Introductory Chapter: Pyridine

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Additional information is available at the end of the chapter

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1. Introduction

Pyridine (C_5H_5N), an aromatic compound where all the pi electrons are shared by a ring, forms one continuous circle of electrons besides the alternate double bonds shared by every atom on the circle. Pyridine is a unique type with nitrogen on the ring to provide a tertiary amine by undergoing reactions such as alkylation and oxidation. Amine is responsible for the slight dipole on the ring because electrons are drawn more toward the nitrogen being electronegative (lone pair electrons on the nitrogen) than other atoms in the ring. The H nuclear magnetic radiation (H-NMR) shows three signals at the ortho, meta, and para positions on the molecule in respect of three different chemical shifts. These chemical shifts are the result of the different electron densities for each of these atoms. As a result, this is not stable as other aromatic compounds (**Figure 1**).

Pyridine, a liquid similar to water, can easily mix with water and other organic solvents. This property is useful for making various products such as medicines, vitamins, food flavorings, pesticides, paints, dyes, rubber products, adhesives, waterproofing fabrics, and nitrogen-containing plant products. This nature of pyridine further makes it to be used as a precursor for many agrochemicals and pharmaceuticals. Hence, pyridine and its derivatives have significant applications in various fields, especially in the medicinal area.

All these properties of pyridine make it worthwhile to have a full overview about pyridine and its derivatives with recent researches in one place for potential researchers. This book provides a range of chapters which touches each and essential aspect of pyridine. It is the electronegative nature of pyridine in the backdrop responsible for the formation of all its derivatives. The synthesis of derivatives using pyridine has the biological activities and vast applications. Pyridine ring is also advantageous in the formation of discontinuous silver films on polymer composite by using its one of the derivative poly (4-vinyl pyridine) (P4VP).

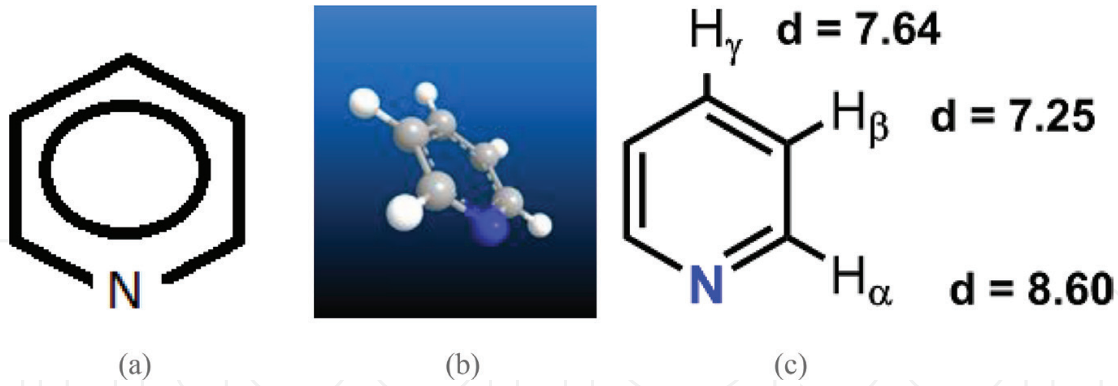

Figure 1. (a) The double bonds in pyridine are shared between all of the atoms in the circle so that they can be drawn as a circle instead of individual bonds. (b) Pyridine. (c) The hydrogen atoms on pyridine have three distinct chemical shifts. Pyridine shares the electrons in the entire circle, but the nitrogen draws more electrons to it, causing a slight dipole to form.

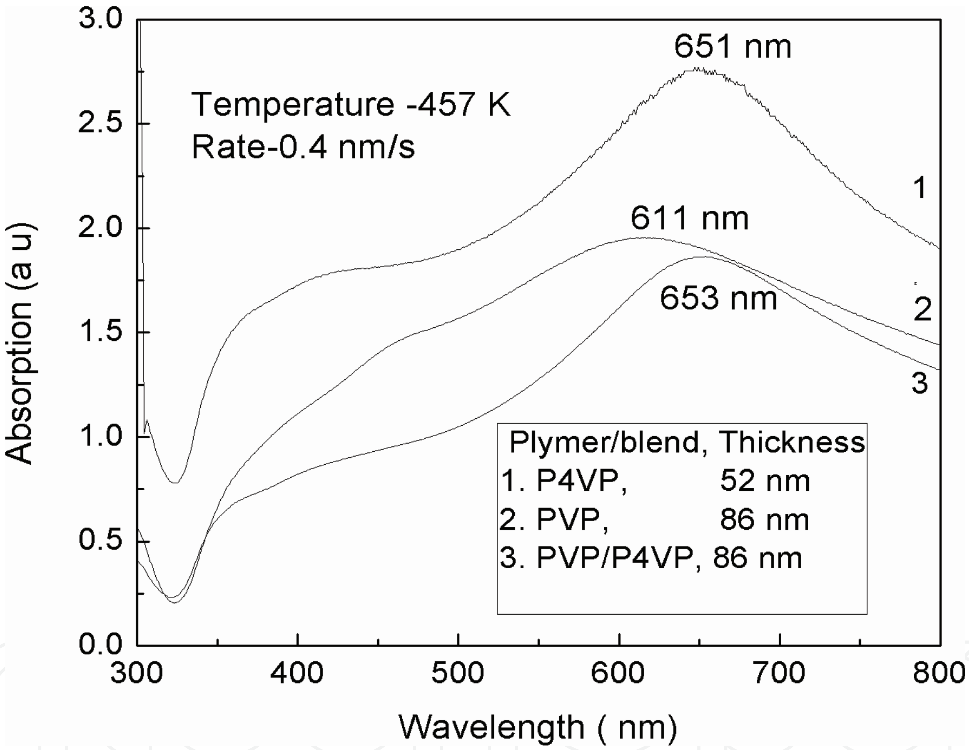

Figure 2. Optical absorption spectra of P4VP, PVP, and their composite.

2. Pyridine a link to Silver nanocomposite

Nanosized silver particles are well known to be used in many bactericidal and antimicrobial applications [1–4]. Antimicrobial property is most important to prevent a wound from microorganism for a long healing process. A lot of disinfectant agents have been introduced to wound dressings. Among them, using Ag NPs is the most advanced technology as its high efficiency has been proven. Preparing silver nanoparticles by toxic precursor chemicals produces hazardous by-products and contaminated Ag NPs, and hence, these must be produced with safe and clean methods.

Polyvinyl pyrrolidone (PVP) attracts considerable attention because of its excellent chemical and physical properties making it an excellent material as a coating or as an additive to different materials. It needs to be uniformly incorporated with Ag NPs. If PVP alone is used as host polymer agglomerated, nonuniform silver films are formed. The pyridine in P4VP because of the lone pair of the electron in nitrogen helps in the formation of nonagglomerated, uniform films on PVP/P4VP (50:50) [5] composites. The optical absorption of spectra shows the embedment of silver nanoparticles in the composite (**Figure 2**).

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