

Confirmation of the configuration of two glucuronic acid units in glycyrrhizic acid

(Received October 22, 2014)

(Accepted December 15, 2014)

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Abstract

Glycyrrhizic acid (GA), a triterpenoid saponin containing two glucuronic acid (GlcA1 and GlcA2) units, is found in the roots of *Glycyrrhiza* plants, and has been widely used as a natural sweetener for foods as well as a natural medicine. Purified GA is commercially available from various manufacturers as an analytical standard or a biochemical reagent. While producers describe the configurations of GlcA1 and GlcA2 as α and β -forms, respectively, reports of the structural elucidation of GA have proposed that both GlcA units are β -form. To clarify this point, commercial GA from various sources was analyzed by 1D and 2D NMR studies. Results confirmed that the actual configuration of both GlcA units in GA is β -form.

Keywords : glycyrrhizic acid, glucuronic acid, natural sweetener

I Introduction

Glycyrrhizic acid (GA) is a triterpenoid saponin found in *Glycyrrhiza* plants such as *Glycyrrhiza glabra* (licorice), *G. inflata*, and *G. uralensis*. Since GA is 30–50 times sweeter than sucrose, root extracts of *Glycyrrhiza* (known as licorice root extract) have been used as a natural sweetener for foods¹⁾. In addition, it has been extensively reported that GA has several pharmacological activities, including anti-inflammatory²⁾, immunomodulatory³⁾, anti-ulcer⁴⁾ and anti-tumorigenic effects^{5, 6)}. Moreover, licorice root is a well-known oriental and occidental herbal medicine that is frequently prescribed for the treatment of various diseases. Purified GA is commercially available, and is utilized as an authentic standard in natural medicines and as a research agent for the investigation of biochemical and pharmaceutical activities.

GA is composed of a triterpenoid aglycone, glycyrrhezinic acid (GLA), and two glucuronic acid units (GlcA1 and GlcA2). The two GlcA units are connected *via* a 1 \rightarrow 2 glycoside linkage (Fig. 1) and the GlcA1 connects to position 3 of the aglycone GLA *via* a glycoside linkage. With respect to the configuration of the two GlcA units, recent papers dealing

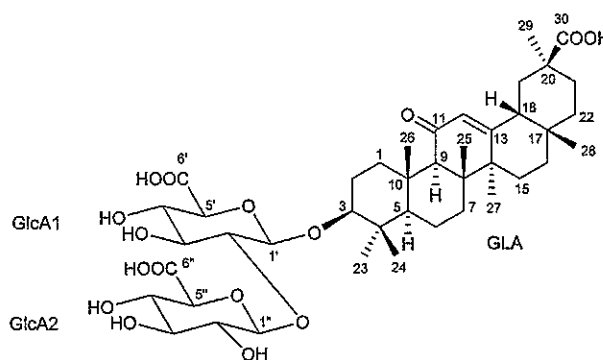


Fig. 1. Structure of glycyrrhizic acid (GA)

with GA prepared from *Glycyrrhiza* plants proposed that both were β -form^{7, 8)}. However, we noted that the labels of commercial GA and GA salts indicate the configurations of GlcA1 and GlcA2 as α -form and β -form, respectively. In our investigation of commercial reagent labeling, all commercial GA and GA salts were labeled as containing the α -form configuration of GlcA1 in their product catalogues. The origin of the labeling might be an authentic database such as the