

Review article the significance applications Schiff rules: Systematic review of the literature

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Abstract

The number of Shaf rules is one of the most important bridge bonds used in coordination chemistry. It has been used in the preparation of a large number of transition elements in particular and in the preparation of complexes with metal ions in general due to its coordination strength and also its ability to form complexes with different bases and different uses., and they are organic compounds containing the azomethine group ($C=N-R$ R2). For the first time in the year (1864), I was the first to discover the process of condensing aliphatic ,aromatic ketones or aldehydes with primary aromatic amines or aliphatic, where the carbonyl group and primary amines are condensed so that the monoalkyl amine or monoaryl amine is added to the atom carbon of the carbonyl group belonging to the middle aldehyde or ketone. Later, the absence of the water molecule of the intermediate compound (N-substituted imine) which represents the base of the final shaf result And why are there so many names, including amines, as well as when it is derived from a ketone, it is called ketamine, and when it is derived from an aldehyde, it is called an aldehyde. This biological activity of Scheff's rules also plays important roles in environmental chemistry, analytical chemistry, and industrial chemistry and is considered as a catalyst in photochemical reactions.

Keywords: Carbonyl group; Bridge bonds; Amines; Organic compounds

1. Introduction

Schiff bases are organic compounds resulting from the reaction of a primary amineWith aldehydes or ketones by bonding the nitrogen atom in the amine with the carbonyl group in or different aldehydes to obtain a groupAzomethine $C=N-R$ R2Which is generally prepared by sublimation of a ketone or aldehyde with a primary amine, where the R group can be aryl or alkyl. ^[1] Schiff bases containing aryl substituents They are faster and more stable in formation than those containing alkyl substituents, and Schiff bases form aliphatic aldehydes that are unstable and ready for the polymerization process, while aromatic aldehydes that contain active electron exchange are more stable. The type of reaction to form a Schiff base is the condensation reaction of ketones or aldehydes, a reverse-type reaction. This reaction occurs in the presence of a basic or acidic catalyst medium, or in the presence of a heating process, as in the following diagram:

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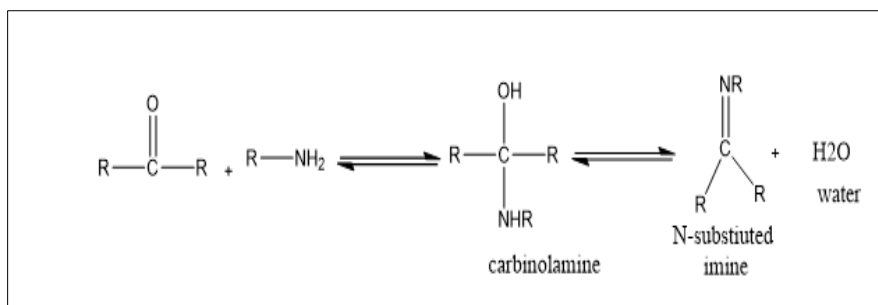


Figure 1 shows the condensation reaction of Schiff bases

The reaction to form these compounds is brought to an end by separation of the product or withdrawal of water, as many Schiff bases are decomposed into their original components (aldehydes, ketones, and primary amines) by acidic and basic aqueous solutions^[2]. Schiff base compounds are formed through the mechanism of nucleophilic addition to the activated carbonyl group, in this case the searching group for the nucleophile is the active amine group in the Schiff base. In the first step of the mechanism, the ketone or aldehyde reacts with the amine group and thus we obtain an unstable intermediate compound called (carbinolamine). It then loses a water molecule by adding a basic or acidic catalyst, as shown in the diagram below. ^[3]:

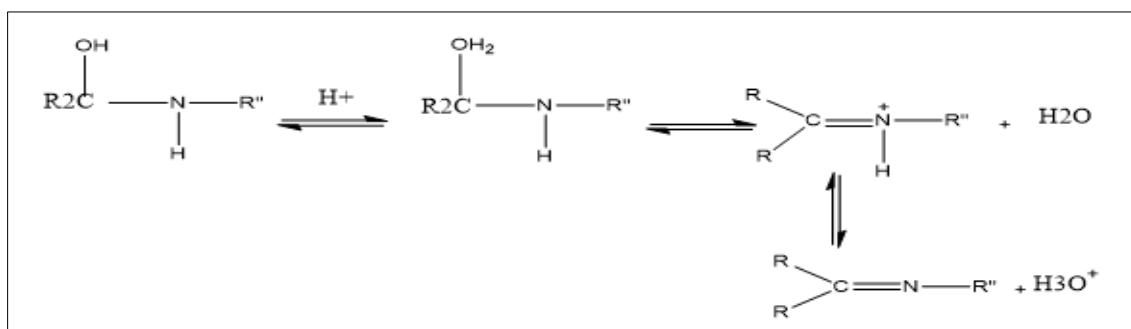


Figure 2 illustrates the mechanism of formation of Schiff bases

Therefore, the process of withdrawing a water molecule from the unstable compound (carbinolamine) is considered the step that determines the rate of the reaction. This is considered the main reason for using acids to stimulate this reaction, and it is required that the acid be unconcentrated because the primary amine group in this case will react with the concentrated acid and thus separate, and then lose its characteristic (nucleophilic). Therefore, the reaction equilibrium shifts to the left, and the intermediate compound (carbinolamine) is not formed [4]. Therefore, most of the reaction in the preparation of Schiff bases occur in a moderately acidic medium of pH. Schiff base reactions fall within the Addition reactions to the azomethine group present in the amine, where the reagent is added to the double and polar bond. These reagents, which are nucleophilic, attack the carbon atom present in the bond of the azomethine group. An example of this type of reaction is the addition of alkyl halides, which produce quaternary amino salts, which in turn transform into the secondary amine group. Schiff bases are nitrogenous compounds that correspond to ketones or aldehydes if their carbonyl group is replaced by an azomethine amino group (C=N). It is a type of amine resulting from a carbon atom linked by a double bond to a nitrogen atom that is linked to an aryl or alkyl group. Prepared by the scientist Hugo ché[5].

2. Types of Schiff Rules

- Single-dentate Schiff bases: This type of complex is linked to the ligand via the nitrogen atom of the azomethine group, which is included in the structure of the molecule[6].
- Bi-dental Schiff bases: These types of Schiff bases are prepared by condensing a molecule of an aliphatic or aromatic amine with aldehydes or ketones. These ligands depend on the type of donor atoms, whether they are (N-N) or (N-O)[7,8].
- Tri-dentate Schiff bases: This type of base is considered a stable type because it is derived from identical di-dentate ligands by adding another donor group such as hydroxide, amine, thiol, or other groups [9].

- Multi-dentate Schiff bases: They are very stable bases and contain a group of atoms as donors to four-dentate Schiff bases, in addition to five-dentate Schiff bases, in addition to six-, seven-, and nine-dentate Schiff bases that are coordinated with donor metal ions such as (N5) (N2O4)[10].

3. Uses of Schiff Rules

- **Catalyst motivating factors**

Some Schiff bases and their complexes were used as catalysts for the reaction, such as the ruthenium complex - Schiff base. Also among the catalytic factors is the three-dentate Schiff base, which is important in organic-life reactions and links amino acids with Schiff bases, thus forming important active sites^[11].

- **In photochemical reactions^[12]**

In organometallic chemistry, Schiff rules and their complexes are important and comprehensive because they are easy to prepare and they exert various stereoscopic or electronic effects on the products of the complexes. The products can also be modified and used as catalysts, especially when these rules are used in the complexation of ruthenium^[13].

- **In medicine and biotechnology Biotechnology and NH^[14]**
- **In the pharmaceutical and pharmaceutical industries It is one of the most important drugs with anti-cancer, anti-fungal and anti-bacterial activity^[15].**
- **Environmental Chemistry**

To estimate organic matter pollutants in water. Schiff's rules play an important role in analytical chemistry in voltammetric, potential, and reversal voltammetric studies, and in calculating the values of kinetic coefficients, which are the reaction rate constant and reaction activation energy, and also for their ability to form colored complexes with many metals and to estimate these metals in selective and sensitive methods, and in the field of chemistry. Industrially, they have been used as stabilizers and plasticizers for polymers, as initiators of the polymerization process, and these bases have also been used as antioxidants. Copper complexes with some Schiff bases have also been used in the manufacture of printing ink and dyes. It is also used to resist metal corrosion. These compounds have Due to their great importance, they have been applied in many different domain, as these bases are considered the basic article in the production of many polymers that are characterized by high molecular weight. These bases have also been used in the preparation of heterocyclic compounds and coordination complexes for these rings. ^[16].

4. Medical Uses of Schiff Rules

Schiff bases are considered one of the chemical compounds of great importance and have contributed to the advancement and development of modern coordination chemistry. Studies have The mineral complexes showed greater biological activity than the free organic compounds, and also an increase in biological activity was enhanced through the association of transition elements in Schiff bases [17].

Many studies have shown that Schiff base complexes have anti-cancer activity against many types of cancer. Given the difficulty of finding a treatment that eliminates cancer cells without affecting the body's healthy cells, the trend was to use compounds that target the division process in cancer cells and have also shown their effectiveness against leukemia. . They form stable chelating compounds with the transition elements present in the cell, these compounds have Schiff bases that are of great benefit in various applications, as they are considered the basic substance [18].

Schiff's base is considered an essential basic material for a number of highly heterogeneous cyclic compounds, as well as the preparation of their complexes in a symmetrically complex form. Through various studies, it has been shown that Schiff's bases have distinct biological activities, including antioxidants. Antibacterial, antifungal and antiviral agents, in addition to their use in eliminating many diseases, including malignant tumors, it has also shown great importance in the pharmaceutical and medical fields. It has been shown that the bonding group in Schiff bases (the azomethine group) is the main responsible for this biological activity and the rest of the other benefits.[19]

It has also been used as an antibacterial, anti-tuberculosis, and anti-tumor agent, as well as its ability to capture metal ions. Due to the high effectiveness of Schiff bases, their complexes have been used in the preparation of some medicines. The zinc complex was used with Schiff bases derived from sylyldehyde and amino acids in the preparation of sulfa

drugs. It has also been used as an anti-inflammatory, antipyretic, pain reliever, and as a pesticide for bacteria, fungi, and algae [20].

5. Conclusion

The basic rules of organic compounds consist The nitrogen atom in the primary amine bonds with the carbonyl group in ketones or various aldehydes to form the active group azomethine ($C=N-R$), where the R group may be alkyl or aryl, where the basic rules contain most aryl substituents. The establishment and rapid formation of those containing alkyl substituents, such as the bases consisting of Aldehyde compounds of the aphatic type are unstable and subject to the polymerization process, while aromatic aldehyde compounds contain effective electron exchange., are most stable in the Scheff base formation reaction (condensation reaction) of aldehydes and ketones The reverse reaction This usually occurs in the presence of a suitable catalyst, basic or acidic, and in the presence of heating, since most of Scheff's bases are decomposed into their primary components (aldehydes, ketones, and primary amines) by acidic and alkaline aqueous solutions, and it also causes this reaction to be stimulated by acids and must be acidic. Non-centered, because Al-Amin Al-Qaidi, in this case, will interact with Witbrten and thus lose the quality The nucleophilicity of the preparation reactions of Scheff's rules occurs in the middle of moderately acidic pH, so it has many uses, including as catalysts in photochemical reactions, also used in organometallic chemistry, in medicine and biotechnology, in the pharmaceutical and pharmaceutical industries, in environmental chemistry, and also as a game of Scheff's rules[21]. They are used in analytical chemistry in voltammetry studies and dynamic and reflection voltammetry studies, and the calculation of kinetic coefficients, and in the field of industrial chemistry, they are used as softeners and positives for polymers, in the polymerization process, and as antioxidants, and in the preparation of high molecular weight polymers, as well as their use in the printing ink and dye industry. and in resistance to corrosion of metals It is considered as one of the most important chemical compounds that contributed to the advancement of modern synthetic chemistry and the development of studies. It has been shown that mineral complexes show greater biological activity than free organic compounds, and the increase in biological activity has been enhanced through the connection of transition elements in Scheff's rules and purity, as well as possessing antibacterial properties. All types of cancer without affecting the healthy cells of the body, tuberculosis and tumors, as various studies have shown that the ingredients of Sheaf have distinct and numerous biological activities, including antibacterial, antifungal, antiviral and algaecides, and the relationship has been explained Azomethine is the compound responsible for this biological activity, which is shown on Scheff's rules, as well as the ability to absorb metal ions Also, the complexes were used in the preparation of al-Salfa medicines, during the use of Al-Kharsin complex with the bases of the shefderived from salsaldehyde and amino acids[22].

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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