HIGH-PRESSURE TECHNLOGIES AS PROMISING GREEN METHODS FOR EXTRACTION OF COCOA SHELL

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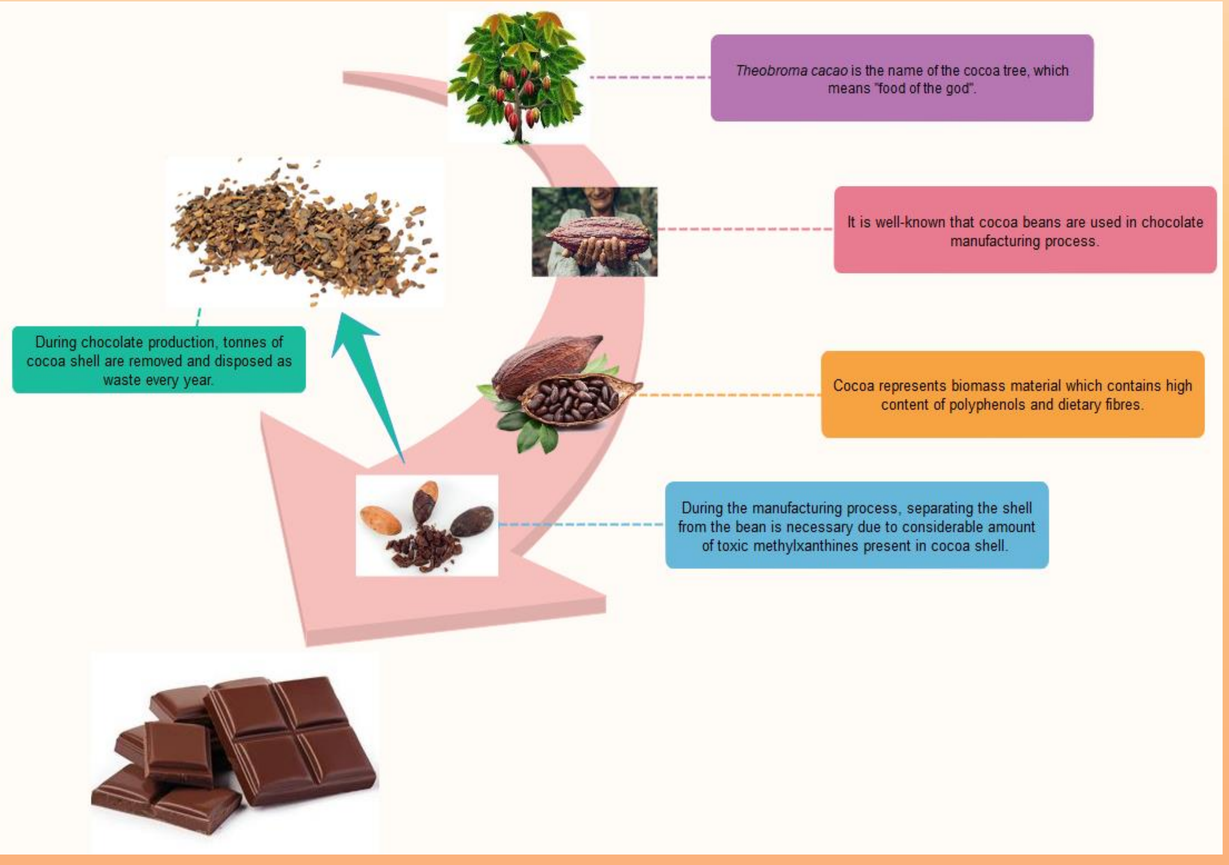
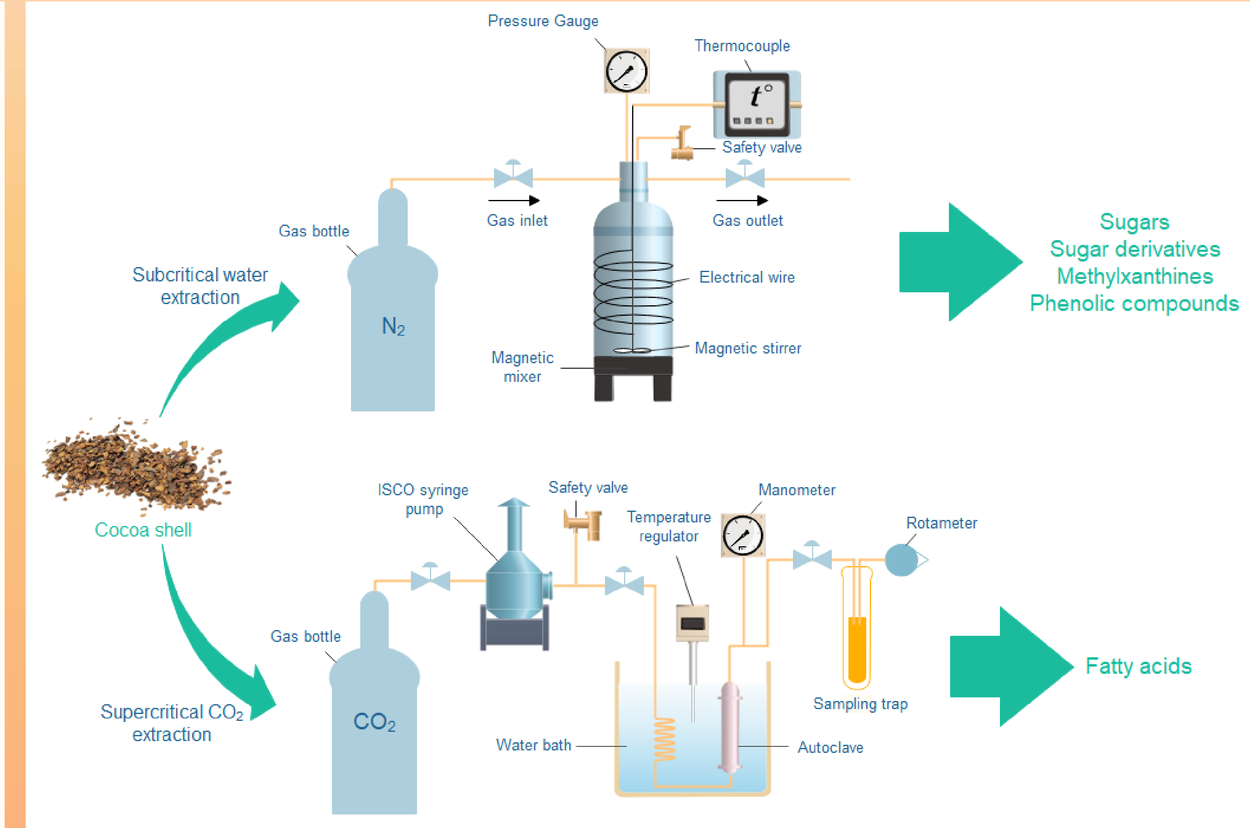
Cocoa shell represents a waste from the industrial production of cocoa and chocolate. However, it attracts a lot of attention because it is rich in valuable compounds. Re-use of cocoa shell won't increase only profitability and avoid environmental pollution, it could also found application in cosmetic, pharmaceutical and food industry due to its antioxidant, antimicrobial, anti-ageing, anti-radical and anticarcinogenic properties. Different methods were used for extraction of cocoa shell, but the data related to the use of green separation techniques are limited in the literature. Therefore, the aim of this work was to use both green-based and conventional extraction methods in order to compare results. Supercritical CO_2 extraction was performed at pressures of 200 and 300 bar and at temperatures 40, 60 and 80 °C. Subcritical water extraction was carried out in a batch reactor at temperatures of 170 °C and 220 °C. Soxhlet extraction with hexane and extraction with 50 % acetone were also performed. Total phenol content, total proanthocyanidin content and antioxidant activity of extracts were determined. Besides phenolic compounds, some extracts contained high amounts of theobromine, followed by caffeine and theophylline. Furthermore, subcritical water extracts were rich in sugars and their derivatives. Fatty acids were also obtained using supercritical CO_2 and Soxhlet extraction of cocoa shell and were analysed by gas chromatography.

INTRODUCTION

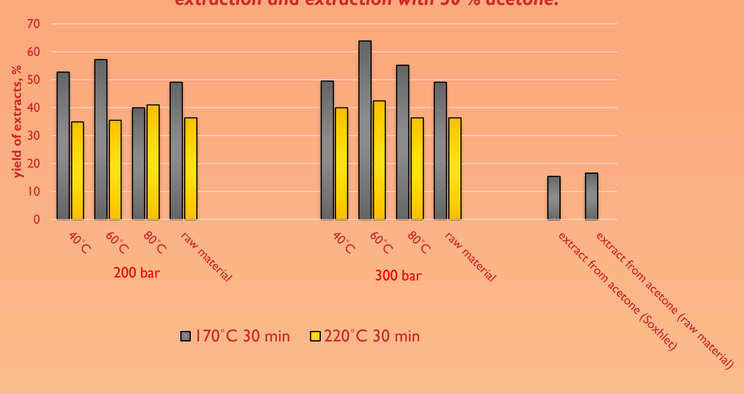


EXPERIMENTAL METHODS

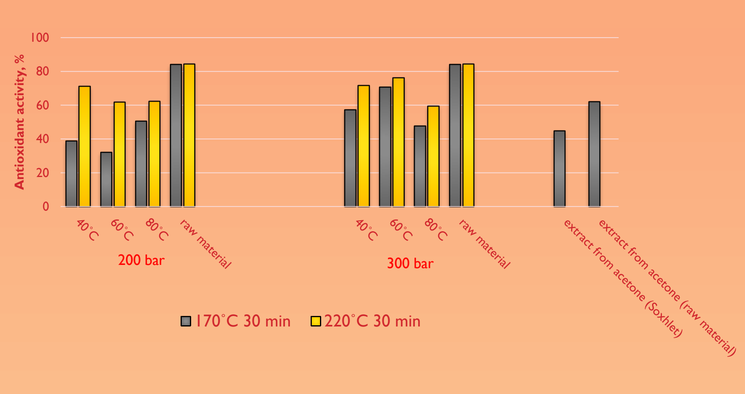


RESULTS

The yield of cocoa shell extracts obtained by subcritical water extraction and extraction with 50 % acetone.

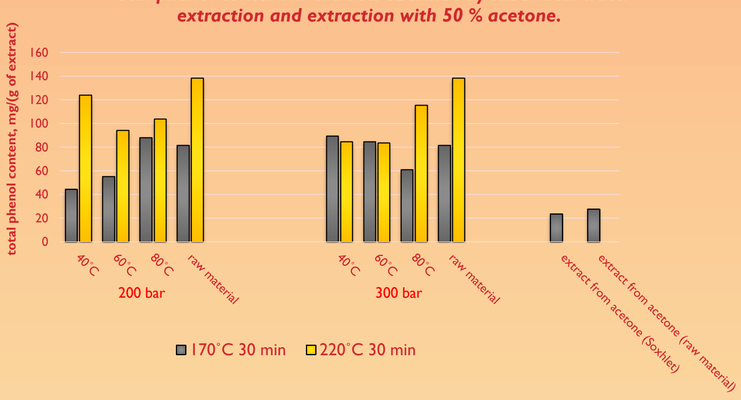


The antioxidant activity of extracts obtained by subcritical water extraction and extraction with 50 % acetone.

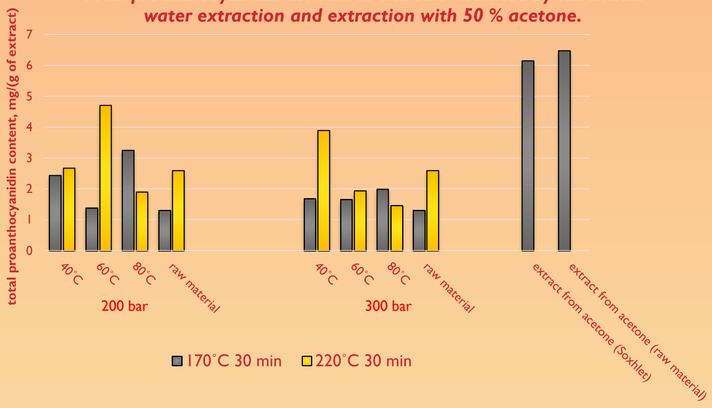


The yield of extracts obtained by supercritical CO_2 extraction at different conditions and Soxhlet extraction with hexane.

Total phenol content in extracts obtained by subcritical water extraction and extraction with 50 % acetone.



Total proanthocyanidin content in extracts obtained by subcritical water extraction and extraction with 50 % acetone.



CONCLUSION AND FUTURE APPLICATIONS

Green-based method such as supercritical CO_2 and subcritical water extraction showed more efficient results than conventional methods. Supercritical CO_2 and subcritical water extractions need shorter extraction time and their extracts are free of hazardous solvents. Furthermore, subcritical water and CO_2 are environmentally friendly, low-cost and safe extraction solvents, which could be promising alternative for recovery of bioactive compounds. Precisely, supercritical CO_2 extraction showed high efficiency for fat recovery, whereas subcritical water technology found application for extraction of sugars, methylxanthines and phenolic compounds. Furthermore, the chemical composition of cocoa shell implies that it could be used in food, cosmetic and pharmaceutical industries.

Compounds extracted from cocoa shell