



Borneol-triarylcorrole hybrids with chiral-optical response and anticancer behaviours

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ABSTRACT

A series of four multifunctional A₂B type H₃CO corroles with *meso*-borneol substituents at the B position have been synthesized and characterized. A detailed analysis of the optical properties was carried out, and a comparison was made with theoretical calculations to identify the key trends in the structure-property relationships. The *meso*-borneol substituent couples with the corrole core leading to clear CD signals in the B band region. Enhanced anti-cancer properties are observed *in vitro* relative to (–)-borneol with cell inhibition rates of up to 94%.

1. Introduction

Chinese traditional medicines, among some of herbal products, have been studied for many medical problems, including stroke, heart disease, mental disorders, and respiratory diseases (such as bronchitis and the common cold), and a national survey showed that about one in five Americans use them. In this field, borneol, a bicyclic chiral monoterpene, is found in the essential oils of medicinal plants and is commonly used in traditional Chinese medicine for analgesia and anaesthesia [1,2]. Borneol derivatives have been intensively studied in the field of medicinal, food and material chemistry, and the research interests are continually growing [3,4]. Although research on borneol has led to a significantly enhanced understanding of its properties during the past few decades, the rational design of borneol derivatives to efficiently enhance their properties is still a challenge, especially to create novel functional borneol derivatives [5–7]. Porphyrin is an organic compound consisting of four pyrrole rings linked by C–H bridges with a heavy metal in the centre, which form part of several important

biological molecules. Examples include the haem group of Haemoglobin and myoglobin, chlorophyll (with magnesium) and cytochromes (with iron). Corroles are important porphyrin analogues that provide sterically constrained environments for coordinating central cations, since in contrast with porphyrins they have three inner N–H protons to maintain the heteroaromatic properties of the ligand π -system in the presence of only three *meso*-carbons [8–10]. Recently, the functionalization of corrole derivatives from synthesis has been received considerable attentions, and various functional groups can be introduced at the *meso*-, β -, and/or axial positions to modify the structures of the corrole ligands and their metal complexes, and the tunable electronic structures were also rationally modulated [11–13]. The application of these functionalized trianionic corrole ligands have been succeeded to stabilize numerous metal ions in higher oxidation states, forming complexes that are suitable for use in bioimaging and biosensors, optical and magnetic materials, and even in biomedical treatments [14–16]. Additionally, corroles can also play the important role in various cancer therapies due to their biocompatibility and low biological toxicity mainly due to they have

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