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Recent Advances in Decarboxylative Nitration of Carboxylic Acids

Soma Majedi [a,] *, Serveh Majedi, [b], Farnaz Behmagham [c]

[a] *College of Health Sciences, University of Human Development, Sulaimaniyah, Kurdistan region of Iraq*
[b] *Department of Chemistry, Payame Noor University, P. O. Box 19395-1697, Tehran, Iran*
[c]*Department of Chemistry, Miyandoab Branch, Islamic Azad University, Miyandoab, Iran*

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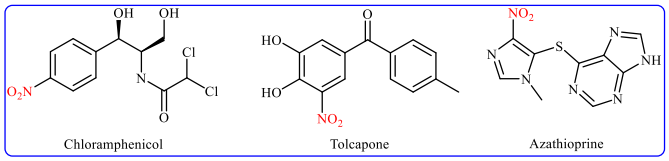
ABSTRACT

In this review, we will summarize the available literature on the preparation of nitro compounds from the corresponding carboxylic acids through nitrodecarboxylation. The review is divided into three major sub-sections. The first focuses exclusively on nitrodecarboxylation of aliphatic carboxylic acids. The second will discuss decarboxylative nitration of aromatic carboxylic acids. The third section will cover the synthesis of nitroolefins *via* decarboxylative nitration of α,β-unsaturated carboxylic acids. Particular emphasis is paid to the mechanistic aspect of reactions.

1. Introduction

Nitro compounds are organic compounds that contain one or more nitro functional groups (−NO_2) in their structure. This versatile functional group is part of the chemical structure of veterinary medications called nitro-drugs [1]. These drugs are used in the treatment of many diseases, including heart failure, hypertension, cancer, trypanosomiasis, and chagas disease (Scheme 1) [2]. The nitro group is also one of the most important and versatile functional group in organic synthesis [3]. It can readily be reduced to amines and oximes, common functional groups required in many pharmaceutical compounds. Recently, nitro compounds have been frequently utilized as versatile and eco-friendly alternatives to traditional organohalide coupling partners in various C-C cross-coupling reactions. These reactions known as denitrative cross-coupling reactions and recently have been highlighted by Cai and co-workers in their interesting review article entitled "denitrative coupling reaction: a powerful synthetic tool in functional transformation" [4]. Due to the widespread synthetic applications and biological activities of nitro compounds, development of novel, straightforward, and efficient synthetic routes to their preparation is always interesting.



Scheme 1. Selected examples of drugs containing nitro group

Carboxylic acids are conveniently available, easy to store, and simple to handle compounds which extensively utilized as building blocks in organic and polymer synthesis [5]. Recently, the decarboxylative cross-coupling reactions carboxylic acids has attracted considerable attention, since it opens a new avenue for fabrication of various carbon–carbon and carbon–heteroatom bonds [6]. In this context, the preparation of nitro compounds through decarboxylative cross-coupling reactions has experienced an explosive growth in recent years. To the best of our knowledge, a comprehensive review has not appeared of the nitrodecarboxylation of carboxylic acids in literature. In connection with our review articles [7], herein, we will summarize the data available from the literature for the synthesis of nitro compounds from the corresponding carboxylic acids (Figure 1). The review is divided into three major sub-sections. The first focuses exclusively on nitrodecarboxylation of aliphatic carboxylic acids. The second will discuss decarboxylative nitration of aromatic carboxylic acids. The third section will cover

* Corresponding author. Tel.: +9891183735667; e-mail: soma.majedi@uhd.edu.iq