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Sulfonated graphene oxide (SGO) catalyzed green synthesis of 2,3-diphenylquinoxaline

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The compound 2,3-diphenylquinoxaline is a valuable nitrogen-containing heterocyclic compound with applications in medicinal, pharmaceutical, and materials chemistry. Conventional synthetic methods often employ various homogeneous and heterogeneous catalysts. Many of these methods have disadvantages, such as the use of strong acidic conditions, high temperatures, and high cost. This study aims to develop an efficient, green, and metal-free catalytic method for synthesizing 2,3-diphenylquinoxaline using sulfonated graphene oxide (SGO). SGO has been identified as a heterogeneous solid acid catalyst for various organic transformations because of its high surface area, large amount of acidic functional groups on its surface, and thermal stability. In this study, 2,3-diphenylquinoxaline was synthesized via double condensation of benzil and o-phenylenediamine by using SGO as a metal-free green solid acid catalyst in ethanol at 78 °C. The reaction produced the desired product in 90.4% yield in 40 minutes. The synthesized compound was characterized using FTIR (ATR method), which confirmed the formation of a 2,3-diphenylquinoxaline structure with these diagnostic peaks, aromatic C-H stretching is at 3056 cm^{-1}, 1546 cm^{-1}, 1479 cm^{-1}, and 1442 cm^{-1} correspond to the C=N stretching in the quinoxaline ring, a 1340 cm^{-1} and 1221 cm^{-1} correspond to the C-N stretching, while 1018 cm^{-1} and 979 cm^{-1} correspond to the in-plane aromatic C-H bending. A very strong peak at 764 cm^{-1} corresponds to out-of-plane C-H bending. The melting point of the final product is 125.3 °C, which is within the range of the values reported in the literature. These results demonstrate that the SGO is an efficient green catalyst for 2,3-diphenylquinoxaline synthesis. Further studies will investigate the mechanistic role of SGO, focusing on its active sites and interactions with reactants to better understand and optimize its catalytic performance and reusability.

Keywords:

2,3-diphenylquinoxaline; Sulfonate graphene oxide (SGO); o-phenylenediamine; benzil.