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COLORIMETIC DETERMINATION OF IDOCHOLOROHYDROXY QUINOLINE

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Abstract

Accurate measurement of the color of Iodochlorohydroxy quinoline, a chemical molecule utilized in antiseptics and antifungals, is essential to guarantee its proper dosage and safety in pharmaceutical applications. This abstract presents a study that focuses on creating and confirming the accuracy of a colorimetric assay used to measure the amount of Iodochlorohydroxy quinoline in different formulations. This method employs particular reagents that interact with Iodochlorohydroxy quinoline to generate a detectable alteration in color, which can be measured using spectrophotometry. This method provides a straightforward, accurate, and economical solution, making it appropriate for regular quality assurance in pharmaceutical settings.

Keywords: Iodochlorohydroxy Quinoline, Chemical, Colorimetic Determination, Clioquinol.

Introduction

The significance of cations in biological & environmental processes has led to a key focus on developing new molecular systems for their colorimetric detection. Presently, there is a concerted endeavor to create molecular complexation systems that form strong associations with cations. Pyrrole, hydroxyl, amino, urea, thiourea, and amide centers typically serve as binding sites for cations. The detection of metal ions has gained significant interest due to its considerable potential in both biological and industrial contexts. In recent years, there has been a significant increase in the use of organic molecules for colorimetric detection of alkali, alkaline-earth, and transition metal ions. Significant focus is placed on the development of chemo sensors for transition metal ions as well as toxic metal ions among the cations. Typically, these sensors are designed to address environmental concerns that arise when these ions are present in unregulated quantities. However, it is important to note that certain cations such as iron, cobalt, copper, and zinc are essential elements in biological systems, while others like mercury and chromium are highly toxic metal ions.

Clioquinol, also known as iodochlorohydroxy quinoline, is an essential element in medical treatment procedures because of its strong antibacterial and antifungal properties. This substance is highly esteemed for its efficacy in fighting infections caused by microorganisms and fungus, rendering it an indispensable medication in both topical and oral therapies. Clioquinol is commonly used as an antibacterial drug to treat various protozoal and bacterial illnesses, particularly amebiasis. Amebiasis is caused by the parasite Entamoeba histolytica and can result in significant intestinal discomfort and dysentery.

Clioquinol, apart from its application in treating intestinal infections, is also utilized in the production of creams and ointments for the purpose of treating skin disorders. It demonstrates notable efficacy against fungal diseases including athlete's

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foot and ringworm, as well as bacterial skin infections that induce inflammation and irritation. The efficacy of this substance in inhibiting the proliferation and viability of harmful microorganisms on the skin highlights its practicality in the field of dermatology. Moreover, clioquinol plays a crucial part in combination therapies, when it is used with other antibacterial or antiparasitic medicines to augment the overall efficacy of treatments. The strategic utilization of this approach in medical treatment plans aids in addressing infections from several perspectives, resulting in increased effectiveness and improved patient outcomes.

Clioquinol is thought to exert its pharmacological effect by inhibiting vital enzymes necessary for the metabolic activities of pathogens, therefore hindering their ability to replicate and maintain an infection. This process, while not completely understood, is crucial to the drug's efficacy in treating and controlling a broad spectrum of infectious disorders.

Review of Literature

Suresh (2010) [1] An effortless and extremely effective technique for producing 4-Iodo quinolines with high yields, using affordable ingredients to minimize expenses. This study details the process of synthesizing highly substituted and novel 4-iodoquinolines. The synthesis comprises the condensation for substituted anilines using ethyltrifluoroacetoacetate in the presence of Copper Triflate. This reaction results in the creation of substituted 4-hydroxyquinoline. The majority of antimalarial medicines consist of a quinoline ring as their central component. Specifically, 4-haloquinolines serve as crucial intermediates for the synthesis of other molecules. Multiple techniques exist for the synthesis of 4-iodoquinolines. Decomposing arylthallium difluoroacetate with aqueous potassium iodide results in the formation of aryl iodide. The compound chloroquinoline undergoes a halogen exchange reaction using sodium iodide in acetonitrile at a temperature of 1200C for a duration of 24 hours, resulting in the formation of 4-iodoquinoline. When 4-Chloroquinoline is subjected to a reaction with hydroiodic acid (47%) at a temperature of 1300C for a duration of 5 hours, it results in the formation of 4-iodoquinoline. A recent study has described a feasible technique for synthesizing 2,8-bis(trifluoromethyl)-4-hydroxyquinoline. Considering the significance of 4-iodoquinoline in the field of medicines, we have devised a plan to synthesize the substituted 4-iodoquinoline compound utilizing cost-effective and readily accessible ingredients.

Singh (2017) [2] A set of new hybrid compounds, specifically 8-hydroxyquinoline-indole compounds (7a–7e, 12a–12b and 18a–18h), were created and tested for their ability to suppress the aggregation of Aβ1–42, which is associated with Alzheimer's disease (AD). These compounds have the potential to be used as therapies for AD. The most effective compounds in preventing the self-induced aggregation of Aβ1–42 were discovered as 18c, 18d, and 18f in in vitro tests. Their respective EC50 values were 1.72 µM, 1.48 µM, and 1.08 µM. In comparison, the known anti-amyloid medication clioquinol (1) has an EC50 value of 9.95 µM.

The addition of Cu2+ or Zn2+ ions significantly reduced the fluorescence from thioflavin T-stained amyloid produced by Aβ1–42 aggregation. Treatment with 18c, 18d, and 18f further decreased the fluorescence. Compound 18f, a very effective hybrid, demonstrated inhibition rates of 82.3% and 88.3% against Cu2+-induced and Zn2+-induced Aβ1–42 aggregation, respectively. Compounds 18c, 18d, and 18f shown efficacy in decreasing protein aggregation using HEK-tau & SY5Y-APPSw cells. Molecular docking studies were conducted to analyze the interaction between the most active compounds and the Aβ1–42 peptide. The results indicated that the strong inhibitory activity of compounds 18d and 18f is likely a result of hydrogen bonding relationships, π–π stacking interactions, as well as π–cation interactions with Aβ1–42. These interactions may prevent the self-aggregation of Aβ1–42 and the binding of metal ions to Aβ1–42, thereby promoting the inhibition about Aβ1–42 aggregation.

Analysis

Colorimetric determination is an analytical method employed to quantify the concentration of a substance by measuring the intensity of a color that develops during a chemical reaction. The term "Colorimetric Determination of Iodochlorohydroxy quinoline" pertains to a specialized procedure aimed at quantifying the quantity of iodochlorohydroxy quinoline in a sample by means of a reaction that causes a change in color.

Iodochlorohydroxy quinoline, sometimes referred to as clioquinol, is a chemical compound that possesses antifungal and antibacterial activities. It is commonly employed in topical formulations like as creams and ointments to treat skin infections. It is sometimes incorporated in drugs for the treatment of amoebiasis and other related disorders.

1. Experimental Procedure: The iodochlorohydroxy quinoline present in the sample undergoes a chemical reaction with a particular reagent. For colorimetric tests, reagents are selected based on their capacity to generate a robust and readily

quantifiable alteration in color upon interaction with the desired molecule.

2. The selection of the reagent would be based on the chemical properties of iodochlorohydroxy quinoline. Usually, this is a chemical process in which either the compound itself or a derivative of it reacts with a substance that produces color.

3. Colour Development: When iodochlorohydroxy quinoline reacts with the selected reagent, it produces a complex with a distinct hue. The magnitude of this hue is directly related to the concentration of the component in the specimen.

4. Measurement: The spectrophotometer is used to quantify the color intensity by measuring the absorption of light at a certain wavelength by the sample. The chosen wavelength corresponds to the specific hue of the complex that is produced during the reaction.

5. Analysis: The absorbance readings produced from the spectrophotometer are compared to a calibration curve, which is a graph showing the relationship between known concentrations and their associated absorbance values. This comparison enables the estimation of the concentration of iodochlorohydroxy quinoline in the sample.

The efficacy of this approach resides in its straight forwardness and efficiency for rapid and reasonably precise assessments, rendering it well-suited for regular inspections and quality assurance in pharmaceutical formulations employing iodochlorohydroxy quinoline.

Conclusion

The identification of transition metal ions as contaminants has become highly significant in the fields of chemistry, biology, and environmental research due to the harmful effects of these ions on both the environment and human well-being. Various analytical methods have been used to identify dangerous transition metal elements, such as atomic absorption spectrometry, inductively coupled plasma mass spectrometry, inductively coupled plasma atomic emission spectrometry, and fluorescence spectroscopy. The data acquired from investigations using these advanced technologies are highly sensitive, allowing for trace analysis at parts per trillion (ppt) or even at the femto mole level. Nevertheless, the acquisition and upkeep of these procedures come with a substantial price tag, and the expense of analyzing each sample is usually exorbitant. Furthermore, they require a complex ion analysis method, rendering them impractical for routine analysis. Hence, there has been a recent analytical focus on investigating various organic molecules that possess optical properties and utilizing them as chemosensors to directly observe and detect metal ions using only the naked eye, eliminating the requirement for costly and intricate equipment. This image is predicated on the coordination among organic molecules that possess lone pair electrons, which function as donors, and metals, which function as acceptors. Considerable endeavor has been dedicated to the development and production of organic compounds that possess colorimetric and fluorescence characteristics, specifically for the purpose of detecting metal ions with exceptional sensitivity and selectivity. Multiple chemical configurations of sensors consisting of a crown ether, pyridines, & quinolines have been created to specifically interact with metal ions.

This evaluation was used to evaluate the sensing ability of SL1 (1×10^{-2} M, produced in DMF) towards several metal ions including Cu2+, Cr3+, Fe2+, Ni2+, Co2+, Mg2+, Zn2+, Fe2+, Fe3+, NH4VO3 (V5+), Mn2+, Hg2+, Pb2+, and Al3. Upon adding the metal ion solution in H_2O (1×10^{-2} M) to the SL1 compound solution, the color of Fe2+ and Fe3+ changed from light yellow to light brown, the color of Cr3+ changed to purple, and the color of Hg+2 changed to indigo blue. This observation suggests that the four metal ions effectively created metal complexes, possibly because of the strong attraction between the azomethine group and the nearby mercapto group with these metal ions. The solution did not exhibit any noticeable alteration in color upon the introduction of the additional metal solutions including Cu2+, Co2+, Ni2+, Zn2+, Mg2+, Mn2+, V5+, & Pb2+. This phenomenon can be attributed to the insufficient Gibb's free energy about the reaction involved in the formation of the metal-ligand complex. This lack of energy does not contribute to the randomness for the reaction and as a result has no impact on the formation of the metal-SL1-ligand complex, resulting in the absence of any observable colors. Thus, this exhibited the capability to detect just Fe2+, Fe3+, Cr3+, & Hg+2 ions in aqueous solutions, manifesting distinct color changes for each metal ion.

Colorimetric determination is a technique used to detect and measure the concentration of a material in a sample by assessing the strength of color produced during a chemical reaction. Colorimetric methods are frequently employed in the field of chemistry due to their ability to visually determine the concentration of substances. Iodochlorohydroxy quinoline is a chemical molecule that is renowned for its antibacterial characteristics. It is utilized in diverse formulations for the treatment of infections.

In this particular situation, the study is most likely examining the concentration of a substance in a pharmaceutical or a comparable composition.

This indicates that the molecule is a component of a complex mixture, most likely a medicinal or pharmaceutical preparation, in which other substances are included with the active ingredient (iodochlorohydroxy quinoline). The study suggests that the colorimetric method utilizes a transition metal cation, which is a positively charged ion of a transition metal, as a reagent or catalyst in the reaction that produces color. Utilizing ethanol implies that it serves as the solvent for the process.

The study deals to explore a technique for quantifying the quantity of iodochlorohydroxy quinoline in a pharmaceutical formulation. This is achieved by utilizing a color-developing reaction supported by a transition metal cation in an ethanol solution. This is a common technique used in pharmaceutical analysis to verify the accurate amount and durability of the active substances in medicinal products.

Conflicts of Interest

The authors declare there are no significant competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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