EMERGING CHALLENGES IN TEACHING LITERATURE AND LANGUAGE IN THE VIRTUAL WORLD

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India Faces Pandemic Covid-19 Disrupts of Teaching and Challenges of Poor Students

Dr. Devashish Haldar

1. INTRODUCTION

The pandemic has significantly disrupted the higher education sector as well, which is a critical determinant of a countries economic future. Sometime in second week of March, state governments across the country began shutting down school and colleges temporally as a measure to contain the spread of the novel corona virus. It's close to a month and there is no certainty when they reopen. This is crucial time for the education sector- board examinations, nursery school admissions, entrance test of various universities and competitive examinations, among others, are all held during this period. After this days passed by with no immediate solution to stop the outbreak of covid-19, school and university closures will not only have a short- term impact on the continuity of learning for more than 285 million young learners in India. This paper will highlight the challenges which poor students facing India in general Chhattisgarh.

2. VIRTUAL LEARNING ARE THE BLESSING OF PANDEMIC IN TEACHING AND ITS CHALLENGES

Transformation is a part of life. Perhaps it is the best and last opportunity for the teachers to educate the society virtually. Opportunity does not come every day. Now it is the right time to fight for education for all through virtual classroom. Virtual-environment plays a fundamental role in education. It is very difficult and challengeable to teach and learn literature through virtual classroom. Literature requires vast explanation and critical appreciations which is impossible through the online mode. Language learners need practice for learning skills. Still the well sophisticated digital tool and techniques are not developed for literary studies. This virtual learning is more successful developed countries. Teaching literature and language online is an important concern, in the virtual world. Through e-learning teachers can't understand the exact method and approach to adopt for their students. It is very difficult and challengeable to teach and learn literature and language through virtual classroom. The virtual classroom is not possible in places like Chhattisgarh,

Jharkhand, Bihar, Odisha, Rajasthan and many other villages of Maharashtra, where 2G internet speeds is provided in many villages in interior areas.

2.1 The Covid-19 Pandemic has Changed Education System in Learning Platforms

The effects of corona virus in the life of students, parents and teachers. Bringing the covid-19 pandemic has sparked a global realization that our current way of life does not work. It has broken hour perception or what is normal deconstructed society as we know it. So, what could the current effects of this global pandemic mean for the future of education system. Some factors affecting the evolution of the education system are as follows:-

a) A change in the purpose of learning

b) The utilization of innovative methods of education

c) Creating tighter relationships with technology in education sector.

2.2 How is the Indian Education Sectors Responding to Covid-19?

In response to significant demand, many online learning platforms are offering free access to their services, including platforms like BIJU'S a Bangalore-based educational technology and online tutoring firm founded in 2011, which is now the world's most highly valued educational technology company. Since announcing free live classes on its think and learn app, other companies are bolstering capabilities to provide a one-stop. Shop for teacher and students for example:- Vedantu, Doubtnet, Unacademy, Topper, Test Book, Grade up began offering teacher and students unlimited video conferencing time, auto-translation capabilities real-time-co-editing of project work and smart calendar scheduling, amongst other features.

2.3 Collaborative Classroom is Helpful to assist our Future e-Learning

Collaborative classroom are the learning environment of the future. Schools and colleges around the world are saying goodbye to the conventional lecture-based learning space where the students remain inert in their respective seats and the teacher remains at the head of the class. In these new collaborative environments, teacher transition from doing all the talking to purposely creating opportunities for student to learn. At the same time, they are facilitating their learners? Thoughts and discussions about what they learn. In

this paper reflect how to collaborative classrooms help further and discover resources to help learners to through e-learning.

3. LANGUAGE PROBLEM IN PEDAGOGY AND ITS DISRUPTION ON ONLINE EDUCATION

The language problem had become a major issue in India's progress in the field of school and colleges. Apart from problems of language pedagogy generally used in Indian school and colleges, such teachers are rather thin on the ground. Most teachers teaching English can do little more than read from a text book. According to study, a very large proportion of teachers were not confident teaching in English. India follows the three-language formula, where children are to be taught in Hindi, English and Regional language, with school having the freedom to decide the sequence in which these languages are taught, as well as the medium of teaching. As we know, Hindi is common official language in India. So, every state follows their regional or Hindi and English languages in education system. Parents, even in rural areas, know about the huge Hindi or Regional languages. Those parents are financially well who has given opportunities to their children study in private schools. Online/virtual classes available material and language in process by 70-80% so the problem faces village poor students because they are Hindi medium preferably. Almost 60-70% students in rural area, who read learn in Hindi medium, because of their low income or poor financial condition. So, in this case majority of Hindi/Regional language medium students raised all over India, after that they cannot give important to learning in English languages. The case of our online learning in Hindi or Regional languages will not better develop for online courses. English language at the advance level of online learning or read and practicing. So, we can tell that English is a global language. People often talk about English a global language. With more than 350 million people around the world speaking English as the first language.

3.1 Lack of Smart Phone, Poor Connectivity a Challenge for Teachers and Students Online Learning

Teachers are facing several challenges in the online mode of learning and teaching. The online platform may be the only way to reach students during lockdown, but digital medium comes with its own challenges. Most of the students and teachers living in remote areas are facing trouble due to slow internet connectivity. In higher institution like IIT have found that about 10% of their students are not equipped to assess online classroom instruction from home. A survey by IIT-Kanpur revealed that 9.3% of its 2789 students, who

responded to the survey, cannot download any material sent by the institute or study online. Every day, the classes are being conducted via Zoom, Google meet, whatsapp and many other app, for 2 to 3 hours, but a communication gap affects understanding. The videos get paused in the live feed due to server issues so he/she missed their live session. Not to clear their doubts.

3.2 Academicians are Facing Challenges in Conducting Online Classes

In online teaching we have lots of advantage, but we also need to recognize their limitations. Students may sometimes get frustrated due to the lack of human contact, the absence of a teacher and an inability to discuss it with their classmate so the students and teacher may need space where they can resolve their queries and practice with real tools, study materials i-e books, library and a health environment. I am a professor and I believe that students are getting impatient or boring due to the challenges of the online module. "When we start a live class, most students get connected, but after a certain period, they start leaving due to poor connectivity or communication gaps". With the lockdown, the teacher is solving their queries over email. The students who could not participate in live classes in Zoom or other such platform, for them we are uploading notes, video lectures and assignments creating a separate platform i-e cgschool.in. But according to the teacher, live classes often got disturbed due to continuous buffering and slow internet, so students mainly choose one to one interaction via-whatapps as there is less chance of disturbance due to lesser load.

4. REMOTE AREAS POOR STUDENTS ARE BADLY HITTED

During this lockdown the situation is worse for these from remote non-urban areas. Highlighting India's poverty and digital device, poor connectivity and lack of smart gadget is providing a hassle for many students. The students who are coming mostly from families of fishermen, farmers, fruit sellers, street venders and home servants. Many students don't have smartphone or laptops to attend online classes or get work on whatsapp because of their financial problem, they how to be afford this expensive expenditure. In lockdown period it's to be more tuff for their service. So low income families students does not fulfill their minimum daily needs. So how could they purchase smart phone and internet connection? Covid-19 has created a challenge for rural areas students. The question is how those people who are not economically well of assess the resources what happens to education to education. But today's reality is different. A large part of India is not used on social media and a very high percentage is not too connected on the mobile. Most of the platforms used

by institution and colleges do not have sophisticated technology, than how to be students can follow the audio-video lectures and virtual lesson. In Chhattisgarh, Jharkhand, Bihar, Rajasthan, Odisha and many other villages of Maharashtra where 2G internet speed is provided village interior areas, Jammu & Kashmir and we know for online classes or learning 4G internet speed is necessary. In my experience, for this reason many government school and colleges have not taken online classes and not only government school and colleges many private school and colleges are faced this problems. I hope, over a period of time, we must mentally shift to the new system and the government has to improve connectivity, the government schools and colleges have taken to online classes and it has succeeded. Many teachers feel the things and they can try to solve their problems over a phone call or video calls. "Learning cannot stop even if schools and colleges are closed".

5. CONCLUSION

Society has to embrace technology of education and technology in education then society can transform from pandemic to pan academic. It's a modern education system. Coming future will be competition to traditional education system like a black board, chalk, pencil and technical education system like an online classes, providing online course material and emphasis to the virtual classes.

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Chapter

Salen and Related Ligands

Ashish K. Asatkar, Mamta Tripathi and Deepali Asatkar

Abstract

The salen and related ligands are very popular among the inorganic chemists due to multiple reasons such as ease in synthesis, coordinating ability with very long range of metal ions, facilitating the metal ions to adopt various geometries, ability of stabilising the metal ion in variable oxidation states and potential applications of metallosalen in several fields. The most common application of metallosalen is in the field of catalysis because of their recoverability, reusability, high efficiency, high selectivity and their capability of working as homogeneous as well as heterogeneous catalysts for numerous functional group manipulations including asymmetric synthesis. Molecular magnetism, sensory applications, bioinorganic activities and medicinal applications of metallosalen are also very promising areas of their applications. Porous materials involving metal organic frameworks (MOFs) and supramolecular building blocks are increasingly getting attention of researchers for the gas absorption and heterogeneous catalysis.

Keywords: salen, salphen, Schiff-base, chelate ligand, metallosalen

1. Introduction

The coupling of aldehyde group with primary amine yields imine bond which is called Schiff's base. Salen ligand system, one of the most studied classes of chelate ligands, is also a Schiff's base ligand. The earliest report of salen-metal complexes is probably by Pfeiffer et al. in the year 1933 [1]. The word 'salen' is composed of two abbreviations, sal+en; '*sal*' stands for salicylaldehyde and '*en*' stands for ethylenediamine. When two equivalents of salicylaldehyde reacts with one equivalent of ethylenediamine potential tetradentate chelating ligand known as 'salen' is produced (**Figure 1**).

Usually, these reactions do not need any catalyst and proceed straightforwardly but sometimes the products may be hydrolysed in reversible manner. To overcome this problem, dehydrating agents or molecular sieves (3 Å) are used so that the water molecules produced during the reaction can be absorbed. Dean Stark apparatus is also used for the removal of water molecules when water-immiscible solvent (e.g., toluene or benzene) is used. Sometimes template synthesis is also performed to get metal-salen complexes directly in which process first metal-salicylaldehyde complex is prepared *in-situ* as template then ethylenediamine is added to get salen ligand. Although, the salen ligands are sensitive towards hydrolysis which is catalysed by acid, their metal complexes are quite stable and thus to avoid the hydrolysis of salen ligands during the applications, their metal-complexes are often used. Metal salen can work even in aqueous medium. Moreover, the salen ligands have potential to stabilise metal ions in various oxidation states, making them good candidates as catalysts.

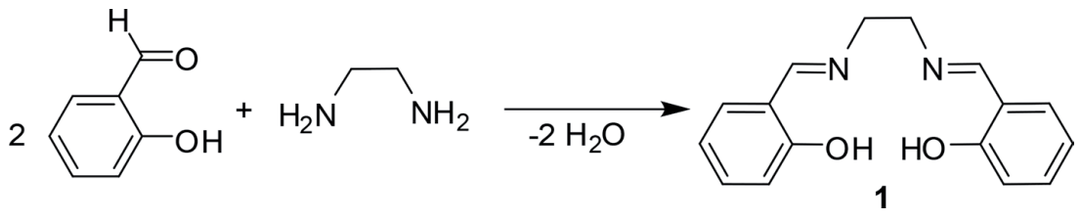


Figure 1.
Synthesis of salen ligand.

Salen ligand possess N_2O_2 donor sites which offers metal ions to adopt various geometries such as square planar, tetrahedral, square pyramidal and octahedral as well, with additional ligand(s) if required. A large number of metal ions have been introduced to salen to produce variety of complexes [2–4]. A very broad range of transition metals, main group metals and inner transition metals have been coordinated with salen ligand systems. Being the multidentate ligand, their complexes often have very high formation constants. Salen based complexes have potentially been used in several fields like catalysis, biochemistry, electrochemistry, sensors, molecular magnetism and materials science. Salen-metal complexes are still leading in the field of homogeneous catalysis for various organic reactions. In the past few decades, numerous reviews based on salen ligand system have been published, highlighting its importance [5–8].

2. Salen ligands and derivatives

Several manipulations have been done on parent salen system to develop the varieties of salen system for various applications. The derivatives of salen are designed to develop desirable properties like solubility, stability, chirality, catalysis, extended conjugation, etc. Aromatic ring and diamine linkage (e.g., ethylene link) are two main portions in salen ligand system, which are used to put various substituents. 3-,5-Positions of salicylideneimine are frequently used for substitution. Substitution at 3- and 5-positions of salicylideneimine also improves the catalytic activities and prevents dimerization as well. The numbering of positions in salen system is shown in **Figure 2**. Substitution at aromatic ring of salicylaldehyde is very popular to enhance solubility of salen ligand and its metal complexes while the substitution at diamine linkage is commonly used to get the chiral ligand. Another position available for the substitution is carbon atom of imine bond.

2.1 Chiral salen

The asymmetry is introduced to salen system mostly by the use of chiral diamine. Chiral salen are of particular importance in asymmetric synthesis as enantioselective catalyst. Many procedures are known for chiral synthesis of

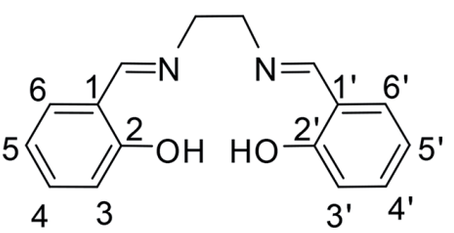
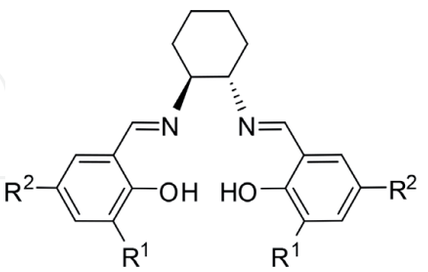


Figure 2.
Numbered positions in salen ligand.

ligands using diamine having one or more stereocentres [9, 10], or a stereoaxis [11], through the incorporation of axial [12] or planar [13–15] chirality within the salicylaldehyde. *Trans*-1,2-diaminocyclohexane and 1,2-diphenylethylene-1,2-diamine are often used as 1,2-diamine to produce the chiral salen. These two chiral salen (**2** and **3**) are very popular and their several derivatives have been reported [16]. Very often, tertiary butyl group and long alkyl chain are put to modify solubility, steric factor and electronic factor.



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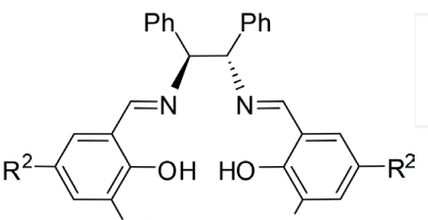

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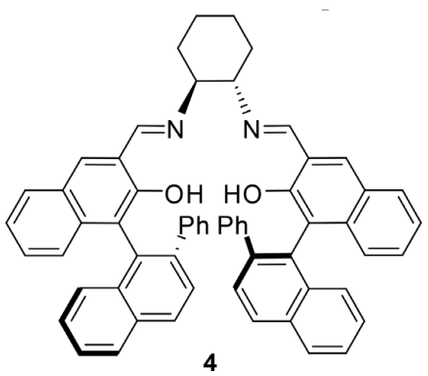
Chiral binaphthyl salen complexes (**4** and **5**) have been designed in such a way that the complexes possess two stereogenic centres and thus considered as second generation metal salen complexes. One of the stereogenic centres belongs to binaphthyl unit while other belongs to diamine unit [17–19]. The complexes were used for non-racemic oxidation of prochiral sulphides.



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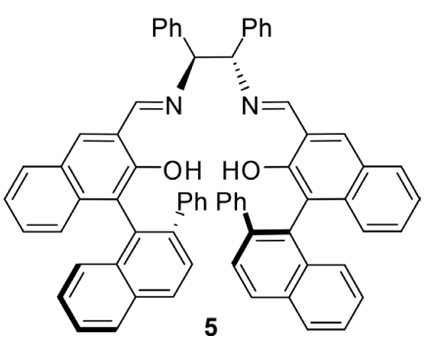

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2.1.1 Non-symmetrical salen

Salen ligand systems have successfully been employed as homogeneous catalysts for variety of organic functional group manipulations. Very often they are symmetrical and having C_2-axis of symmetry. Non-symmetrical ligands bring out further magnify opportunities for tuning of electronic, steric and catalytic properties and therefore various nonsymmetrical analogues of salen have also been developed [20]. There are various advantages of unsymmetrical salen over symmetrical salen such as nonsymmetrical salen with single functional group can be immobilised onto heterogeneous and homogeneous traps to recover it after use [21, 22]. Moreover, electron releasing and/or withdrawing groups can be put on aryl rings of salicylideneimine part of salen. Presence of electron releasing and withdrawing groups together acts as push-pull system for electron density. Also, the unsymmetrical salen-metal complexes have shown better enantioselectivity in certain cases [23, 24].

The easiest way to prepare an unsymmetrical salen can be direct two step Schiff base coupling i.e., the reaction between salicylaldehyde and ethylenediamine in 1:1 molar ratio to get mono-keto-imine product followed by the reaction with substituted salicylaldehyde (**Figure 3**) [25–27]. This method do not need any

protection of group or presence of special reagent, but the main drawback of this method is that the stepwise coupling is not much favourable due to the formation of symmetrical product in first step and lability of imine bonds towards hydrolysis which reduces the yield of desirable unsymmetrical product drastically. Jacobsen et al. exhibited another way to prepare nonsymmetrical salen ligand directly by the reaction of two different salicylaldehyde derivatives and (1R,2R)-(+)-1,2-diaminocyclohexane L-tartrate in 1:1:1 molar ratio in single spot, but in moderate yield (**Figure 4**) [28, 29]. Another approach for the synthesis of non-symmetrical salen is selective protection of one of the amine groups of diamine compound followed by Schiff base coupling of another amine group with salicylaldehyde, then the protected amine group is deprotected and coupled with distinct salicylaldehyde (**Figure 5**) [30, 31].

Silica- and polymer-immobilised Co(III)-salen non-symmetrical complexes (**6**) have also been developed and successfully used as catalysts for hydrolytic kinetic resolution of terminal epoxides with better rate, enantioselectivity and recyclability [32, 33]. Similar Mn(III)-salen non-symmetrical complexes have also been designed and studied [7]. Rigamonti et al. reported the synthesis of nonsymmetrical salen-Cu(II) complexes (**7**–**14**) by the reaction of salicylaldehyde/5-nitrosalicylaldehyde

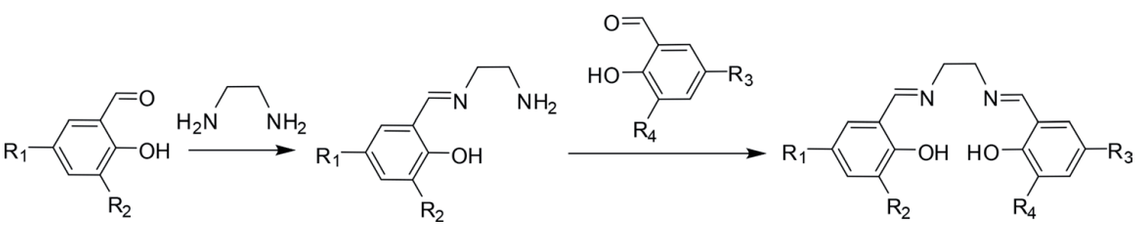


Figure 3.
Direct two step synthesis of nonsymmetrical salen ligand.

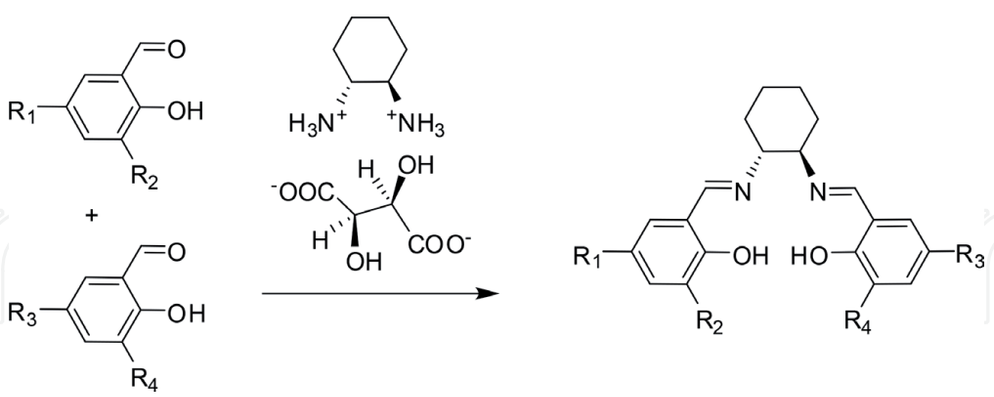


Figure 4.
Direct one step synthesis of nonsymmetrical salen ligand.

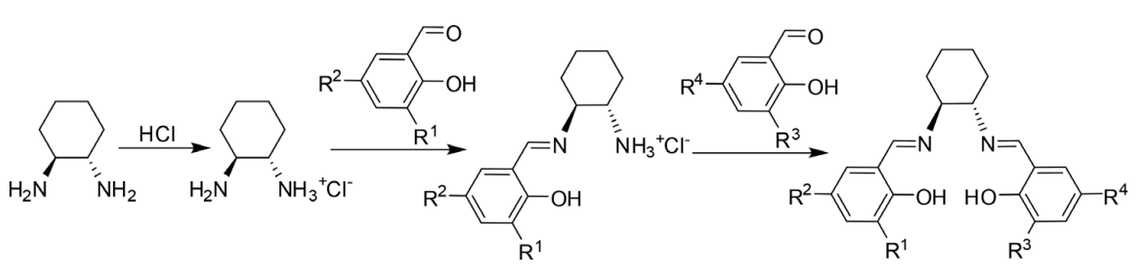
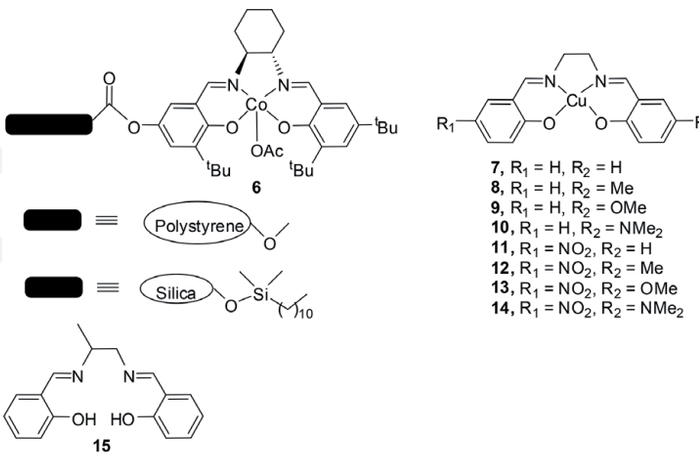


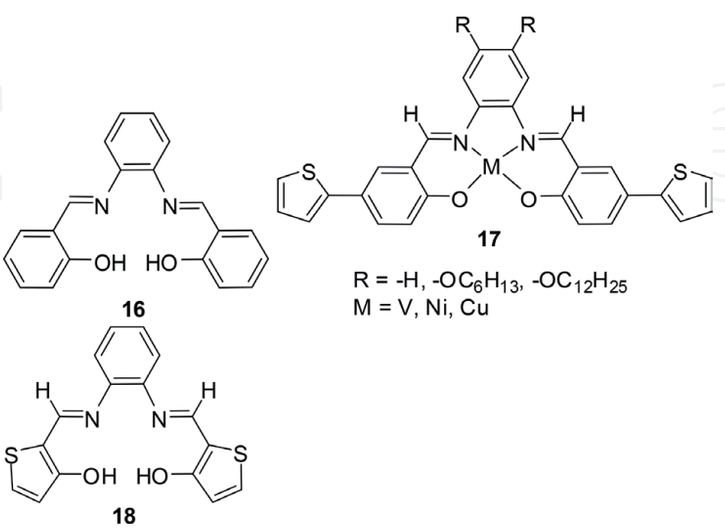
Figure 5.
Protection-deprotection method for the synthesis of nonsymmetrical salen ligand.

and ethylenediamine/propylenediamine in 1:1 molar ratio in presence of Cu(II) ion and pyridine followed the addition of differently substituted salicylaldehyde and their nonlinear optical properties were studied and correlated with the structural diversities [34]. Salen ligand with methyl group at ethylene backbone is known as "salpn" (**15**). Salpn and its complexes have been used as additive in engine oil [35].



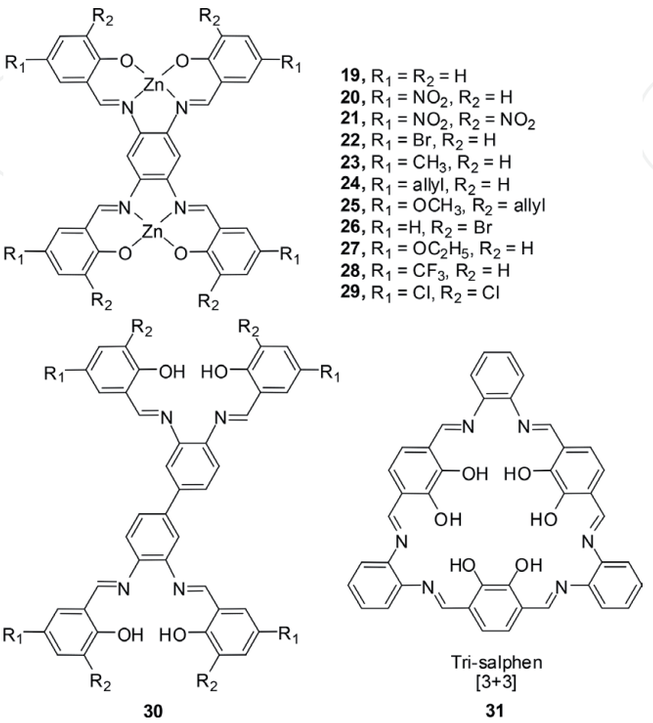
2.2 Conjugated salen

When phenylenediamine (phen) is taken in place of ethylenediamine during the reaction, the ligand formed is known as "Salphen" or sometimes "Salophen" (**16**). Salphen has extended conjugation with rigid planarity when coordinated with metal ion in square planar, octahedral or square pyramidal geometry, which is a very important criterion for material applications. Their photophysical properties can be fine-tuned by putting suitable substituents. Pietrangelo et al. synthesised thiophene capped salen ligands and their V, Ni and Cu copper complexes (**17**) and electrochemically polymerised them [36]. Asatkar et al. reported the synthesis of thiophene analogue of salphen (**18**) by taking 2-formyl-3-hydroxythiophene in place of salicylaldehyde and their Cu(II) and Zn(II) complexes [37]. However, the complexes could not be electrochemically polymerised as thiophene capped salphen did.



Even more complicated salphen have been developed by linking/merging two or more such units either through phenelene or salicylaldehyde [38] Bis-salphen scaffold ligand can be prepared by the reaction of four equivalents of salicylaldehyde and one equivalent of 1,2,4,5-benzenetetramine and its derivatives can also be developed is similar way [39, 40]. Kleij et al. reported the synthesis of unsymmetrical

bis-metal-salphen scaffold complexes by partial hydrolysis of parent symmetrical bis-zinc-salphen scaffold complex followed by Schiff-base coupling with differently substituted salicylaldehyde derivatives (**19**–**29**) [41]. Similarly, another bis-salphen symmetrical and unsymmetrical ligands (**30**) are prepared using one equivalent of 3,3′-diaminobenzidene and four equivalents of salicylaldehyde [42, 43]. Salphen based tri [3+3] (**31**), tetra [4+4] and hexa [6+6] macrocycles have also been prepared using 2,3-dihydroxybenzene-1,4-dicarbaldehyde and 1,2-phenylenediamine [44–47].



2.3 Salen based metal organic framework

Metal-organic frameworks (MOFs), is a fascinating classification of porous materials that can exits as self-assembled *via* coordination of metal aggregation/ions with organic linkers [48–50]. Shultz et al. synthesised MOF using pyridine functionalized Salen-Mn complex and tetrakis(4-carboxyphenyl)benzene [51]. The MOF was further used to prepare new MOFs with change in metal ion. The Mn-MOF was demetalated first using H_2O_2 then remetalated with Cr(II), Co(II), Ni(II), Cu(II) and Zn(II) ions [52]. Lin et al. reported MOFs using chiral Mn-Salen functionalized with variable size dicarboxalic acid linkage. The MOFs exhibited asymmetric epoxidation catalysis with enantiomeric excess as high as 92% [53]. Jeon et al. reported infinite coordination particles based on carboxalic acid functionalized Salen-Zn complex and studied the gas absorption capacity. The amorphous material showed excellent hydrogen gas intake capability [54]. Roesky et al. used carboxalic acid functionalized Salen-Ni complex and lanthanides to synthesise MOFs [55]. Shape of the framework was found to be dependent of size of lanthanides.

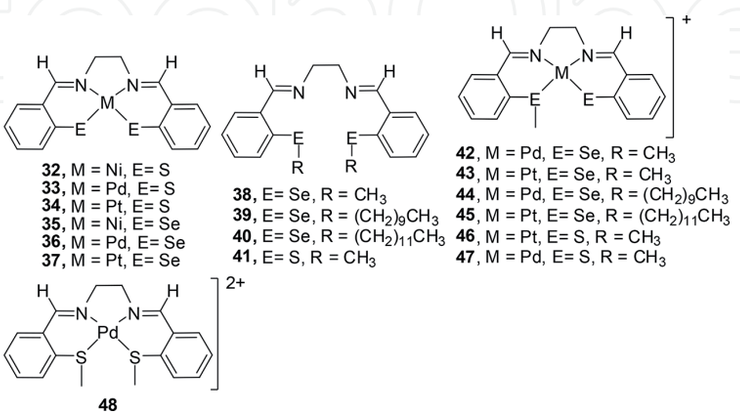
Kleij et al. found the unique self-aggregation nature of bis-Zn(salophen) [14, 15, 56, 57]. They have secure self-assembly behaviour through linking coordination motifs that are fundamentally different from those usually found for the self-assembly of mononuclear Zn-salophens [58]. This takes place on both at the interface of solid-liquid as well in solution. Oligomeric $(Zn{-}O)_n$ coordination moiety are accustomed inside the assembly and this is quite distinct from mononuclear analogues

of Zn(salphen) which form dimeric structures having a classical Zn_2O_2 central unit [59]. Multimetallic salen frameworks have been revealed to act as metallohosts forming adduct complexes with further structural ordering upon substrate binding [38]. Nabeshima et al. employed a linear metallohost containing two N_2O_2 binding units [60]. Upon metalation with Zn(II) a 1:3 ligand to metal complex forms *via* a highly cooperative process. One Zn(II) ion is situated in a C-shaped O_6 site in the centre of the helical complex. Guest exchange was shown to occur through substitution of the central Zn(II) with rare earth metal and lanthanide cations. Excitingly, the helicity of the complex is relying on the size of the central guest cation.

3. Analogues of salen

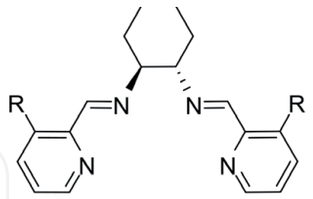
Due to the extended applications of salen ligand systems, their various analogues have been developed and studied. Chalcogen analogues of salen include sulphur and selenium derivatives as thiasalen and selenasalen. However, the sulphur and selenium analogues are relatively less explored because of the volatile nature, instability, synthetic complications, unpleasant smell and adverse effect of thiol and selenol compounds. To synthesise the metal-thiasalen/selenasalen complexes, template synthesis is often used.

Dutta et al. reported the one pot synthesis of thia/selena analogues of salen-metal complexes (**32**–**37**) *via* oxidative addition of zero valent group ten metals (Ni(0), Pd(0) and Pd(0)) to S-S/Se-Se bond of bis(o-formylphenyl)disulphide/−diselenide followed by *in situ* coupling with ethylenediamine [61]. Panda et al. reported the synthesis of bis(alkylseleno)salen ligands (**38**–**41**) by the reaction of 2-(alkylthio/seleno)benzaldehyde and ethylenediamine [62]. Their complexation with Pd(II) and Pt(II) ions exhibited very interesting results. Complexation of 2-(alkylseleno) benzaldehyde with Pd(II) and Pt(II) ion yielded the formation of unsymmetrical complexes with the cleavage of one of the alkyl groups from Se-C(alkyl) bonds. However, the complexation with Pd(II) ions Complexation of 2-(methylthio) benzaldehyde with Pt(II) ion, reported by Dutta et al., yielded similar unsymmetrical complex (**42**–**46**) while the same with Pd(II) ion yielded time dependent product [63]. When the reaction mixture was refluxed for 5 min the symmetrical complex (**48**) with both the methyl groups intact was obtained, but when it was refluxed for 4 h the unsymmetrical complex (**47**) was obtained.

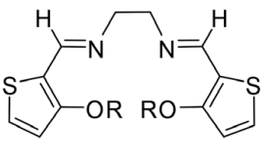


Benzene rings have also been replaced by other aromatic rings to design the new salen analogues. Jeong et al. reported the synthesis of pyridine based salen type chiral ligands (**49**–**50**) and their complexes and used them as enantioselective catalysts in Henry reaction [64]. Asatkar et al. reported the thiophene analogues (**51**–**52**)

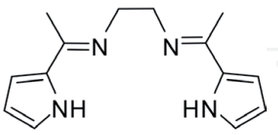
of salen ligand system [65]. Interestingly, thiophene analogue of simple salen was found to exist in different tautomeric forms in solid and solution phases, unlike salen ligand. Its reaction with Cu(II) ion resulted in the dimeric complex. Another example of change in aromatic ring is pyrrole based salen type ligand (**53**), reported by Berube et al. along with its dimeric samarium(II) complex [66].



49, R = H,
50, R = CH_3



51, R = H
52, R = CH_3



53

4. Applications of salen-metal complexes

M(salen) complexes have unique and exciting class of ligand based complexes with exceptionally versatile applications ranging from laboratory reaction to mass scale industries level. Interestingly, metal salen complexes gained popularity because of their roles in multiple areas few important of them are discussed below:

4.1 Catalysis

Metal-salen complexes appear as both homogeneous and heterogeneous catalyst and have been substantially investigated by researchers for multiple uses [5]. The most attracting feature of metal salen catalysts is that they can be recovered and reused. Usually found that the salen as catalyst possess high stability revealed by their high stability constants [7]. When metal salen are applied as catalyst, demetalation of the complex occurs because of competitive binding with reagents, solvent or products, may be associated with changes in the oxidation state of metal in catalytic cycle. Few important reactions catalysed by metal salen includes Meerwein-Ponndorf-Verley reductions (MPV) [67, 68], Friedel-Crafts Reactions [69], Oppenauer oxidation, Tishchenko reactions [70, 68], ene reaction [71], mixed-aldol condensation [72, 73], Diels-Alder reactions [71], dipolar cycloadditions, Claisen rearrangements [74] and the cyclotrimerization of isocyanates to isocyanurates [75].

Interestingly, Metal salen holds important role in many oxidation reactions like alkene epoxidation [76], asymmetric syntheses of cyanohydrins and amino acids [77], and oxidation of heteroatom-containing compounds [78]. In biological system they actively take part in catalytic oxidation of Ni(III) oxidised in the catalytic cycles of Ni-Fe hydrogenases [79–82], acetyl coenzyme A synthase(ACS) [83–85], COdehydrogenase [86, 87], and methyl coenzyme M reductase [88]. Mirkhani et al. have found that the oxidation of diphenyl sulphide mediated by Mn(III)-salphen and Mn(III)-salen employing terminal oxidant as sodium periodate. The Mn(III)-salphen complex yields a product mixture of sulfoxide and sulfone (4, 1 ratio) in 100% transformation under mild conditions [89]. This is in contrast to the analogous Mn(III)salen complex which only led 18% (ratio of sulfoxide and sulfone, 2:1). Mn(III)-salphen catalytic system was also successfully applied towards a variety of other sulphides and also furnished 100% yields.

Salen complex of heterobimetallic origin have been exclusively examined for many asymmetric catalytic synthesis [90]. Salen ligands are prepared from diamines and salicylaldehydes [91], configuration of both of these constituents can

easily be changed, sterically modified as per desirable physical and electronically altered which makes it possible for the synthesis of recyclable and immobilised salen complexes [7, 92–96]. Shibasaki et al. have used chemoselective complexation of transition metals at N_2O_2 coordination core while the rare earth metal utilised O_2O_2 core of same ligand. However, the key role for selectivity and reactivity of these multimetallic catalysts is based on metal ions e.g., coupling of Cu(II) and Sm(III) yields 66–99% enantiomeric excess (ee) in Mannich-type reactions [97] whereas Pd(II) and La(III) is the best combination for the asymmetric synthesis in Henry reaction, yielding product in 72–92% ee [98].

4.2 Molecular magnetism

Magnetic linkage of paramagnetic metal centres with some non-innocent ligands, in multimetallic salen complexes has produced essential information on spin interaction mechanisms. The extent of magnetic interaction (whether it be antiferromagnetic or ferromagnetic) is dependent on a number of factors including the distance between the paramagnetic centres and comparative orientation of the related magnetic orbitals. The relative ease of synthesis and the distance between the paramagnetic centres. Single molecule magnets have gained much research attention since the discovery of spontaneous magnetization below a critical temperature [99, 100]. By applying proper ligand scaffolds, ferromagnetic interactions can be enforced between metal centres in multimetallic complexes [101]. Glaser et al. investigated phloroglucinol as a linker between paramagnetic metal salen units [102–104]. At the time, *m*-phenylene linkers had been well established in the organic radical community as an efficient ferromagnetic coupler and had been used extensively as a means to produce high spin organic radicals [105]. First row of transition metal V(IV)═O [106], Mn(III) [107], Fe(III) [108], Ni(II) [109] and Cu(II) [110] are best fitted coordinating with triple salen.

4.3 Material applications

Metal salen based materials have drawn attraction of material scientists as well [111]. Metal organic framework (MOF) and zeolite encapsulated salen have porosity in their bulk material and thus exhibited gas storage properties and thus expected as gaseous fuel loading materials [6, 112]. Various lanthanide and transition metal-lanthanide complexes have been found to have excellent luminescence properties [113]. Yu et al. reported the Zn(II) complex of salen type ligand exhibiting blue photoluminescence with brightness of around 37.2 cd m^{-2} [114]. The LED material also showed excellent thermal stability and thin film coating property. Ni(II), Pd(II) and Pt(II) complexes of salphen derivatives have also shown LED uses [115, 116]. Cu(II) and Zn(II) complexes of thiophene analogue of salphen have been reported as semiconducting material for field-effect transistor with excellent hole mobilities [37]. Thiophene capped salen-metal (V, Ni and Cu) complexes, Pietrangelo et al., where electrochemically polymerised as thin film to get conducting polymers. The polymerised complex materials exhibited enhanced nonlinear optical properties [36].

4.4 Biological activities

Metallosalens exhibits many biological activities as antimicrobial activity, antioxidant activity [117] and anticancer propensity [118]. Their numerous applications have been seen in therapeutics and as biosensors. It has been found that the metal salen have functional enzyme mimic models as superoxide dismutase [119, 120], and Galactose oxidase mimics [121], Cytochrome P-450 mimics [122], Cytochrome

P-450 mimics [123], vitamin B_{12} [124, 125]. Metallosalens are capable of inducing specific damage to DNA or RNA and have been recommended as footprinting agents [126, 127]. Salen complexes are versatile (biomimetic) catalysts for important organic transformations. Derivatives of diaryl-substituted amines linked with metal attached with salen as ligand were experimented in number of cancerous cell lines [128]. Aromatic ring substitution and structural orientation of salen complexes predict the cytotoxicity. Two labile titanium-salen complexes of *cis* configuration were discovered as antitumor agents due to its chelating ability as found in cis-platin [129, 130].

4.5 Sensors

Metal salen complexes have shown the sensory properties for verities of metal ions and small molecules [2, 38]. Colorimetric and fluoremetric both types of responses have been observed depending on the sensor and sensing ions. Chan et al. reported the Pt(II)-salphen based polymeric sensors for the detection of Pd(II), Cd(II), Hg(II), Zn(II), Mg(II), Ca(II), Li(I) and K(I) ions [131, 132]. Wezenberg et al. reported Zn(II)-salphen complexes as metal ion sensors based on demetalation of complexes [133, 134]. Many multimetallic salen complexes have found to be potential sensory properties [2]. Song et al. reported chiral salen based fluorescent polymeric sensor for the enantioselective detection of α-hydroxy carboxylic acids showing fluorescence quenching upon reaction [135]. The same group reported another chiral salen based fluorescent polymeric sensor for the detection of Zn(II) ion as turn-on fluorescence response [136]. Salen based chemosensors for the detection of Al(III) ion based on transmetalation mechanism have also been reported [137].

5. Conclusions

Researcher aims to design or synthesise a molecule with multidirectional use, for developing such a molecule endless work is needed with clarity of innovation leading to novelty. Salen is among those important creation, nevertheless molecule has unimaginable and multiple scope of application ranging from catalysis to biological activities, or as therapeutic use in many medicinal drugs. Salen and its derivatives have been extensively studied because the structural configuration of complex felicitates its importance in various chemical reactions. Widespread use enhances its reliability as catalyst in oxidation, reduction, asymmetric synthesis and many more. The nonsymmetrical salen derivatives have signify to be essential for the preparation of different polymer-supported catalysts that show improved properties (higher activities, catalyst recycling) as collate with parent mono-nuclear complexes. Metallic interference adhere tremendous approach in chemical reaction, presence of metallic centres promotes many specific reaction. Henry reaction, Mannich reaction, Diels-Alder reaction, alkene epoxidation and many such reactions encountered frequently employing salen as transitional part between reactant and product. Metal organic framework (MOF) using salen ligand is recent advancement in the field of macromolecule i.e., supramolecular structure attracting great attention in the field of catalysis and material science. Thus, it is assumed that in near future salen can escort a bloom in the field of catalysis, magnetism, sensors, medicinal areas and material sciences.

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Reverse Migration: Impact on Rural Economy

Dr. Devashish Haldar

1. Introduction

Reverse migration refers to the situation when workers, workers and people start migration back to their native place in the backdrop of non-availability of livelihood and job opportunities. Employment opportunities are the most common reason due to which people migrate. Migration has always been a strategy in which a majority of workers in India used to fulfill their aspiration and to reduce poverty in their life uplift their livelihood. There are many reasons for migration like climate change, political issues; economic issues include poverty and employment, religious persecution etc. There are different types of migration such as counter-urbanization, emigration, immigration, internal migration, international migration and rural-urban migration. Two basic types of migration first of **internal migration** this refers to a change of residence within national boundaries, such as between states, provinces, cities or municipalities, secondly **international migration**refers to change of residence over national boundaries.

Objectives :

- To find out the infirmity conditions of migrant workers and how to cope up
- To find out the burdens of migrant workersin rural economy
- To evaluate the causes of migrant workers and their problems
- To identify the opportunities of rural sector

2. Our desperate migrant workers trapped in lockdown

After the announcement Indian prime minister extended a

nationwide lockdown to contain the spread of the corona virus, thousands of migrant workers gather near a railway station. There had been rumours train services restarting and the workers had gathered defying rules of social distancing, putting themselves and others at risk. They demanded that the higher authorities arrange transport to send them back to their home towns and villages so they could be with their families. The police instead, used sticks to disappear then. At the same time, in the western state of Gujarat, hundreds of textiles workers protested in Surat city demanding to return their home. And a day later, in Delhi the capital of India when several migrants were living under a bridge along the Yamuna river. Wherethe people were unwashed and said they had not eaten in three days, since government shelter they lived in was burned down. They have now been move to new shelters. Through the source of media and news channels we know that how to millions of poor Indians who migrate from village to cities in search of livelihood and how the lockdown trapped them and we also know the situation of those people who has stranded far away from home, with no jobs or money.

2.1 They are leaving but will they return?

There are millions migrant workers, who have been forced to take on unprecedented journeys after the 21 days of complete lockdown, imposed in the country due to the novel corona virus pandemic. In this paper will highlight the stories of migrants on the road, why the lockdown has been so difficult for a large part of Indian population. The last few weeks of the three months how migrants have been "mentally, physically, financially and emotionally" faced the difficulties in cities and industrial belts. It will also have a direct impact on India's economy. In this case question will arises which is that "they are leaving the cities but they will be return or not in future"? In my point of view the migrant crises will be create in future if they will be not to return in jobs. Because the informal economy also includes regular wage workers who work on construction site, manufacturing sectors. Many migrant workerslives in human conditions in slum and shanty town. There is also a heavy pressure on essential daily services, just like lack of water, toilet facilities and living space. So they back to villages, because they could not leave in the horrible conditions any more.

2.2 Reverse migration and opportunity for the government to revive the rural economy

The return of so many people to the villages after the lockdown

may be an opportunity for the government to revive the rural economy. In the large-scale movement of the migrant working population back villages from cities. At a time the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is the life line of rural economy or sectors. A lot of people are coming back and a lot of things are changing on ground level. So, I think that for at leastthree to four months, people are not going to go back to cities because of the uncertainty of jobs, shelter and food in the urban areas. In this case survival a big challenge for them. A fear has create in their mind, when the next lockdown trapping them again in cities or urban areas. In this of situation the government is going to start to give 100 days wages work to everyone, who is looking for work right now. MGNREGA should be there. The frame wok of MGNREGA-to dig up holes and fill it. It should be make the life of people who lost their jobs, shelter and food during this lockdown.

3. A reorientation needs to happen, so that alternatives are proposing to people in the way forward in rural areas.

I think people could look at this ongoing period which is an opportunity to revive agriculture.So, people can go for food crops at the movement as a temporary relieve. Because nobody knows how long this pandemic will last. As we know that the country will see, the cases ofcorona virus pick in May. This has now been shifted to June-July. This virus is spread to be vitally. If we need to revive the reverse migrant in villages or if they are ready to living in a village right now, feeding their family, earn to money, so they could be biggest concern about agriculture right now. The last two months where important season for many people in rural areas because during this period or farmers harvested their crops. It will be the resource of income for their who come back to rural areas. Everyone is affected by the ongoing economic crisis, included tribal whose weekly markets which will be held on every weeks, the daily wages workers in agriculture field.

3.1 Companies are offering free food and air tickets to workers back to cities

Due to the lockdown, a large number of migrant workers had to return their villages. Now, cities are allowed to return in their work sites and to run economic activities. Because companies have to face workers force problem. So, they do various initiative activities to recall them, right now. After the relaxation of the lockdown, the cities are coming back on

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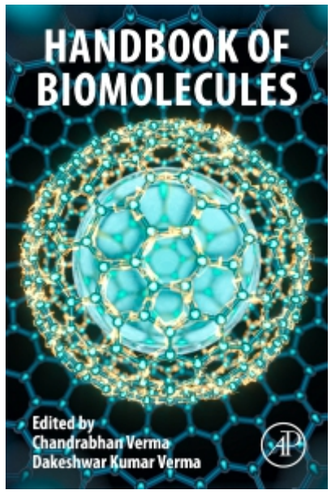

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Handbook of Biomolecules: Fundamentals, Properties and Applications is a comprehensive resource covering new developments in biomolecules and biomaterials and their industrial applications in the fields of bioengineering, biomedical engineering, biotechnology, biochemistry, and their detection methods using biosensors. This book covers the fundamentals of biomolecules, their roll in living organism, structure, sources, important characteristics, and the industrial applications of these biomaterials. Sections explore amino acids, carbohydrates, nucleic acids, proteins, lipids, metabolites and natural products, then go on to discuss purification techniques and detection methods. Applications in biomolecular engineering, biochemistry and biomedical engineering, among others, are discussed before concluding with coverage of biomolecules as anticorrosion materials.

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