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MEDICINAL CHEMISTRY RESEARCH

ORIGINAL RESEARCH

# Comparative study of conventional and microwave-assisted synthesis of some Schiff bases and their potential as antimicrobial agents

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**Abstract** A series of Schiff bases (compounds **1–10**) were synthesized by condensing heterocyclic/aromatic aldehydes with heterocyclic/aromatic amines through both, conventional method and microwave-assisted synthesis. The compounds were confirmed by means of IR spectroscopy, Mass spectrometry, $^{1}$H NMR and elemental analyses. The compounds were assayed for antibacterial activity against selected strains of Gram positive, Gram negative bacteria and some fungi by zone inhibition method. Minimum inhibitory concentration (MIC) was also determined for each compound. Reaction times were drastically reduced by microwave-assisted synthesis. MIC was as low as 50 μg/ml exhibited by compounds **2** (against *Escherichia coli*, *Aspergillus niger* and *Penicillium chrysogenum*) and **10** (against *Bacillus subtilis*). The study presents a series of potential antimicrobial agents through efficient and simple reactions and mild reaction conditions, thereby offering a green chemistry approach.

**Keywords** Schiff base · Antibacterial · Antifungal · Microwave-assisted synthesis · Green chemistry

## Introduction

Compounds with the structure of $Ar_1C{=}NAr_2$ are known as Schiff bases, which are usually synthesized from the condensation of primary amines and active carbonyl groups. Many Schiff bases have been reported to possess antibacterial (Sridhar *et al*., 2001; Mladenova *et al*., 2002; Pannerselvam *et al*., 2005; Walsh *et al*., 1996; Bharti *et al*., 2010; Tenorio *et al*., 2005), antifungal (Walsh *et al*., 1996; Bharti *et al*., 2010; Tenorio *et al*., 2005) and antitumor activities (Liu *et al*., 1992; Hodnett and Dunn, 1970). Researchers have consistently studied the synthesis, characterization and structure–activity relationship of Schiff bases (Curini *et al*., 2002; Yadav *et al*., 2004; Byrnes *et al*., 1990; Kamel *et al*., 2010). It is well known that microwave (MW) irradiation can accelerate a great number of chemical processes and, in particular, the reaction time and energy input are supposed to be mostly reduced in the reactions that are run for a long time at high temperatures under conventional conditions (Loupy, 2002). The most successful applications of microwave irradiation are found to be related to the use of solvents and solvent-free systems, in which microwaves interact directly with reagents. Therefore, it can more efficiently accelerate chemical reactions (Burczyk *et al*., 2005). In classical organic synthesis of Schiff bases, the common problems are removal of solvents from the reaction mixture, liquid extraction especially in the case of aprotic dipolar solvents with high boiling point and product isolation through liquid–liquid extraction. The absence of solvent reduces the risk of hazardous explosions when the reaction takes place in a closed vessel or a microwave oven (Yang *et al*., 2002). Local overheating, which can lead to product, substrate and reagent degradation is avoided in microwave-assisted synthesis (Lidstorm *et al*., 2001). The solvent-free organic synthesis mediated by microwave irradiation offers several advantages such as higher atom economy, environmental friendship and reduced hazard potential. This approach has been used in past for synthesis of imines and enamines (Varma *et al*., 1997) and sulfonylimines (Vass *et al*., 1999). Thus, it was decided to utilize microwave irradiation for the synthesis of Schiff bases in

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