SCIENCE SECTION

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COHERENCE

SEMINAR EDITION

VOL 2, ISSUE 2, DECEMBER 2017

The Bhawanipur Education Society College
Kolkata-700020

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PREFACE

We would like to present with great pleasure 'COHERENCE' our scientific magazine. This is mainly seminar issue on 'Environmental awareness: Demand of the Day' organized by Environmental Development committee of our college in collaboration with Department of Environmental Science, University of Calcutta.

We live in environment and use the environmental resources like air, land and water to meet our needs. While meeting our needs, we put pressure on the environment .When the pressure exceeds carrying capacity of the environment it creates serious problem of environmental degradation. The environmental degradation poses a great danger to man's own survival. Therefore there is a need to create 'awareness' about environmental protection. It is the responsibility of every citizen to use our environmental resources with care and protect them from degradation.

The main objective of publishing this magazine is to originate environmental awareness and its protection amongst the undergraduate students as well as the researchers in this field. Environmental awareness serves as an educational tool, helping people around the world understand the economic, aesthetic and biological importance of preserving resources. Various research papers on air pollution, green house gases, water pollution, wastes and their management, alternative energy and sustainable development, resource utilization and biodiversity of ecologically sensitive regions have been published here. Articles are thoroughly checked and reviewed by experts working in this area. New and emerging trends in environmental science are the key highlights of the articles presented here.

We convey our grateful thanks to Teacher in –Charge and management of our college for their encouragement and financial support.

Dr. S. K. Datta
Vice Principal (Science)
The Bhawanipur Education Society College

FOCUS

Baby steps and teething troubles are not for humans alone: they play dominant role in inorganic growth process also. This was our learning in the process of publication of the second issue of Coherence, a culmination of academic efforts of the Science faculty of Bhawanipur Education Society College.

In this issue we have been more focused in our academic exercise. The first issue of coherence was multi faceted, but here we present a collection of articles discussing man made environmental disasters with extensive mal utilization of air, water, energy and biotic resources while also instilling a sense of hope for the future. The academic discourse was based on the essence that'environmental awareness is the demand for the day'. Moving beyond the rhetoric of 'reduce, reuse and recycle", the academia present research papers on ecological security, mitigation strategies using energy technology for ground water contamination, conservation and honest utilization of marine and mangrove biodiversity green audit, to name a few major themes.

The awareness on alarming situations that demand interventions have been discussed with focus on priority areas earmarked by WWF 2014. The dilemma of curbing airpollution which may unmask the aerosol cooling effect and enhance the surface warming is highlighted and the need for a common integrated framework is put forth. Suggestions on adaptation strategies to mitigate the reject management is considered to be an optimal, economic and sustainable method. Some interesting issues in terms of a strict and proactive conservation strategy being imperative for food security is the core idea in most of the papers included in this volume. Fundamentals of solar photovoltaic systems and global green initiatives are delineated.

In preparing this volume the team has received genuine support and encouragement from scholars in the field of environment science, authors and reviewers, who have contributed in making this publication possible. The editorial board acknowledges the sponsorship of the University Grant Commission in publication of this volume. The administrative body of the Bhawanipur Education Society College has no mean contribution in success of this venture. We acknowledge all.

Kolkata
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Dr. Pradip Dutta Gupta

Contents

An Overview on Bromination : A Green Approach

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Abstract

Anample range of organo-compounds with bromo functionality in nature are formed through photochemical reactions,geothermal events, and metabolic pathways. A huge number of commercially important products are mainly used as flame-retardants, herbicides, pesticides, gasoline additives, halons, polymers, pharmaceuticals, agrochemicals*etc*. They also act a significant role as intermediates in the fields of agrochemicals and pharmaceuticals. C–C formation bond using cross-coupling reactions named as Heck, Stille–Suzuki and Sonogashira coupling can be employed with these bromides. So bromination on organic molecules is one of the most important tools in organic synthesis and mostly can be performed using molecular bromine in industry and agriculture. Elemental bromine is used to manufacture a wide variety of bromo compounds used in industry and agriculture. However, there is risk in treatmentof molecular bromine, as volatile elemental bromine is harmful and is a strong irritant. It causes painful blisters on exposed skin and mainly mucous membranes. Therefore, the use and handling of bromine needs special precautions.

Therefore, bromination under mild condition and milder brominating agents such as monobromomalononitrile (MBM), 2,4-diamino-1,3-thiazole hydrotribromide, Bu_4NBr_3,1,8-diazabicyclo[5.4.0]undec-7-ene hydrobromideperbromide, 1,8-diazabicyclo[5.4.0]undec-7-ene hydrobromideperbromide, H_2O_2–V_2O_5–Et_4NBr, $NaBrO_3$–NaBr, CAN/LiBrare used as green reagent for the bromination on organic molecules.

Keywords: Green technology, brominating, environment friendly, less hazards

1.0 Introduction: Impact of green chemistry on utilization of molecular bromine

Green Chemistry is environmentally benign chemistry which eliminates and reduces the use or generation of hazardous substances in the design, manufacture, and application of chemical products."Now a lot of different approaches are being pursued in the laboratories mainly at the postgraduate and undergraduate level to make students realization of the meaning of green and safe chemistry (Ahluwalia, 2007, p. 1856; Ahluwalia, 2006, p. 1). A huge number of commercially important products are mainly used as flame-retardants, herbicides, pesticides, gasoline additives, halons, polymers, pharmaceuticals, agrochemicals *etc* (Gribble, 1999, p. 335). They also act a significant role as intermediates in the fields of agrochemicals and pharmaceuticals.

2.0 Objectives

C–C formation bond using cross-coupling reactions can be employed with these bromides. So

bromination on organic molecules is important in organic synthesis and mostly can be performed using molecular bromine. Elemental bromine is used to manufacture a wide variety of bromo compounds used in industry and agriculture. However, there is risk in treatment of molecular bromine, as volatile elemental bromine is harmful. It causes painful blisters on exposed skin and mainly mucous membranes. Moreover, corrosive and toxic nature of bromine water is a severe drawback for handling such chemical. Therefore, milder and eco-friendly brominating agents are urgently desirable for the bromination on organic molecules (Eissen and Lenoir, 2008, p. 9830).

3.0 Materials and Method:

Types of sources to avoid molecular bromine

Various solid organic ammonium tribromides like Me_4NBr_3, 2,4-diamino-1,3-thiazole hydrotribromide, Bu_4NBr_3, 1,2-dipyridiniumditribromide-ethane(DPTBE), $PyHBr_3$, phenyltrimethylammoniumtribromideand1,8-diazabicyclo[5.4.0]undec-7-ene hydrobromide-perbromide ($DBUHBr_3$) are exploited for bromination which avoid the direct use of molecularbromine (Toda and Schmeyers, 2003, p. 701). Another method involves oxidative bromination using hydrogen bromide and bromide salts like H_2O_2–V_2O_5–Et_4NBr, oxone/HBr, oxone (the active component is potassium monopersulfate,$KHSO_5$)/NaBr, H_2O_2–HBr, ^{t}-BuOOH–HBr,Selectfluor®/KBr, $NaBrO_3$–NaBr, CAN/LiBr, and cerium(IV)ammonium nitrate (CAN)/KBras a bromine sourcewhere bromine is generated in situ in the reaction mixture (Bora et al., 2000, p. 247). Also *N*-bromosuccinimide (NBS) and monobromomalononitrile (MBM) are also employed for bromination reaction (Pathak, Kundu and Pramanik, 2014, p. 10187).So some of bromomination reactions involving milder brominating agents are included in this review article.

4.0 Results and Discussion:

Some of controlled bromination reaction using green brominating agents

(i) Pathak, Kundu and Pramanik (2014) have successfully designed a mild reaction conditions for monobromomalononitrile (MBM) where it can perform as an efficient and selective mono brominating agent (Figure 1). The efficacy of the methodology lies in the bromination of enamines containing activated aromatic rings and 1,3-dicarbonyl compounds with shorter reaction time and high yields of the product formation (Pathak, Kundu and Pramanik, 2014, p. 10187).

(ii) Mallick and Parida (2017) reported an oxidative bromination on phenols using KBr where H_2O_2acts as oxidizing agent over HPA (15%) impregnated on a zirconia support at room temperature in acetic acid (Figure 2) (Mallick and Parida, 2007, p. 889). Here bromination occurs selectively in para position of phenols and good to excellent yields are obtained.

(iii) Potassium peroxymonosulfate is an inexpensive and readily accessible oxidizing agent. It is commonly used as Oxone®($2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$) and is a versatile oxidant for the transformation of a wide range of functional groups (Webb and Levy, 1995, p. 5117). A number of different aromatic substrates were subjected to the bromination reaction to test the generality of this method by Webb *et al* (Figure 3).

Employing user friendly brominating agents as a transport medium for bromine reduces the chance of expose towards hazardous potential of molecular bromine,examples include; poly(vinylpyrrolidone) (PVP) (Lakouraj, Tajbakhsh and Mokhtary, 2005, p. 481), sol—gel-entrapped pyridiniumhydrobromideperbromide (PHPB@s.g.) (Levin, Hamza, Abu-Reziq and Blum, 2006, p. 1396), pyridine hydrobromide (Tanaka, Shiraishi and Toda, 1999, p. 3069), 1,2-dipyridiniumdibromide-ethane (Kavala, Naik and Patel, 2005, p. 4267), *N*-octylquinolinium bromide (Kaushik and Polshettiwar, 2006, p. 2542), pentylpyridinium bromide (Salazar and Dorta, 2004, p. 1318) and tetramericDABCO (TM)-bromine (DABCO=1,4-diazabicyclo[2.2.2]octane) (Heravi, Derikvand and Ghassemzadeh, 2006, p. 125).

5.0 Conclusion

The demand of environmentally benign reactions is very much significant in view of today's ecofriendly and sensitive attitude. 'Benign by Design' symbolizes the 12 principles of Green Chemistry by John Warner and Paul Anastas. These principles have proven with ample examples for the evaluation of the synthetic chemical procedures that can help scientist to develop new eco-friendly routes. These are very much useful for less waste and also these paths use and produce less toxic substances. The research to avoid toxic, highly reactive, corrosive, and hazardous molecular bromine is still current topic of interest. Still now most of the new bromination methods, which replace the use of molecular bromine, have severe disadvantages, owing to waste production as well as environmental, health and safety aspects. So bromination under mild reaction condition is still urgent requirement.

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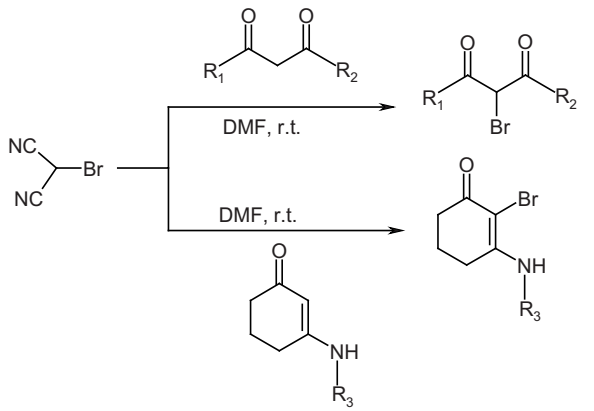

Figure 1: Monobromomalononitrile: an efficient regioselective mono brominating agent

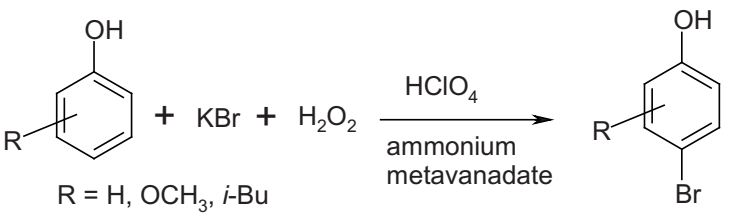

Figure 2: oxidative bromination on phenols using KBr/H_2O_2

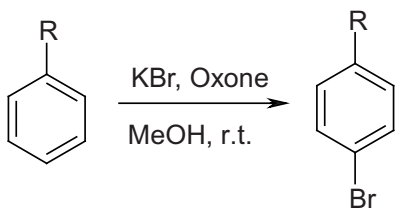

Figure 3: Bromination on aromatic compound using potassium peroxymonosulfate