A NEW SENSITIVE, ECO-FRIENDLY, ECONOMIC AND EFFORTLESS SPOT TEST FOR AROMATIC NITRO COMPOUNDS.

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Abstract : **Aromatic nitro compounds are routinely assessed in chemistry and forensic laboratories. Present spot test will be helpful in detection of nitro group in micro quantities and in reduced time upto one minute depending upon the nitro compound. The objective of this study is to develop a new, sensitive economic, ecofriendly simple spot test on microplate or filter paper for aromatic nitro compounds. Existing spot test reported requires two step reactions first reduction and then further reaction to produce coloured compounds.. The Nitro group is deactivates and reduces the electron density of the aromatic ring making them more prone to reduction by milder reducing agents. The reported spot test is based on the reduction of nitro group to coloured azoxy compounds by means of reducing sugar e.g. glucose at pH >10 . This type of detection methods also could help police by providing them with low-cost tools for detection of explosive organic compound .The λ_{Max} determined spectrophotometrically for the coloured compound formed is 420 nm. The test besides being environmental friendly will be very handy for the detection of explosives and hence will have wide range of applications.**

KEYWORDS: Spot test, Chemistry Laboratory, Forensic Analysis, Economical, Ecofriendly, Green chemistry, Aromatic Nitro Compounds, Azoxy Compounds, Glucose, Alkali, Undergraduate, Explosives.

I. INTRODUCTION

Aromatic (poly) nitro compounds fit to the class of the most threatening toxic compounds. These compounds are the core of numerous explosive agents. There is a need of sensitive and fast-time methods to detect low concentrations of these compounds. Aromatic nitro compounds, such as 2,4-dinitrotoluene (DNT) and 2,4,6-trinitrotoluene (TNT) are the lion's share explosives in most landmines; therefore, are indicator for landmines. The present study can give economical, greener, less time consuming new spot test for the detection of aromatic nitro compounds in landmine detection and explosive detection for forensic analysis.

The methods of determining these compounds which exist at present are not always satisfactory from the viewpoint of sensitivity, selectivity, fast operation or reliability. Routine laboratory test requires chemicals which add fire to the already hazardous air. The studied methods for rapid and sensitive detection requires the conversion of nitro compounds to luminescence compound or by optical sensors.[1,2,3] The colored Detection of aromatic nitro compounds by means of their pi-complexes with N, N-diethylaniline[4] is also reported. Earlier methods reported for detection of aromatic nitro compounds include first their reduction and then converting the resulting amines to azodyes 0r indophenol which are carcinogenic.[5,6] Instrumental method includes detection of aromatic nitro compounds with electrode polarization controlling sensor.[7]

PRESENT WORK

A review of literature shows that the reported spot test of nitro group are tedious and require two step reactions.[6] Mulliken's Barker test is mostly preferred in the case of detection of nitro group in laboratory. The main advantage of our spot test is that commonly, inexpensive and greener reagents are used which give positive test with polynitro as well as mononitro aromatic compounds. Reduction of nitro group with glucose is already repoted[8] we have successfully transformed this reaction into spot test for nitro functionality.

GENERAL PROCEDURE

The aromatic nitro compound(0.5 mL) was dissolved in alcohol (1mL) and a drop were poured in microplate containing 2 drops of 2N sodium hydroxide. 10% glucose solution in water was added. The reaction was heated in oven at 60° C or in boiling water bath for 5 minutes. The wine red colour was obtained.

RESULTS AND DISCUSSION

The result indicates that the presence of electron-withdrawing group in the aromatic ring facilitate the reaction and minimized the reaction time. Presence of hydrazine group in the ring does not inhibit the reaction and change in the color was observed under the reaction condition. The wine red color compound so obtained is the outcome of reduction of nitro group and is due to partial reduction of nitro group in the aromatic dinitro or trinitrocompounds (figure 1). The spot test give best result in minimum time when NaOH is used as base. Use of pyridine although tried is avoided due to its adverse effect on health and environment.

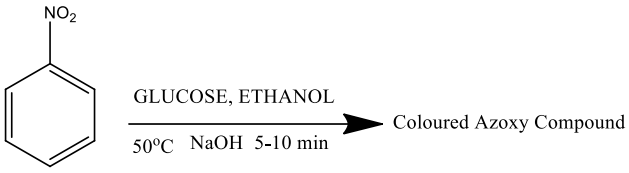

Figure 1.

Table 1: Reaction of nitrocompound with glucose in alkaline medium.

S.No.	Nitro Compound	Reaction time (min.)
1.	Nitrobenzene	8
2.	m-Dinitrobenzene	5
3.	Picric acid	1
4.	3,5 Dinitrosalicyclic acid	1
5.	o- chloronitrotoluene	5
6.	2,4-Dinitrophenylhydrazine	7
7.	m- Nitrotoluene,	5
8.	m-Nitroaniline	7
9.	p-Nitroanisole	7
10.	o-Nitrophenol	6
11.	m-Nitroacetophenone	5
12.	m- Nitrobenzenesulfonic acid	1
13.	2-Nitro-4-chlorotoluene	5
14.	3,5-Dinitrobenzoic acid	1

HAZARDS

Hazards chemicals are not used or in a minimum quantity. Safety data sheet for the chemicals used in the experiments are available at www.sigmaaldrich.com.

CONCLUSION

The reported spot test can be carried out in any chemistry laboratory as no special equipment, instrument and reagents are required. Sugars are easily available reagents. This protocol has been used by undergraduate students of our institute. The present work is a step to develop environmental sensitivity among young and budding scientists.

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