ANALYSIS THE BASIC APPROACH FOR SYNTHESIS OF IBUPROFEN USING NANO - PREYSSLER AS A GREEN AND ENVIRONMENTALLY FRIENDLY CATALYST

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Abstract

"Green sustainable chemistry" uses chemical technology to make less harmful things and procedures for our planet's ecosystems (GSC). Green chemistry uses eco-friendly, high-efficiency synthetic techniques to make life-saving drugs. This decreases medication development's environmental effect and speeds guide optimization. HPAs have various economic and environmental benefits as catalysts. The large range of reaction domains in which heteropolyacid catalysts can be utilised as acids is examined. SPNPs are an efficient, cost-effective, and eco-friendly catalyst (H14[NaP5W30O110]/SiO2). This method has high yields, easy operation, and an uncomplicated product-working procedure. SPNPs (H14[NaP5W30O110]/SiO2) offer hydrolytic and thermal stability. Preyssler's anion is non-toxic and reusable.

Keywords: Synthesis Of Ibuprofen, Nano- Preyssler, Green , Environmentally Friendly Catalyst

Introduction

The flavanones are a class of polyphenolic compounds that are created naturally and are found in a wide variety of plant foods. Flavanones can be found in berries, tea, coffee, and even chocolate. They are widespread throughout the plant kingdom and can be obtained through a variety of diets that are plant-based. They are plant pigments that are naturally present in a wide range of fruits and vegetables, as well as in beverages like tea, red wine, and coffee. Berries are another source of plant pigments besides plants themselves. There is

evidence to suggest that flavanone can induce a variety of biological effects, some of which include antibacterial features, cytotoxic capabilities, anti-inflammatory qualities, and anti-tumor activities. In this scenario, specific flavanones that include hydroxyl groups on either the A or B ring have been repotted as prospective antioxidant agents. These flavanones can either be found on the A ring or the B ring. These flavanones[1] are located either on the A ring or the B ring of the structure. It is now well documented that such potency is mostly owing to the capacity of hydroxyl groups to supply hydrogen, which enables the flavanone to undertake a redox process that permits them to scavenge free radicals. This reaction is what gives flavanones their ability to scavenge free radicals. Because of this interaction, flavanones are able to have such a high level of antioxidant activity. This capacity is what gives flavanones their unique properties. The capacity of hydroxyl groups to donate hydrogen is the key contributor to its potency. [Case in point:] [Case in point:] The presence of hydroxyl groups in the skeleton also contributes to a high affinity for proteins and, as a result, acts as inhibitors of microbial enzymes8 and inhibition of NADH dehydrogenase of mitochondrial inner membranes. This is because the presence of hydroxyl groups increases the affinity of the skeleton for proteins. Because of this, the presence of hydroxyl groups in the skeleton improves its affinity for proteins. The presence of hydroxyl groups inside the skeleton of the molecule is another factor that contributes to the molecule's high affinity for proteins. There is a prenylated side chain present in the flavonoid skeleton, which distinguishes prenylated flavanones from all other naturally occurring flavanones and establishes them as a separate class of naturally occurring flavanones. This is because prenylated flavanones have a skeleton that contains a flavonoid skeleton. Flavonoids contain compounds known as prenylated flavanones. It has been demonstrated that the action of flavonones requires the existence of at least one phenolic group as well as a specific degree of lipophilicity. Additionally, flavonones must have a particular amount of lipid compatibility. In addition to this, flavonones are required to possess a particular degree of polarity. It may be possible to enhance the capacity of flavonoids to interact with cellular membranes by increasing the number of prenyl groups that are housed within the flavonoid ring structure. This would result in an increase in the lipophilicity of flavonoids. Plants include a variety of flavonoids called flavones. Flavones can be found in plants. There are many different flavones, but some examples of them are chrysin, apigenin, and luteolin. Flavonoids are a diverse class of secondary metabolites that are found in plants [2]. Flavones are also referred to as flavanones in some circles. These compounds have a wide spectrum of pharmacological activities, some of which include decreasing anxiety, increasing heart function after ischemia

and exhibiting antiestrogenic effects in breast cancer cell cultures 18. Their fundamental molecular structure is made up of two benzene rings that are joined to one another by a heterocyclic pyrone or pyran ring that is placed in the core of the molecule. Celery, parsley, thyme, and sweet red peppers are some of the few foods that contain flavones. Flavones are found in very few foods. Flavones are rare. It has been established that flavones can only be found in meals of this particular type. Some methoxyflavones, such as -heptamethoxyflavone (HMF) and pentamethoxyflavone, increased the body's ability to absorb vinblastine by blocking drug efflux through the P-gp transporter in particular. As was the case before, both of these methoxyflavones had the aforementioned behaviour (tangeretin). Methoxyflavones are found in high concentrations in orange juice; some notable examples include hexamethoxyflavone, tangeretin, and HMF (nobiletin). They might be able to perform the role of agents with the capability of reversing the effects of multidrug resistance or restoring the bioavailability of a particular medication.

Related work

Bamoharram, et al[3] The hydrothermal synthesis of ZnO nanostructures, such as nanospheres and nanoplates, was carried out using a heteropolyacid of the Preyssler type (H14 [NaP5W30O110]) and carried out at 140 degrees Celsius for 48 and 72 hours, respectively, by reacting zinc acetate. Analysis of ZnO nanostructures was In terms of diameter, the nano plates were hexagonal and ranged in size from 40 to 60 nanometers. We were able to use the ZnO nanostructures we created earlier to degrade methylene blue and Congo red in a photocatalytic reaction. As a result, in a relatively short period of time, more than 70% of the colour was eliminated. The first-order reaction constants for the degradation of methylene blue and Congo red were found to be 0.0745 and 0.0746, respectively, using this approach. That first-order kinetics is valid can be inferred from this.

Kherroub, et al[4] Catalyzed ring opening polymerization of D4Ph,Me using Maghnite-H+, a solid green catalyst generated by sulfuric acid activation of a natural clay (D4Ph,Me) is the goal of this study. The acid replaces the interlayer cations with protons, causing the montmorillonite sheets to be spaced. An analysis of the XRD spectrum clearly shows this. The polymerization was carried out in large quantities and under rather lenient conditions. To increase the yield of the reaction while raising the average molecular mass of polyphenylmethylsiloxane (PPMS) produced, various tests were conducted to alter the temperature, time and catalyst mass content. All three NMR analyses (IR, 1H, and 13C) were

utilised to determine the structure of the PPMS produced at different times. DSC analysis was utilised to investigate the thermal properties of the material. An explanation of the role of Maghnite-H+ in the various steps of the reaction has been proposed.

Lourentius, et al[5] Indonesia's 70% imported liquefied petroleum gas must be replaced. Dimethyl ether, generated from coal, could replace LPG. Two-step or one-step processes can convert coal to syngas and syngas to dimethyl ether. Cu–Zn–Al/g–Alumina can synthesise dimethyl ether from syngas in one step. Syngas is 1:1 carbon monoxide and hydrogen. The conversion reaction temperature was 240 to 300 degrees Fahrenheit at 40 bar pressure and the space velocity was 29.3 to 32.7 mL/g catalyst/minute. Maximum CO conversion is 90.08 percent at 300 oC and 29.3 mL/g catalyst/minute. The synthesis's end product was GC-tested. Dimethyl ether is a green fuel since it doesn't disrupt the ozone layer, has no sulphur, and burns at a low calorific value.

Rashidi, Alimorad, et al.[6] Spiroindolone was synthesised using a one-pot, three-component process involving a nanocatalyst constructed of functionalized multiwall carbon nanotubes. As a result, spiroindolone might be synthesised. As a result of the technology being used, FMWCNTs showed remarkable catalytic and recyclable properties. In addition to being simple and easy to use, the approach now in use is free of any hazards and produces amazing results.

Alimadadi, Behnoush, et al [7] The necessary pyrido[2,3-d]pyrimidine derivatives were successfully synthesised in good to exceptional yields by using H14[NaP5W30O110]/SiO2 as a nano-catalyst. H14[NaP5W30O110]/SiO2 is a recyclable, environmentally friendly, and green nano-catalyst. An efficient and non-harmful condensation method was developed using the 6-aminouracil derivatives, various aromatic aldehydes, and either ethyl or methyl acetoacetate as the condensation agent.

Proposed methodology

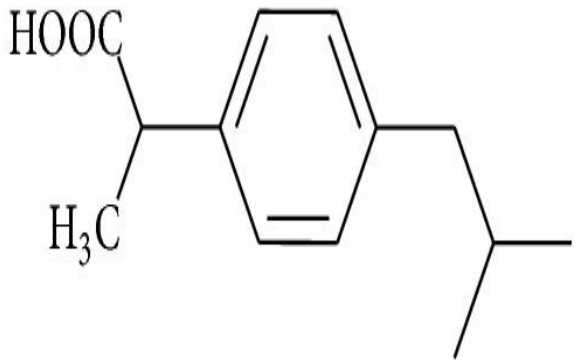
Heterocycles can be classified as either aliphatic or aromatic heterocycles. Of all the branches of organic chemistry, heterocyclic chemistry is by far the largest and most complete. Pharmaceuticals with biological activity rely heavily on heterocycles, which account for a large portion of the market. Inventing and testing new structures has been the driving force behind much of the significant achievement in the fight against disease. It's not uncommon for these new chemicals to be hetero aromatic derivatives. Organic compounds can have a wide range of structures, depending on the constituents. Heterocyclic compounds[8], which

are found in nature, play a significant function in a wide range of biological processes. Purine and pyrimidine bases in nucleic acids, vitamins (thiamine B1, riboflavin B2, nicotinamide B3, pyridoxal B6, and ascorbic acid C), heme and chlorophyll in heme and chlorophyll, penicillins, cephalosporins, macrolides, and so on are some examples. Compounds that have at least one carbon atom and one or more other atoms in the ring structure are called heterocyclic compounds. Aromatic or non-aromatic ring systems may have been used in the constructions. heterocyclic chemistry is a branch of organic chemistry dealing with the production of heterocycles as well as their usage in the pharmaceutical and industrial sectors. Sustainability in the use of chemicals and chemical technology to produce environmentally friendly products or processes is referred to as "green sustainable chemistry" (GSC). Drug discovery and bioactive molecule production can be expedited while negative environmental impacts are minimised through the use of highly efficient and environmentally friendly synthetic technologies under the auspices of green chemistry. In green chemistry, catalysis is a key topic because it provides atom-economic, selective, and energy-efficient answers to numerous industrially[9] relevant problems. An overview, the most recent experimental findings, and examples of industrial utilisation will follow in the following order: heteropolyacid (HPA) catalysts as green and nano catalysts. Environmentally friendly heteropolyacid (HPA) catalyst candidates will be discussed as follows: first, a general overview; second, the most current experimental result; and thirdly examples of industrial utilisation. The following discussion will show that heteropolyacids can be used as ecologically friendly catalysts in various successful examples. As a result, HPA catalysts will be used in a variety of ecologically friendly and sustainable applications in the future, such as as "catalytically active solid solvents" that can deliver unique reaction fields. In other words, "fake" liquids. They are non-corrosive and safe, produce little waste and may be separated easily. Acid catalysis uses heteropolyacids. Both economically and environmentally, the attraction of solid heteropoly acids is enhanced by the compounds' stability and acidity. Catalysis is becoming increasingly dependent on the use of heteropolyacids (HPAs) and other comparable compounds. Research in the fundamentals as well as fine-chemistry techniques are rapidly evolving right now. HPAs have a high acidity, but they also have good redox characteristics, which may be tweaked by altering the heteropolyanion's[10] chemical makeup. Because of this, the redox characteristics of HPAs can be customised to meet the needs of particular applications. A wide range of academics have studied and examined the reactions that take place in heterogeneous and homogeneous systems. Keggin type HPAs are the most common and employed for most catalytic applications, even though there are

numerous different structural types of HPAs. For acid catalysts, this is especially true because of their ease of access and chemical stability. There are also newer catalysts, including the Preyssler heteropolyacid and the Wells-Dawson heteropolyacid. Because of their high activity in acid-base catalytic reactions, these compounds are used as homogeneous and heterogeneous catalysts in a wide range of catalytic processes. There have been only a few documented cases of Preyssler catalysts being used in the catalytic process . The use of Preyssler and Keggin catalysts has been examined recently in a number of organic processes . Several reactions that were previously catalysed by Bronsted and Lewis acids now continue more satisfactorily under milder conditions with higher selectivity, improved yields, and shortened reaction durations when HPAs are used. The usage of Keggin and Wells–Dawson structures for HPAs has been the focus of extensive investigation. Chemical processes that utilise Keggin heteropolyacids can produce heterocyclic, medicinal, and organic chemicals in a more ecologically responsible manner. Heteropolymers like the anion found by Preyssler are intriguing. In spite of its great thermal and hydrolytic stability, [NaP5 W30O110]14-, Preyssler's anion, has been generally disregarded[11] and just a few reports for its catalytic performance have been cited . A wide pH range is supported by [NaP5 W30O110]14-'s strong thermal and hydrolytic stability. A few of the notable properties of this heteropolyacid include the following: High acidity with a total of fourteen titrable acid protons, great thermal stability (with a pH range of 0–12), and high hydrolytic stability (with a pH range of 0–12) are some of the features of Brnsted acidity. Another characteristic of Brnsted acidity is that it has a pH range of 0–12. In addition to this, it has a high degree of reusability and can be recycled for a variety of other applications. A Brnsted acidity is deemed to be of a high strength if it contains fourteen titrable acidic protons. high levels of resistance to the effects of temperature change Catalytic activities and heteropoly molecules are of special interest to us as they pertain to the inquiry that we are conducting. Recent research has concentrated on examining the usage of the Preyssler catalyst in a range of different chemical processes. These investigations were carried out in recent years. Even after repeated applications of ecologically friendly catalysts that are easy to recover[12] and reuse, the catalysts' active properties and fundamental structure are unchanged and unaltered. [Case in point:] [Case in point:] [Case in point:] [C In the year 1961, the Boots Pure Chemical Company was the one that was responsible for the development of ibuprofen, which was then patented by the company. It is available under a wide number of brand names, some of which include Advil and Motrin, and is categorised as a nonsteroidal anti-inflammatory drug (NSAID), which is another term for the medication. Ibuprofen is just one of many 2-aryl propanoic acids that

may be purchased over-the-counter today. Other options include naproxen and acetaminophen. Ketoprofen, flurbiprofen, and naproxen are just some of the various drugs that fall into this category. Ibuprofen is derived from the name "isobutylpropanoicphenolic acid," but this nomenclature has not been used for many years, and in fact, practically all chemists working today are unfamiliar with it. However, the word "ibuprofen" is derived from this nomenclature. This nomenclature was the source from which the word "ibuprofen" was initially coined. To our relief, however, the name continues to be a reasonably good match for the name 2-(4-isobutylphenyl)propanoic[13] acid, which is the name that is currently approved. [13] Acid 2-(4-isobutylphenyl] Ibuprofen is one of the anti-inflammatory medications that is used the most commonly. It is also known as (+/-)2-(4-isobutylphenyl)propionic acid and can be seen in Figure 1(a). It is considered to be the ancestor of the profens, which are a group of synthetic 2-arylpropionic acids that belong to the 2-arylpropionic acid family. Nonsteroidal anti-inflammatory drugs, or NSAIDs for short, are a broad category of pain relievers and fever reducers (NSAIDs). In recent years, the effens have come to dominate this treatment class, which was formerly dominated by antidepressants.

Previously, antidepressants were the clear frontrunners. Patients who suffer from painful disorders such as arthritis, muscle strain, cephalalgia, and a number of other painful conditions may be given ibuprofen as a prescription medication.



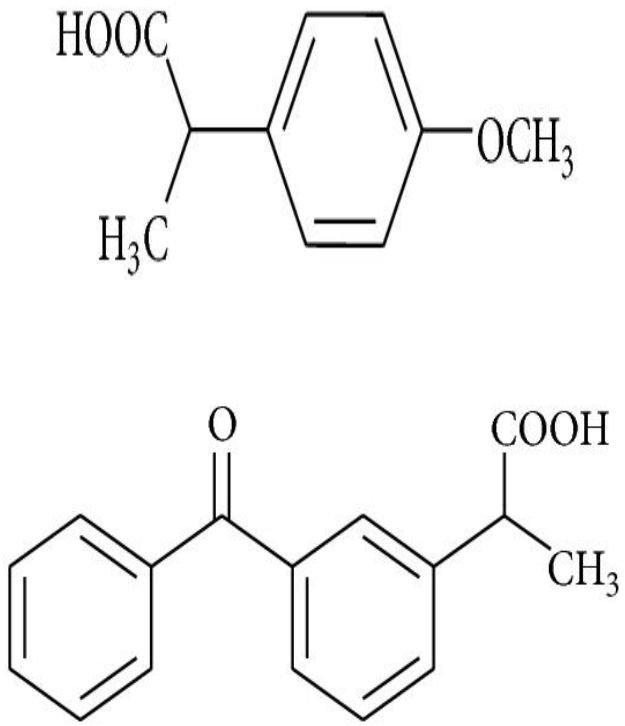


Figure 1 Ibuprofen (a), Naproxen (b), Ketoprofen (c), and Flurbiprofen (d) are some examples of the various types of Profen drugs that are currently available on the market,

The profens have a carbon centre that is asymmetric, and it is related to a carboxylic acid group, a methyl group, and an aryl group, all of which have distinct structural configurations. In addition, the profens have an aryl group that is attached to the asymmetric carbon centre. Ibuprofen (a), Naproxen (b), Ketoprofen (c), and Flurbiprofen (d) are some examples of the various types of Profen drugs that are currently available on the market, and they are depicted in Figure 1. (d). Both ibuprofen and naproxen can be purchased without a doctor's prescription, and naproxen was one of the top ten pharmaceutical drugs that were sold the most in the world in 1989 [13]. It is common practise to take ibuprofen in order to alleviate the symptoms of a wide range of diseases and conditions, including headaches, backaches, menstrual pain, tooth pain, neuralgia, rheumatic pain, muscular pain, migraines, cold and flu symptoms, and arthritis. Some of these symptoms include tooth pain, menstrual pain, tooth pain, neuralgia, and tooth pain. NSAIDs are able to [14]. This is the mechanism by which NSAIDs are able to exert their pharmacological and toxicological effects. This is the major method via which NSAIDs are able to exert their effects, hence it is important to understand how they work. In the past twenty years, heteropolyacids, which are also known as HPAs,

have been put to use in a wide variety of acid-catalyzed processes, where they have proven to be both effective and adaptable as acid catalysts. This is due to the fact that they have been used in a wide variety of acid-catalyzed processes. Heteropolyacids have a molar catalytic activity that is anywhere from 100 to 1000 times more active than that of H2SO4, making them several times more active than both inorganic and organic acids. This is because heteropolyacids have a molar catalytic activity that is greater than both H2SO4 and H2O2. In addition to this, it is possible to make use of them in quite small quantities. One of the most fascinating areas of research in recent years has been the synthesis and characterisation of catalysts with reduced dimensions. This field of study has evolved in recent years. We are aware that the relative number of surface atoms will grow as the particle size reduces, which will, as a direct result of this phenomena, lead to an increase in activity. This is the case because this phenomenon. In addition, due to the quantum size effects, particles on the nanoscale scale may exhibit unusual features, which enables them to be utilised in a wide variety of applications. These particles are suited for usage in a wide range of fields. A Preyssler acid, which belongs to the family of heteropolyacids and is distinguished by its exceptionally acidic nature, demonstrates excellent catalytic activity in a wide variety of acid-catalyzed reactions. This is due to the acidic nature of the Preyssler acid. Because of this, our objective was to improve the efficiency of this catalyst even further by utilising it in the form of nanoparticles in organic synthesis and reactions. Catalysts based on heteropolyacids provide a number of advantages over liquid acid-based catalysts, which are used in a variety of processes. They do not corrode, they are not harmful to the environment, and they present fewer issues when it comes to getting rid of them. Solid heteropolyacids have garnered a lot of interest in the field of organic synthesis as a result of their simple work-up procedures, ease of filtering, and ability to minimise cost and waste generation as a result of their ability to be reused and recycled as catalysts [6]. This is because solid heteropolyacids have the ability to be recycled and reused as catalysts, which allows them to minimise cost and waste generation while also reducing the amount of waste generated. The development of these catalysts has been the subject of a diverse range of research and development initiatives. Recent studies have led to the creation of Keggin nanocatalysts as a result of these studies. These efforts were a component of our larger endeavour to use heteropolyacids as a catalyst rather than relying on other types. We have also described an alternative approach for the synthesis of (S)-Naproxen that is an easy-to-follow procedure. This process makes use of a Preyssler catalyst known as H14[NaP5W30O110. This catalyst is beneficial to both the

environment and the ecosystem, as well as being eco-friendly, inexpensive, non-corrosive, and reusable.

Conclusion

This article outlines an alternative method that is straightforward for the synthesis of ibuprofen by employing Silica-Supported Preyssler Nanoparticles (H14[NaP5W30O110]/SiO2) (SPNPs) as an efficient catalyst that is also kind to the environment, economical, and low-cost. The method can be found in the following paragraphs. The product can be worked up in an easy manner using this approach, which has a number of advantages including high yields, ease of operation, and a straightforward procedure. One of the numerous advantages provided by these nanoparticles is a higher hydrolytic and thermal stability, which is delivered by Silica-Supported Preyssler Nanoparticles (H14[NaP5W30O110]/SiO2) (SPNPs). These nanoparticles also provide a number of other advantages. Anion developed by Preyssler is significant for a number of reasons, the most important of which are its availability, lack of toxicity, and reusability. Within the realm of organic synthesis, we are of the opinion that the application of this technique could prove to be beneficial.

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