A New Method for the Selective Synthesis of Indirubins

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The purpose of this research is selective synthesis of indirubins and analysis of their properties. First, the synthesis of indirubins was carried out using potassium indoxyl sulfate which had never been studied as a starting material. Hydrolysis with isatin or N-substituted (N-methyl, N-allyl, N-phenyl, N-benzyl) isatin was performed under acidic condition. The sulfo group in potassium indoxyl sulfate was cleaved by hydrochloric acid, yielding indoxyl efficiently. In each case, the target product was obtained in high yield. And it should be emphasized that indigo was not formed at all. The products were analyzed with a silica gel thin-layer chromatography and ^{1}H-NMR spectroscopy. As a result of the analysis, the products were identified as indirubin or 1-substituted indirubin (1-methyl, 1-allyl, 1-phenyl, 1-benzyl). To the best of our knowledge, it is the first time to synthesize indirubins selectively in ambient conditions. Second, physical properties of the products, which are red pigments, were analyzed by UV-visible spectroscopy and cyclic voltammetry. In the visible spectra in chloroform, indirubin and all 1-substituted indirubins showed strong absorption at 536 – 550 nm. In the cyclic voltammograms in acetonitrile, an irreversible oxidation wave appeared at 0.83 – 0.91 V versus ferrocenium/ferrocene. The redox potential of 1-substituted indirubins was shifted to the negative side in the order of phenyl-, benzyl-, methyl-, and allyl-derivatives as compared to indirubin. From the results above, it is suggested that the method developed in this study is widely applicable to the synthesis of indirubin derivatives with different optical and electrochemical properties.

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