

ORIGINAL ARTICLE

Synthesis of Drugs Jupiterine-A and Saturnine-A via Retro-Synthetic Formalism: A Theoretical approach.

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ABSTRACT

The novel molecule Jupiterine-A (1) and Saturnine-A (2) which have been isolated via a creative manipulation technique from two pieces of Himalayan stones resembling the characters of the planets Jupiter and Saturn respectively, have been theoretically subjected to their Retro-synthetic analysis. Efforts have been made to make the synthetic strategies of these molecules attractive for the reader, researcher and the learners of Organic chemistry and it's needful for further research.

Keywords: Jupiterine-A (1), Saturnine-A (2)

Received 08/07/2016

Revised 16/09/2016

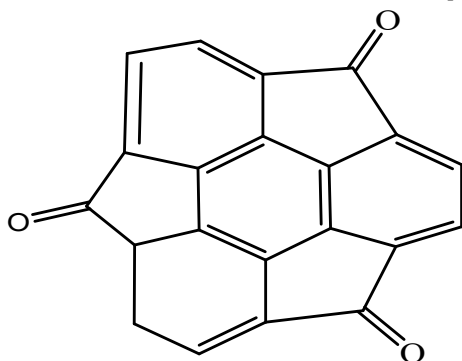
Accepted: 04/11/2016

How to cite this article:

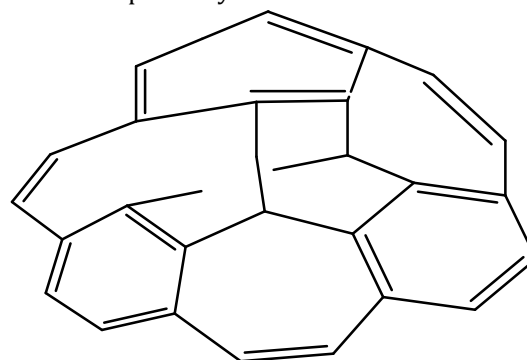
P. R. Dixit, R. Barik, B B. Kar and P. Chattopadhyay. Synthesis of Drugs Jupiterine-A and Saturnine-A via Retro-Synthetic Formalism: A Theoretical Approach. Adv. Biores. Vol 8 [2] March 2017: 63-67.

INTRODUCTION

The natural product chemistry, although happened to be a pretty old branch of science today, scientists have not yet withdrawn their attempts and endeavor to search for newer molecules from our natural systems with the hope that they could make them useful for the cause of human benefits in multi-dimensional pathways. The Jupiterine-A [1a] and Saturnine-A [1b] have been a rare variety of natural molecules discovered from the Himalayan natural sources, from two strange stone pieces that have resemblances with the materials of the planets Jupiter and Saturn respectively.



Jupiterine-A (1)



Saturnine-A (2)

METHODOLOGY

Since the molecules as shown above look highly interesting with respect to their geometrical [2] Symmetrical [3] and Topological [4] aesthetic point of view, we have decided to discuss the probable synthesis pathways of these molecules via a theoretical Retro synthetic Formalism.

We believe that the beauty in organic synthesis always rests on the availability of starting materials, the cost effectiveness of the synthetic strategy and time effectiveness of the methodical procedural progress

[5, 6]. Mention may be we have recently reported a theoretical approach to the synthesis of Pyrene and Fluorene from this lab via a retrosynthetic analytical technique [7]. However, the present molecule Jupiterine-A and Saturnine-A look geometrically such a diverse class of molecules that we need to go via a completely different strategy to reach into the starting materials that can be available in any of the ordinary post-graduate or undergraduate laboratories of India or abroad.

Retro-Synthesis: - A Hierarchy

Professor E.J. Corey and his Co-workers [8] for the first time thought on the synthetic strategy of many complicated organic molecules via retro-synthetic pathways. Although the retro-synthetic pathways have been initially conceptualized via relay approaches, later on the approaches such as the convergent approaches, divergent approaches and synthon approaches have been introduced to make the concept much simpler for the beginners of organic synthesis [5,6]. The use of digital computational technique to derive synthetic pathways of an unknown molecule of difficult structural framework has become a damn easy task in the present day synthetic organic chemistry [10]. However, we have undergone a manual exercise to derive and to discuss the synthesis of our desired compounds via Retro-synthetic Relay Approach, by keeping in the view of cost and time effectiveness in the synthetic methodology. It has also become necessary for us to discuss all the steps of synthesis in the light of space time constraints parameter controlled mechanistic pathways [11, 12]. Although Retro-synthetic strategies to understand organic synthesis are not very new, its connection with space-time relativistic approach is completely new and modern. We also tried to provide readers a feedback on the importance of the stoichiometry and the space-time constraint parameters on the feasibility of an organic chemical reaction mechanism.

RESULT AND DISCUSSION

1. Synthesis of Jupiterine-A

As shown in the Scheme-1, the Jupiterine-A is likely to be obtained from Triphenylene (3) via Friedel craft acylation reaction with phosgene when taken in 1:3 ratio and the reaction is carried out in tetrahydrofuran or hexane. Here the Friedel craft catalysts should be in 6-molar quantities. The Triphenylene is known to be synthesized by Fitting Reaction [13] from Chlorobenzene. Besides the benzyne can also be generated from chlorobenzene (5) in presence of sodamide and liquid Ammonia at -60°C temperature. But at this temperature Ammonia is known to add benzyne to

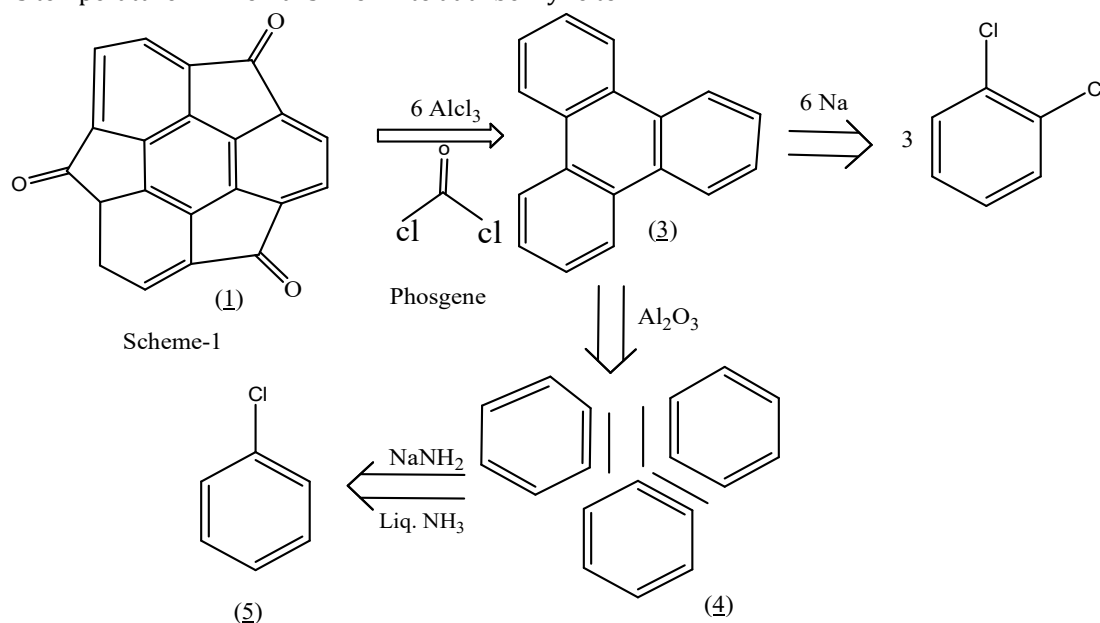


Fig.1. Retro-Synthetic Approach of Jupiterine-A (process-1).

aniline under certain space-time constraints values [14]. (The parameters of space-time constraints includes pressure, temperature, concentration, gravity, identity, symmetry, solvents, substituents, catalysts, sound, light, space, time, etc)

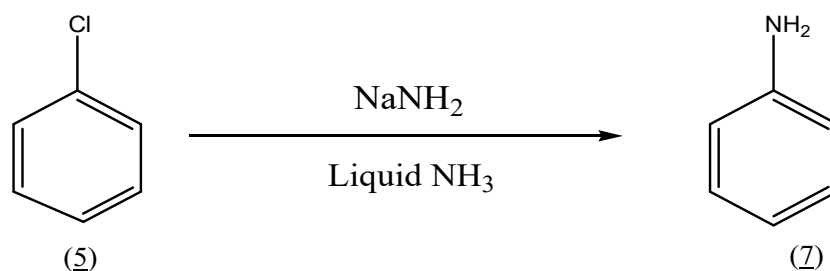


Fig.2. Retro-Synthetic approach of Jupiternine-A (process-2).

However in case, we wish to avoid the amination reactions in the benzyne intermediate, it may be necessary to pump dilute HCl to the reaction medium to stop further amination reaction as shown in the following mechanism. Sometimes the benzene so generated could also quick polymerization to triphenylene (3) in presence of Al_2O_3 catalyst bed without allowing amin-addition reactions in the benzyne.

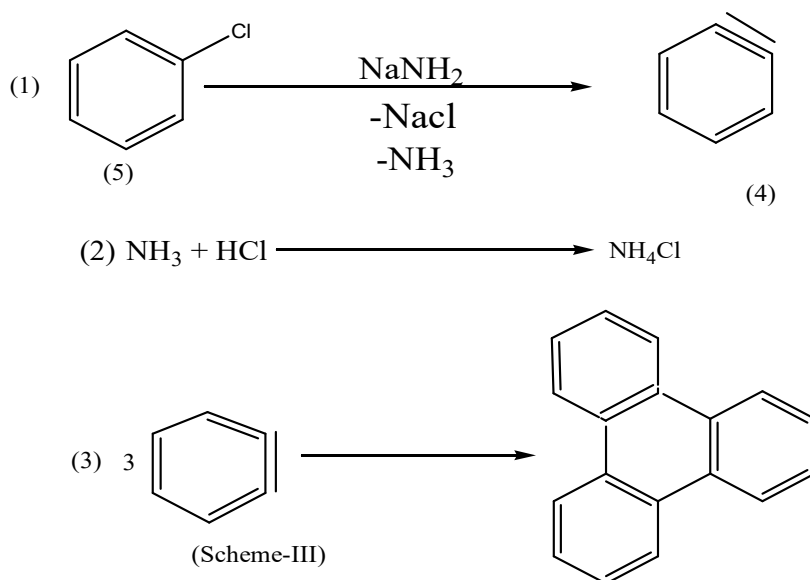
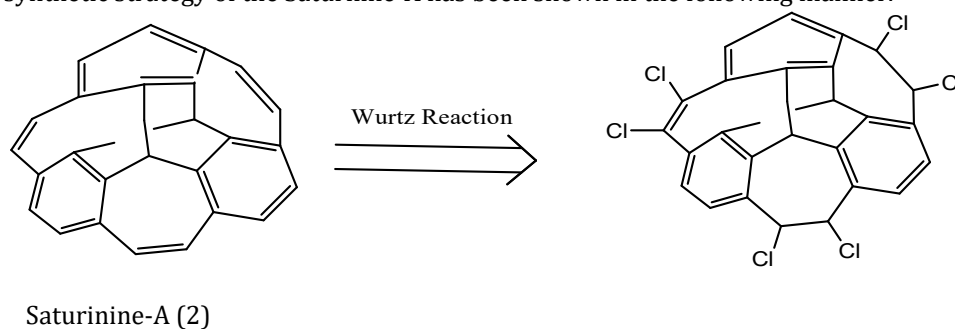


Fig.3. Retro-Synthetic approach for Jupiternine-A (process-3).

On the other hand, the formation of tri phenylene (3) from ortho-dichloro benzene via Wurtz mechanism could also be a facile method.

2. Synthesis of Saturnine-A (2)

The Retro synthetic strategy of the Saturnine-A has been shown in the following manner.



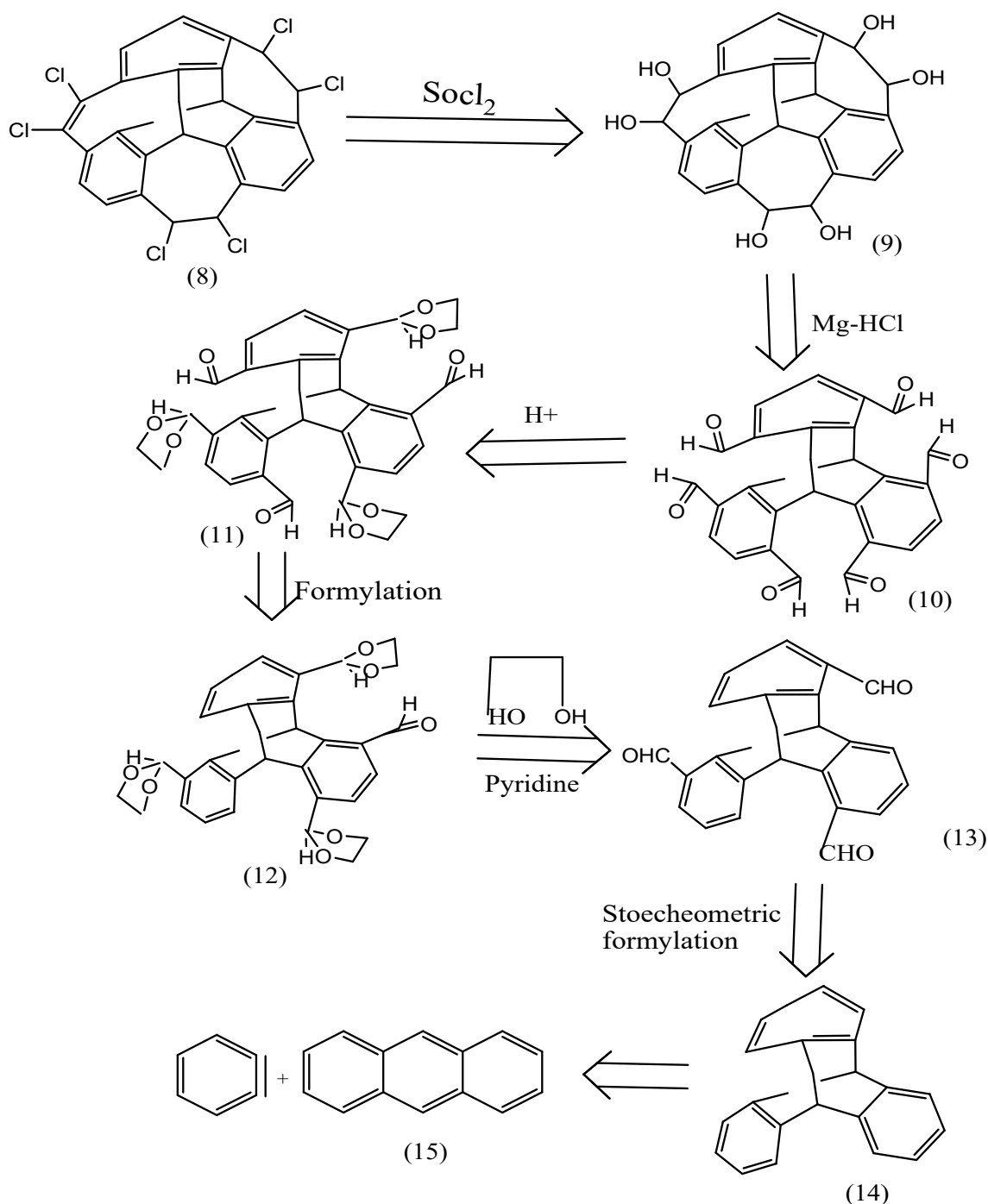


Fig.4. Retrosynthetic approach for Saturnine-A (Complete process).

As shown in the Scheme-III, the Saturnine-A can easily be obtained from the hexachloro -derivative (8) via Wurtz reaction and this hexachloro derivative also can easily be obtained from the corresponding hexa-hydroxy counter part either by reacting with SOCl_2 or in an inert solvent hexane. Again the hexa-hydroxy derivative (9) can easily be obtained via pinacole-reaction from the hexaformyl derivative (10). Again (10) can be obtained from the tri protected system (11) and the (11) can easily be obtained from (12) either by Houben-Hoesch formylation reaction or via Friedal- crafts formylation in presence of H-COCl and BF_3 . Again (12) can be easily prepared from (13) by treatment with ethelene glycol and Pyridine. Further (13) can be easily prepared from (14) by applying Houben-Hoesch formylation reaction or Friedal- crafts formylation technique. Mention may be made that when pressure, temperature and concentration would be kept constant the solvent and catalyst(s) could be the variable factors to check the feasibility of a reaction process.

Here it is also necessary to point out that the conservation of orbital symmetry criteria [15,16] in the formylation process of (14) to (13) always forces to go via an alternative symmetry allowed electrophilic substitution reaction process. Thus randomness in the formylation process of Tribenzobarrelene (14) could be a symmetry forbidden process. Further the Tribenzobarrelene can be obtained by reaction of anthracene (15) with benzyne via Diels-Alder mechanism [16]. Mention may be made that the benzyne so reacted could be generated in-situ via fitting reaction from chlorobenzene.

CONCLUSION

The molecules that we have attempted to discuss via Retro-synthetic analysis are absolutely novel and each belongs to one among the creative molecular universes. The synthetic strategy that we have adopted could be extremely simple in the present day synthetic world. It is possible that these molecules can be achieved in any laboratories in India and abroad via an appropriate space-time parameter controlled pathways. The approaches could be sometimes so exotic that people who loves working with symmetry, geometry and stereo-chemistry would loves these synthetic designs as gateways to paradise of their eternal pressure. On the other hand, in case the biological activities of the molecules (1) and (2) goes in favor of the noble causes of humanity, people of synthetic organic chemistry would probably become made after this.

ACKNOWLEDGEMENT

The Authors would like to acknowledge the encouragements from Founder and Dean, KIIT University, Bhubaneswar and Director, Institute of Minerals and Materials Technology (CSIR), Bhubaneswar, Odisha, India and Principal, Bhadrak (Autonomous) College, Bhadrak, Odisha from their continuous moral and financial Support by without which this innovative activities would not have been possible.

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