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A novel biocompatible Ni^{II} tethered moiety as a glucose uptake agent and a hit against methicillin-resistant Staphylococcus aureus

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Abstract

In the efforts to develop a biocompatible transition metal complex as a drug alike for some of the prevailing non-communicable diseases (NCDs) and communicable diseases (CDs), a novel binuclear Ni^{II} compound [{Ni^{II}(hpdbal-sbdt)}$_2$] (**2**) has been synthesized by the reaction of $Ni(OAc)_2.4H_2O$ and H_2hpdbal-sbdt (**1**) [**1** is a dibasic tridentate ONS^{2-} donor Schiff base ligand obtained by the condensation of 2-hydroxy-5-(phenyldiazenyl)benzaldehyde (Hhpdbal) and S-benzyldithiocarbazate (Hsbdt)]. Both ligand **1** and compound **2** were structurally characterized in the solid and solution state using various spectroscopic techniques like ATIR, ^{1}H-NMR, ^{13}C-NMR, TGA, FESEM, EDS and CHNS analysis. The antidiabetic activity of H_2hpdbal-sbdt (**1**) and [{Ni^{II}(hpdbal-sbdt)}$_2$] (**2**) were assessed using 2-NBDG uptake assay. The assay results showed 85% and 95% of fluorescent glucose uptake by insulin resistant HePG2 cells treated with compounds **1** and **2** respectively. The 2-NBDG uptake by the cells treated with the compound **2** was observed to be comparable to the standard antidiabetic drug metformin. Compounds **1** and **2** were also tested against five bacterial and two fungi strains in order to evaluate pathogen killing activity. Compound **2** showed significant inhibitory action towards the methicillin-resistant Staphylococcus aureus (MRSA) strain with an MIC value of 2 µg/mL whereas the ligand **1** was found to be inactive. Furthermore, the interactive nature of compound **2** with a model serum carrier protein bovine serum albumin (BSA) was studied using a multi-spectroscopic approach which provided an insight into the nature and extent of binding, conformational changes and the quenching of amino acid residues of the protein.