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Simultaneous extraction of oil and antioxidant compounds from oil palm fruit (*Elaeis guineensis*) by an aqueous enzymatic process

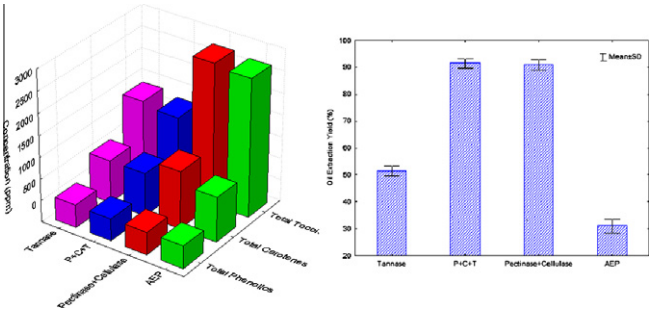
Camilo B. Teixeira [a,*], Gabriela A. Macedo [b], Juliana A. Macedo [b], Luiza Helena M. da Silva [a], Antonio Manoel da C. Rodrigues [a]

[a] Faculty of Food Engineering, Technology Institute, Federal University of Para, UFPA, Augusto Corrêa Street, Guamá, CEP 66075-900 Belém, PA, Brazil
[b] Food Science Department, Faculty of Food Engineering, University of Campinas, UNICAMP, Monteiro Lobato Street, Cidade Universitária, CEP 13083-862 Campinas, SP, Brazil

HIGHLIGHTS

- Simultaneous extraction of oil and antioxidant compounds from oil palm fruit.
- Pectinase and cellulase increased carotenes and oil recovery.
- Tannase improved the extraction of polyphenols, resulting in higher antioxidant activity.

GRAPHICAL ABSTRACT



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ABSTRACT

Oil palm (*Elaeis guineensis*) fruit was treated with enzymes to facilitate simultaneous recovery of oil and bioactive compounds. Tannase from *Paecilomyces variotii*, cellulase and pectinase were evaluated for their influence on oil recovery and antioxidant capacity (DPPH), oxidative stability (Rancimat), fatty acid profile, total phenols, total carotenoids and tocols of the oil. Maximum oil recovery (90–93% total oil) was obtained with central composite design using 4% of enzyme preparation (w/w) as 80 U of tannase, 240 U of cellulase and 178 U of pectinase, pH 4, ratio of solution to pulp of 2:1 and 30 min of incubation at 50 °C. Tannase improved the phenolic compounds extraction by 51% and pectinase plus cellulase improved carotene extraction by 153%. Samples treated with tannase showed a 27% and 53% higher antioxidant capacity for the lipophilic and hydrophilic fractions.

1. Introduction

Oil palm (*Elaeis guineensis* Jacq.) is the highest yielding edible oil crop in the world and is cultivated in 42 countries on 11 million ha worldwide (Abdul Khalil et al., 2008). Oil palm and its fractions are used in the manufacturing of cooking oil, margarines, spreads, ice creams and dairy products (Kok et al., 2011). Palm oil contains palmitic, monounsaturated oleic, polyunsaturated linoleic and stearic acids (Kok et al., 2011; Mortensen, 2005; Sampaio et al., 2011) and also minor constituents with nutritional and beneficial health properties, including tocopherols, tocotrienols, carotenoids, phytosterols, phenolic compounds and other phytonutrients (Edem, 2002; Sambanthamurthi et al., 2000).

Industrial processes for the extraction of edible oil from oil seeds generally involve solvent extraction or mechanical processing (Baryeh, 2001; Do and Sabatini, 2010); however, for oil palm extraction, a third method that can be employed is aqueous extraction (Owolarafe et al., 2007, 2008). Aqueous extraction processing (AEP) has found increasing interest due to the need for environmentally cleaner alternative technologies for oil extraction (Rosen-

* Corresponding author. Present Address: Food Science Department, Faculty of Food Engineering, University of Campinas, UNICAMP, Monteiro Lobato Street n°80, Cidade Universitária, P.O. Box 6183, CEP 13083-862 Campinas, SP, Brazil. Tel.: +55 019 3521 2175.
E-mail address: camilobt@hotmail.com (C.B. Teixeira).

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