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Determination of free, esterified, glycosylated and insoluble-bound phenolics composition in the edible part of araticum fruit (*Annona crassiflora* Mart.) and its by-products by HPLC-ESI-MS/MS

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ARTICLE INFO

Chemical compounds studied in this article:
Catechin (PubChem CID: 9064)
Epicatechin (PubChem CID: 72276)
Rutin (PubChem CID: 5280805)
Quercetin (PubChem CID: 5280343)
Protocatechuic acid (PubChem CID: 72)
Gentisic acid (PubChem CID: 3469)
Chlorogenic acid (PubChem CID: 1794427)
Caffeic acid (PubChem CID: 689043)
p-Coumaric acid (PubChem CID: 637542)
Ferulic acid (PubChem CID: 445858)

Keywords:
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Antioxidant activity
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Natural phenolic antioxidants
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ABSTRACT

Phenolics present in the free, esterified, glycosylated and insoluble-bound forms of araticum pulp, peel and seed were for the first time characterized and quantified using HPLC-ESI-MS/MS. Levels of total phenolics, flavonoids, condensed tannins and antioxidant activities from araticum fruit followed the order peel > pulp > seed. Overall, insoluble-bound and esterified phenolics were the dominant forms of phenolics from araticum fruit parts and the highest contributors to their antioxidant activities. Extracts were found to contain contrasting levels of phenolics that were specific to each fruit part. From 10 phenolics quantified in araticum fruit, catechin and epicatechin were the major ones from pulp and peel, whereas seed displayed caffeic acid, catechin and epicatechin as its main phenolics. Araticum fruit was found to provide a good source of phenolics, and the full exploitation of this fruit may find applications in the food, cosmetic and pharmaceutical industries.

1. Introduction

Araticum or marolo (*Annona crassiflora* Mart.) is an exotic fruit of Brazilian Cerrado belonging to the *Annonaceae* family. This fruit has oval or rounded shapes, tomentose surfaces of green colour when developing and brown when ripe with dimensions ranging from 9 to 15 cm in length per 10 to 15 cm diameter, and weighing from 0.5 to 4.5 kg. Its seeds (70 to 190 per fruit) are dark-brown with obovate-flattened shape, measuring from 10 to 13 mm per 20 to 27 mm, whereas its pulp is lightly sweet with a pleasant aroma, and colour ranging from white to yellow (Arruda & de Almeida, 2015). Araticum is one the most consumed fruits in the Cerrado region (within the top 20) (Arruda, Pereira, & Pastore, 2017a). Apart from its unique sensory features such as colour, flavour and aroma, the araticum fruit holds high nutritional value (1.52 g proteins, 3.50 g lipids, 14.39 g carbohydrates, 0.47 g ash, 6.80 g dietary fibre and 95.12 kcal per 100 g of pulp) and a great diversity of phytochemicals such as carotenoids, tocopherols, folates, some vitamins (Cardoso, Oliveira, Bedetti, Martino, & Pinheiro-Sant'Ana, 2013), and mainly phenolic constituents (Arruda, Pereira, & Pastore, 2017b; Roesler, Catharino, Malta, Eberlin, & Pastore, 2007). The rich profile of nutrients and phytochemicals in the araticum fruit has attracted growing interest of researchers, consumers and food, cosmetic and pharmaceutical industries.

Recent studies have demonstrated diverse biological properties of extracts from different parts of the araticum fruit, such as the ability to inhibit digestive enzymes and formation glycation products (Justino et al., 2016; Pereira et al., 2017), antioxidant (Roesler, 2011), antibacterial (Silva et al., 2014) and hepatoprotective (Justino et al., 2017) activities of fruit peel; antiproliferative, anticholinesterase (Formagio et al., 2015), insecticidal (Krinski & Massaroli, 2014), larvicidal

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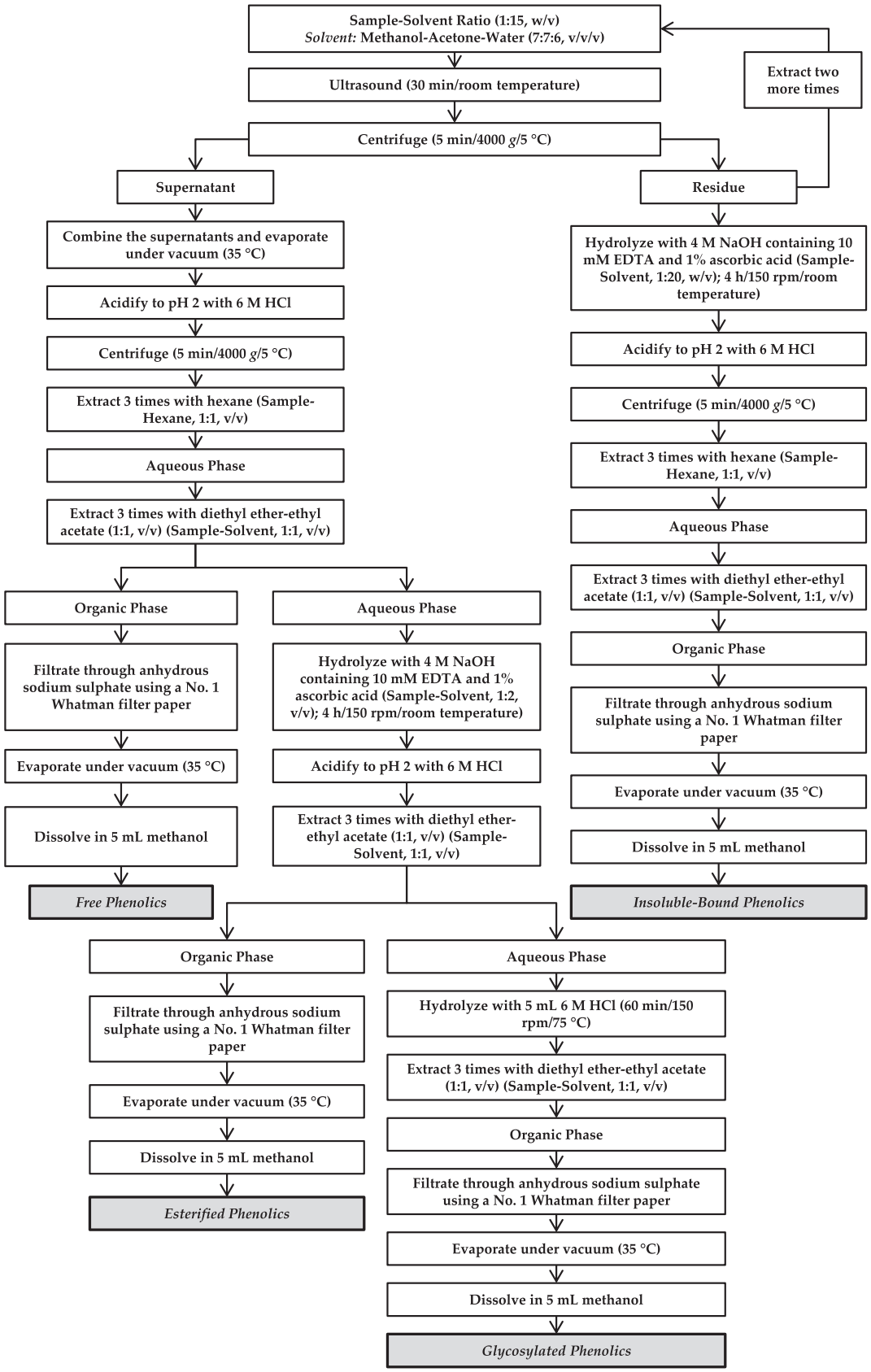

Fig. 1. Flowchart describing the procedure adopted for extraction and fractionation of phenolic compounds from araticum pulp, peel and seed.