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MEDICINAL CHEMISTRY RESEARCH

ORIGINAL RESEARCH

Synthesis, in vitro cytotoxicity, and antibacterial studies of new asymmetric bis-1,2,4-triazoles

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Abstract A series of asymmetric bis-1,2,4-triazoles (**4a–l**) were synthesized from respective 1,2,4-triazole-3-thiocarbohydrazides (**2a**, **b**) via base catalyzed dehydrative cyclization of thiosemicarbazide intermediates (**3a–l**). The synthesized compounds were characterized by IR, ^{1}H-NMR, ^{13}C-NMR, and Mass spectral studies. The asymmetric bis-1,2,4-triazole derivatives (**4a–l**) were evaluated for in vitro antioxidant activity by DPPH radical scavenging assay method. The compounds with significant antioxidant potential were evaluated for in vitro cytotoxicity by MTT assay method against HT29 (Human adenocarcinoma) and MDA-231 (Human breast cancer) cancer cell lines. All the synthesized compounds were evaluated for in vitro antibacterial activity against *Bacillus subtilus* (ATCC 6633), *Staphylococcus aureus* (ATCC-25923), *Escherichia coli* (ATCC-25922), and *Pseudomonas aeruginosa* (ATCC-27853).

Keywords Asymmetric bis-1,2,4-triazoles · DPPH radical scavenging · MTT assay

Introduction

Cancer is the second leading cause of death worldwide, following cardiovascular diseases. The World Health Organization has estimated 12 million deaths worldwide due to cancer in 2030. Although progress has been steadily made in cancer research to reduce mortality and improve survival, cancer still accounts for nearly 1 in every 4 deaths in the world (Jemal *et al.*, 2009). Many symmetric and asymmetric bis-heterocyclic systems are drawing much attention in the recent past due to their wide spectrum of biological activity (Fucheng *et al.*, 1999; Spicer *et al.*, 2000; Holla *et al.*, 2001; Al-Soud and Al-Masoudi, 2004; Zhang *et al.*, 2006; Dabholkar and Ansari, 2008; Sztanke *et al.*, 2008). Many dimeric compounds designed as bis-DNA intercalators were evaluated as anticancer agents (Purohit and Mayur, 2012). Some of these bis-intercalators were reported to possess highly selective cytotoxicity against human colon carcinoma (Yong *et al.*, 2005; Denny, 2003). Many of the bis-1,2,4-triazoles have also been reported to possess wide spectrum of biological activity (Holla *et al.*, 2000; Ghorab *et al.*, 2000; Holla *et al.*, 2002; Demirbas *et al.*, 2004).

On the other hand, the emergence of multidrug-resistant microorganisms is posing a serious challenge to the scientific community in developing newer and safer molecules for the treatment of infectious diseases. Resistant organisms like methicillin-resistant *Staphylococcus aureus* (MRSA), chloroquine-resistant *Plasmodium falciparam*, multidrug-resistant *Mycobacterium tuberculosis*, and vancomycin-resistant *Enterococcus faecium* (VRE) are on the rise (Rostom *et al.*, 2009).There is an urgent need for the development of new antimicrobial for the treatment of such microbial infections. In view of these finding and in continuation of our study on 1,2,4-triazoles (Pujar *et al.*, 2006; Purohit *et al.*, 2011), we report here the synthesis of a small library of asymmetric bis-1,2,4-triazoles and their in vitro anticancer and antibacterial activities.

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