.

Similarly, 2-phenylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine **(Xllb)**,2-methylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine **(Xllc)**, 2-p-chlorophenylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine**(Xlld)**, 2-o-tolylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine **(Xlle),** 2-m-tolylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine **(Xllf)** and2-p-tolylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine **(Xllg)** were synthesized by the interaction of 1-formamidino-3-ethylformamidinothiocarbamide (0.1M) **(IIId)** with phenyliso-cyanodichloride, (0.2M) **(XIb)**, methylisocyanodichloride, (0.2M) **(XIc)**, p-chlorophenylisocyanodichloride (0.2M) **(XId),** o-tolylisocyanodichloride (0.2M) **(XIe)** m-tolylisocyanodichloride**(XIf)** and p-tolylisocyanodichloride **(XIg)** lemon juice respectively and enlisted in **Table- 1**

I have mentioned description of only one synthesized compound that is 2-ethylimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine, this table predict that series of all synthesized compound, its % yield and melting point.

Table 1

Sr. No.	2-Substitutedimino-4-amino-6-ethylformamidino-1,3,5-thiadiazine	Juice	Yield %	M. P.
1.	2-Phenylimino----------thiadiazine	Lemon	94	198
2.	2-Methylimino----------thiadiazine	Lemon	90	168
3.	2-p-Chlorophenylimino--thiadiazine	Lemon	93	153
4.	2-o-Tolylimino----------thiadiazine	Lemon	97	179
5.	2-m-Tolylimino----------thiadiazine	Lemon	97	158
6.	2-p-Tolylimino----------thiadiazine	Lemon	97	165

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