

## Synthesis and molecular modeling studies of naproxen-based acyl hydrazone derivatives

Tugba TAŞKIN TOK<sup>1,\*</sup>, Özgün ÖZARSLIK<sup>2</sup>, Deniz SARDIĞÖL<sup>2</sup>,  
Ayşe UZGÖREN BARAN<sup>2</sup>

<sup>1</sup>Department of Chemistry, Faculty of Arts and Sciences, Gaziantep University, Gaziantep, Turkey

<sup>2</sup>Department of Chemistry, Faculty of Science, Hacettepe University, Ankara, Turkey

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**Abstract:** A series of *N*-acylhydrazone derivatives (**2a-2p**) containing 6-methoxy-naphthalene and acylhydrazone moieties were synthesized in good yield using microwave irradiation and developed as potential COX-2 inhibitors. Furthermore, the interactions between COX-2 and the compounds were examined in detail by molecular modeling studies such as structure-activity relationship and molecular docking performed using Gaussian 09 and Discovery Studio 3.5. As a result, it was found that *N*-acylhydrazone compounds displayed a different mechanism than SC-558 as COX-2 inhibitor by binding to different active sites of the protein, COX-2. Compound **2c** would be a good COX-2 inhibitor candidate for preclinical studies.

**Key words:** Naproxen, microwave, acyl hydrazones, molecular docking

### 1. Introduction

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used to reduce pain, inflammation, and fever. Most NSAIDs reduce pain by preventing prostaglandin biosynthesis, by inhibiting the activity of the cyclooxygenase enzyme (COX).<sup>1</sup> Until 1990, only one form of the COX enzyme was known and it was thought to be responsible for both its anti-inflammatory activity and unwanted side effects. After 1990, it was found that the COX enzyme had 2 iso forms: COX-1 (constitutive form) and COX-2 (inducible form). Inhibition of the COX-1 enzyme causes some of the unwanted side effects such as gastrointestinal hemorrhage, ulceration, and decreased renal function, while inhibition of COX-2 is responsible for reducing pain, fever, etc.<sup>2</sup> An ideal NSAID would inhibit COX-2 enzyme activity without affecting COX-1 enzyme activity. To find an ideal NSAID, researchers synthesized many COX-2 selective hybrid NSAID compounds. Unfortunately, at the end of 2004, the COX-2 selective NSAID drug rofecoxib was withdrawn from the market because it was discovered that it increased the risk of cardiovascular events.<sup>3</sup>

After that many new studies were conducted to find NSAIDs that were safe in both gastrointestinal and cardiovascular terms. In these studies, naproxen showed the lowest cardiovascular risk<sup>4-5</sup> but had significant gastrointestinal side effects.<sup>6-8</sup> As part of the research, molecular modeling techniques<sup>9</sup> were used to design and develop the optimal compound(s) with less time, labor, and cost. Such methods also became increasingly useful in many other clinically oriented studies.<sup>10</sup>

In the present study, we planned to synthesize hybrid compounds of naproxen that minimize the side

\*Correspondence: ttaskin@gantep.edu.tr

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