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Catalytic lipophilization of natural antioxidants

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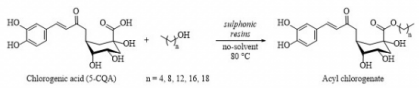
PURPOSE OF THE ABSTRACT

The valorization of agro-food industry residues is a pillar of circular economy.
Silverskin is a residue of the coffee roasting industry with almost no application. However, in the framework of project CirCo aiming at its valorisation, several products have been developed.
First of all a lipid fraction with unusual composition has been extracted from silverskin.
This fat contains significant amounts of long chain fatty acids such as C20:0 and C22:0 that are not present in other natural fats such as shea or cacao butter.
This unusual composition make this fat very interesting for the cosmetic industry. A lipstick and an eye shadow have been already formulated and tested showing enriched texture and increased adhesion to the lips and eyelids.
Another interesting component of silverskin is chlorogenic acid (CGA), a natural polyphenol widespread in nature (plants, vegetables, fruits), displaying several pharmacological and biological activities such as antioxidative, antibacterial, antihypertensive, antitumor, anti-inflammatory. However, its highly hydrophilic structure strongly limits its bioavailability and hinders the use into oil-based products such as cosmetic and nutraceutical preparations.
To overcome this drawback, CGA can be lipophilized through esterification with a fatty alcohol. The use of heterogeneous Brønsted solid acid catalysts, such as the sulphonic resins Amberlite® IR120 and Amberlyst® 15, resulted greatly effective in the direct acylation of CGA with fatty alcohols (4, 8, 12, 16, 18) in a sustainable, solvent free, one-pot reaction (Scheme 1).

Butyl, octyl- and lauryl- chlorogenate were isolated in high yields (up to 93%) and fully characterized by NMR and LC-MS analyses. The antioxidant activity of these products has been studied and compared to unsubstituted CGA (Figure 1). All the tested esters showed antioxidant activity higher that that exhibited by the parent chlorogenic acid.
Preliminary reactions highlighted the applicability of this method also to the esterification of mono- and oligo-saccharides.

FIGURES



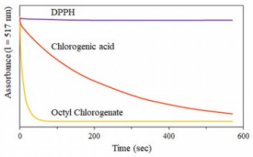


Figure 1

FIGURE 1

Scheme 1

Acid catalyzed esterification of chlorogenic acid

FIGURE 2

Fig.1

Antioxidant activity of CGA with respect with its n-octyl ester according to the DPPH test

KEYWORDS

waste valorization | natural antioxidants | lipophilization | solid acids

BIBLIOGRAPHY