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RECENT APPLICATION OF SOLVENT FREE GREEN SYNTHESIS OF SCHIFF'S BASES AND IT'S DERIVATIVES: A REVIEW

R. G. Mahale*[1] and Deepak V. Nagarale

Department of Chemistry, S.S.V.P.S.'s L.K. Dr. P.R. Ghogrey Science College, Dhule, North Maharashtra University, Jalgaon(MS), India.

***Corresponding Author: R. G. Mahale**

Department of Chemistry, S.S.V.P.S.'s L.K. Dr. P.R. Ghogrey Science College, Dhule, North Maharashtra University, Jalgaon(MS), India.

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ABSTRACT

The Chemistry has wide scope for Carbon-Nitrogen bond forming reactions and upgrade from traditional towards modern synthetic and mutidisciplinary methods. The preferred interesting topic in chemistry that may benefit from advantages of Microwave irradiation process. The Microwave technique was intensively used to carry out many kinds of organic and Inorganic preparations and has become a useful non-conventional means of performing organic synthesis. In these review we systematic plotted condensation of the aldehydes and amines and its applications according to recent years development in present global scenario.

KEYWORD: Green Synthesis, Schiff's Base, Solvent free, Microwave, Inorganic preparations.

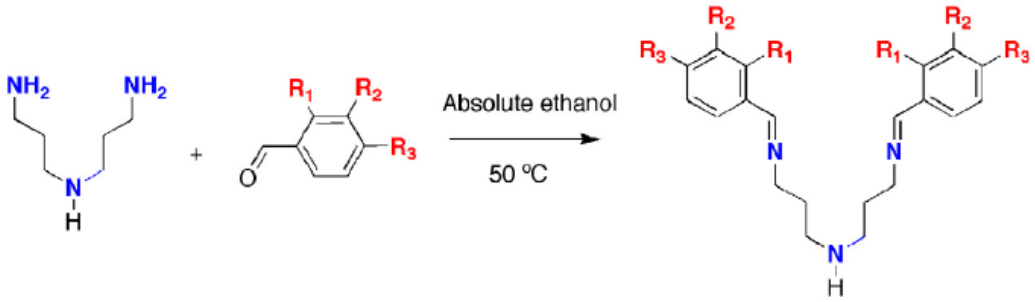
INTRODUCTION

As environmental consciousness in chemical research and industry has increased, efficient, economic and clean procedures have received increased attention in recent years. The development of a simple and effective method, using an environmentally friendly approach as well as an economical process is in great demand in coordination chemistry. Recent advances in technology have now made microwave energy a more efficient means of heating reactions. Chemical transformations that took hours, or even days, to complete their organic reaction, can now be accomplished in minutes. Microwave irradiation is well known to promote the synthesis of a variety of organic and inorganic compounds, where chemical reactions are accelerated because of selective absorption of microwave by polar molecules.[1-4]

A large number of Schiff bases and their metal complexes have been found to possess important biological and catalytic activity. Due to their great flexibility and diverse structural aspects, a wide range of Schiff bases have been synthesized conventionally and their complexation behavior was studies. The development of the field of bioinorganic chemistry has increased the interest in Schiff base complexes, since it has been recognized that many of these complexes may serve as models for biologically important species and were investigated for antifungal, antimicrobial, anti-bacterial, anti-inflammatory, anti-convulsant, anticancer activities[5-9] and synthesized from Vilsmeier-Hack reactions.[10-13]

D. B. Dupare gave synthesis of metal oxides doped polypyrrole–polyvinyl alcohol blend thin films by in situ chemical oxidative polymerization, using microwave oven on glass substrate for development of Ammonia and Trimethyl ammine hazardous gas sensor. They studied surface morphology as observed in the SEM image. That observed to be uniformly covering the entire substrate surface. The sensors were use for different concentration (ppm) of TMA and Ammonia gas investigation at room temperature (304 k). This study found to possess improved electrical, mechanical and environmental stability metal oxides doped PPY-PVA films.[14]

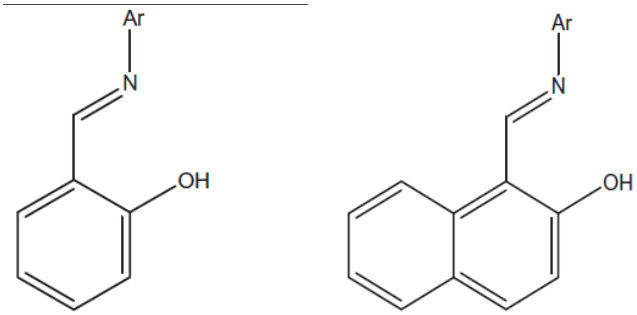
Suzan A. Matar et al studied Six Schiff bases which prepared by reacting 3,30-diaminodipropylamine with different benzaldehyde derivatives. The structures of these compounds were confirmed through different spectroscopic methods such as ^{1}H-NMR, ^{13}C-NMR and mass spectrometry. The prepared compounds were evaluated in vitro for their antimicrobial activity against a number of pathogenic Gram-positive and Gram-negative bacteria and Candida. The Schiff bases were prepared by reacting 3,30-diaminodipropylamine with different benzaldehyde derivatives in ethanol as shown in Scheme 1.[15]



Scheme 1: Synthesis of schiff base from 3,30-diaminodipropylamine and aldehyde.

In findings given by Soleiman Hisaindee et al showed a series of Schiff base derivatives that share common structural properties and by considering their antibacterial and antifungal effects, it was possible to rationalize the trend in the biological data on the basis of specific structural properties of the examined drugs. Generally speaking, drugs with –OH and –SH group tend to be mostly active than otherwise substituted, depending on their position on Schiff base backbone structures.[16]

Eighteen structurally-related Schiff base derivatives, which belong to salicylidenebenzylamine and 2-hydroxy-1-naphthylidenebenzylamine families were prepared and characterized by spectroscopic techniques. All the synthesized compounds were screened in vitro for their antibacterial and antifungal activities.Human pathogenic gram-negative (Escherichia coli, Proteus mirabilis, Pseudomonas aeruginosa and Serratia marcescens), gram-positive bacteria (Staphylococcus epidermidis, Staphylococcus aureus and Bacillus subtilis), and fungi (Alternaria alternata, Aspergillus niger, Penicilliumroqueforti, andSaccharomyces cerevisiae)were evaluated based on their toxicity to different concentrations of Schiff base compounds.

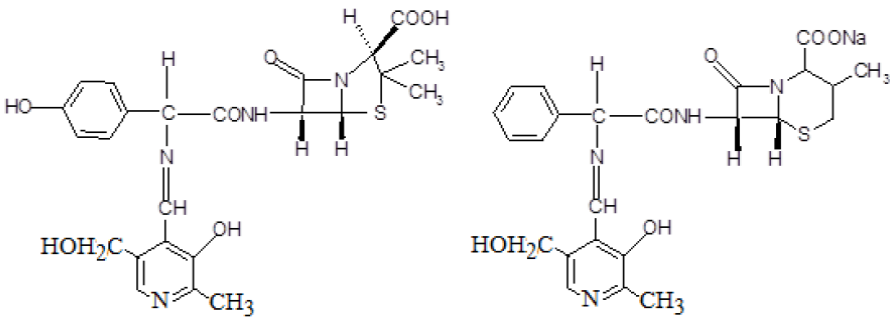


Schiff base derivatives of **Salicyaldehyde**

Schiff base derivatives of **2-Hydroxy-1-naphthaldehyde**

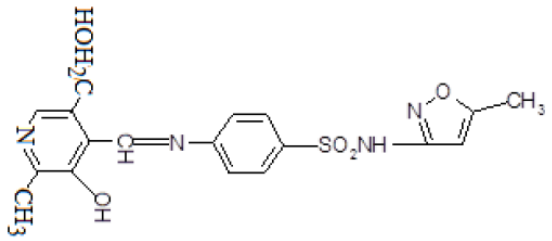
Fig 1: The chemical structures of the examined structurally-related Schiff base derivatives.

K.P.Srivastava et al gave synthesis by using Microwave irradiation as a green approach for rapid, efficient, clean and environmentally benign exclusive synthesis of Schiff bases as new ligands and their complexes with Cu(II) have been developed using condensation of pyridoxal and amoxicillin (L^1), cephalexin (L^2), sulphamethoxazole (L^3) and trimethoprim (L^4) efficiently in analcoholic suspension medium using alkali catalyst with excellent yields shown in fig 2.[17]

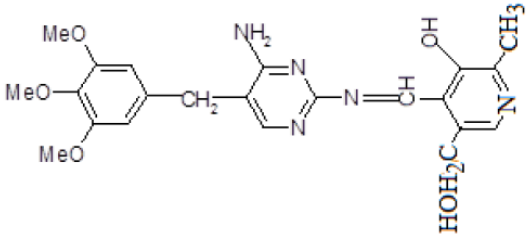


L^1H = Pyridoxylideneamoxicillin

L^2H = Pyridoxylidenecephalexin

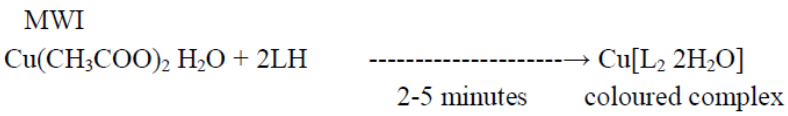


L^3H = Pyridoxylidenesulphamethoxazole



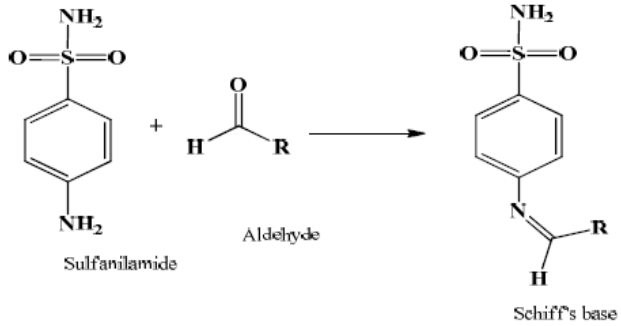
L^4H = Pyridoxylidenetrimethoprim

Fig 2: Ligand used for investigation.



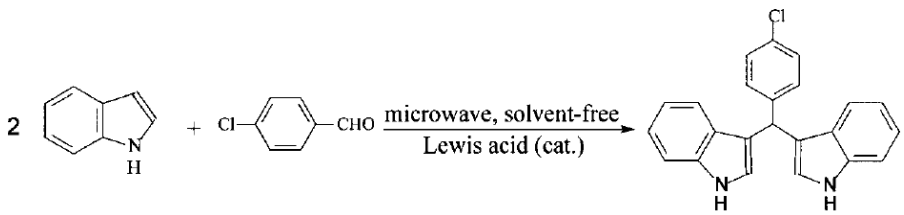
Scheme 2: Synthesis of Metal complexes.

Sofian Saleh Mohamed and coworkers gave synthesis of a series of new Schiff's bases of Sulfanilamide were synthesized by condensation of sulfanilamide with different substituted aromatic aldehydes shown in scheme-3.[18-19]

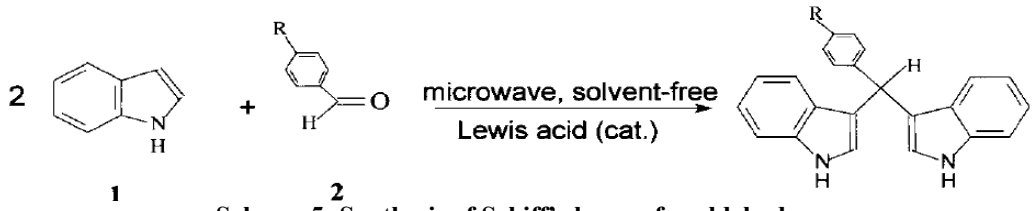


Scheme 3: Synthesis of benzenesulfonamides.

Min Xia et al gave synthesis of Bis(indolyl)methane derivatives which can be rapidly and smoothly prepared in good yields under solvent-free microwave irradiation, though Lewis acid catalyzed electrophilic substitution of indoles with aldehydes and Schiff's bases of aryldehydes.[20]



Scheme 4: Synthesis of Bis(indolyl)methane derivatives.



Scheme 5: Synthesis of Schiff's bases of aryldehydes.

Among these polymers, Schiff base polymers are of considerable interest and are produced by the polycondensation of diamines with various dicarbonyl compounds.[21-30]

M. Y. Khuhawar et al gave a Seven Schiff base polymers poly 5,50-methylenebis(2-hydroxyacetophenone)semicarbazone (PHASC), poly-5,50- methylenebis(2-hydroxyacetophenone)thiosemicarbazone (PHATS), poly 6,60-methylenebis(2-hydroxynaphthaldehyde) 1,2-propylenediimine (PHNPn), poly 6,60-methylenebis (2-hydroxynaphthaldehyde)1,3-propylenediimine (PHNPR), poly 6,60-methylenebis (2-hydroxy-naphthaldehyde)thiosemicarbazone (PHNTS), poly 6,60-methylenebis(2-hydroxynaphthaldehyde) urea (PHNU) and poly-6,60-methylenebis(2-hydroxynaphthaldehyde)semicarbazone (PHNSC) were prepared by polycondensation of 5,50-methylenebis(2-hydroxyacetophenone) (MHA) or 6,60-methylenebis(2-hydroxynaphthaldehyde) (MHN) with semicarbazide, thiosemicarbazide, 1,2-propylenediamine, 1,3-propylenediamine or urea.[31] Polymer-supported Schiff base ligands are synthesized easily and loaded with different metal ions without any difficulty. The catalytic activities of polymer-supported Schiff base complexes are constant in the presence of moisture and during their applications in high temperature reactions. During the last few years, several reports on synthesis of polymersupported Schiff base complexes and evaluation of their catalytic activities have appeared.

Currently, many transition metal ions complexes have been identified as homogeneous catalysts for various reactions, which showed high homogeneity, reproducibility, selectivity, and high activity to catalyze reactions under mild conditions. Although the activities of these transition metal complexes in catalyzing various reactions have been explained at molecular level, these complexes are still associated with problems of corrosion, contamination of reaction products and difficulties in their separation. To overcome these difficulties, heterogeneous catalysts are developed, either by dispersing metal ions on porous solid supports, which are classified as solid supported liquid phase catalysts (SLPC) or chemical binding of metal ions on functionalized polymer supports, which are classified as polymer bound catalysts (PBC).[32-37]

The polymer-supported Schiff base complexes of metal ions are highly active in various reactions. The discussion presented in the review has clearly demonstrated that an impressive progress is made in the area of polymer-supported catalysts in the oxidation of organic compounds. The methodologies described have clearly opened up newavenues for amajor growth in the area of oxidation chemistry. The oxidation of alcohol reactions has made remarkable progress, while the oxidation of alkanes, benzylic substrates and alkenes was extensively explored shown in fig-3.[38]

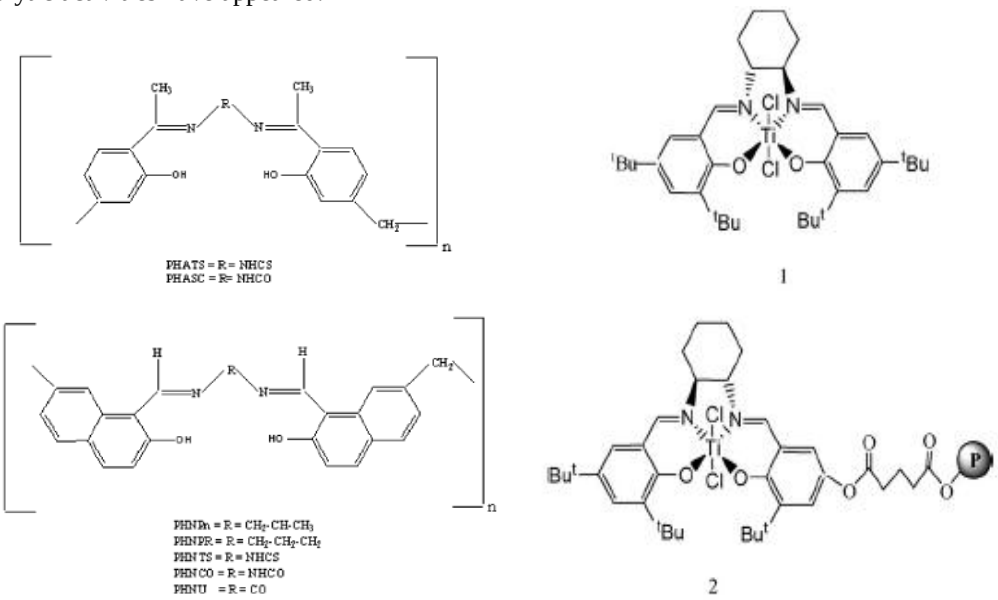
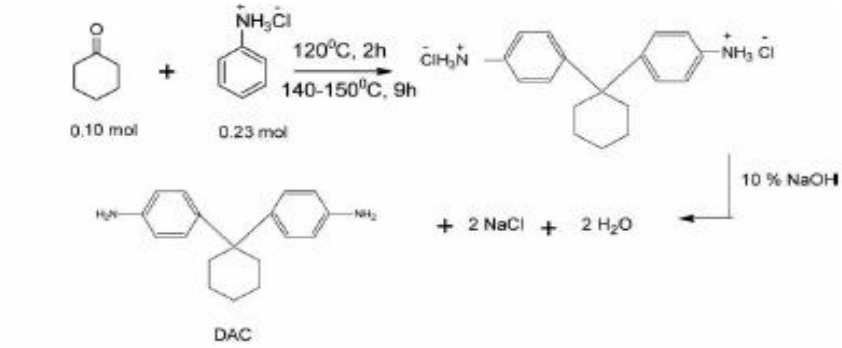


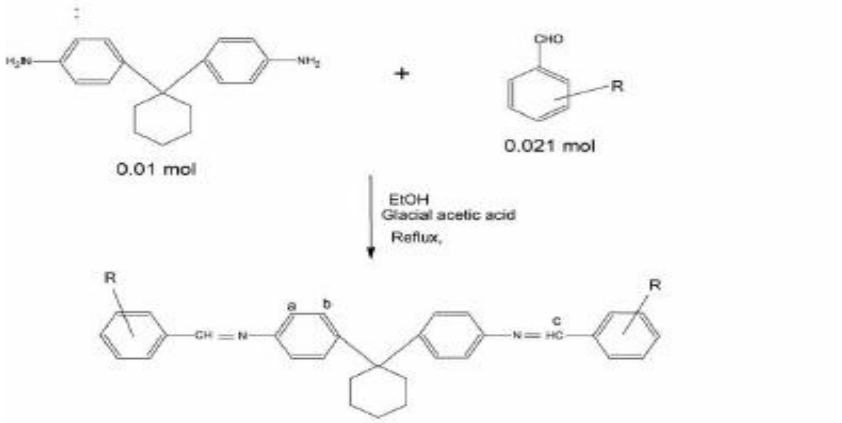
Fig 3: Structural presentation of polymer.

The co-polymerization of metal containing monomers with styrene and divinylbenzene has also been used to prepare polymer-supported catalysts.[39-40]

A series of new symmetric double Schiff bases of 1,10-bis(4-aminophenyl)- cyclohexane and substituted aromatic benzaldehyde are synthesized by classical and microwave-irradiated techniques. The synthesis time is much shorter and yields of the Schiff bases are found to be better with the microwave-irradiation technique than classical technique shown in scheme 6 and scheme 7.[41]



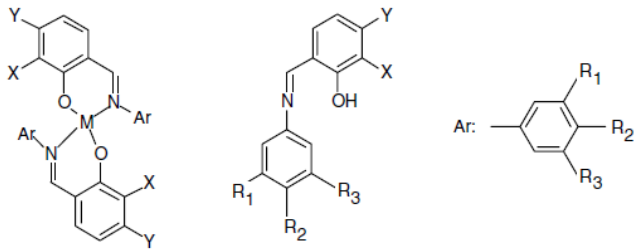
Scheme-6.



Scheme-7.

All of the seven Schiff bases, the standard drugs, and solvent DMF have been screened for their microbial activity against Escherichia coli, Bacillus megaterium, Proteus vulgaris, Staphylococcus aureus and Aspergillus niger by cup-plate method at 37°C.

Aysegul Golcu et al reported the synthesis of the Schiff base ligands, 4-[(4-bromo-phenylimino)-methyl]-benzene-1,2,3-triol (A1), 4-[(3,5-di-tertbutyl- 4-hydroxy-phenylimino)-methyl]-benzene-1,2,3-triol (A_2), 3-(p-tolylimino-methyl)-benzene-1,2-diol (A_3), 3-[(4-bromo-phenylimino)- methyl]-benzene-1,2-diol (A_4), and 4-[(3,5-di-tert-butyl-4-hydroxy-phenylimino)-methyl]-benzene-1,3-diol (A_5), and their Cd(II) and Cu(II) metal complexes, stability constants and potentiometric studies. Antimicrobial activity of the ligands and metal complexes were tested using the disc diffusion method and the strains Bacillus megaterium and Candida tropicalis shown in fig -4.[42]



M: Cu(II) and Cd(II)

Groups	A_1	A_2	A_3	A_4	A_5
X	OH	OH	OH	OH	H
Y	OH	OH	H	H	OH
R_1	H	$C(CH_3)_3$	H	H	$C(CH_3)_3$
R_2	Br	OH	CH_3	Br	OH
R_3	H	$C(CH_3)_3$	H	H	$C(CH_3)_3$

Fig 4: Proposed structure of Ligands and their metal complexes.

CONCLUSION

Carbon-Nitrogen bond forming reactions has broad range for their uses and applications out of that schiffs base synthesis by using microwave upgrade chemistry which transform from traditional to modern synthetic and its multidisciplinary nature. It is the preferred interesting topic in chemistry that may benefit from advantages of Microwave irradiation process. The present review explains the importance of modern synthetic method and its overview of the Schiffs base in chemistry.

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