LOCALISATION OF EXTRACTABLE OIL AND ANTIOXIDANTS FROM *Sclerocarya birrea* (MARULA) NUTS

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Kernels from nuts of *Sclerocarya birrea* (A.Rich.) Hochst. subsp. caffra (Sond.) Kokwaro (Anacardiaceae) contain a high percentage of oil as well as a powerful antioxidant. This antioxidant has been found to be six times more resistant to oxidation than virgin olive oil, and twice more than palmolein[1]. The exceptional stability of marula oil towards oxidation renders the use of the oil an attractive alternative for application in cosmetic formulations. Harvesting and processing marula nut oil may therefore become a sustainable industry.

Two extraction methods, supercritical fluid extraction (SFE) and Soxhlet extraction with hexane were investigated for possible application at a commercial scale. Hexane extraction was largely eliminated due to the toxicity factor of hexane residues in the oil. Anomaly in the percentage oil extracted by the two extraction processes was obtained. Hexane extracted kernels yield 40% - 50% oil while unmodified supercritical carbon dioxide extraction yields only 30% oil. A consecutive SFE did, however, extracted more oil to make this process comparable with solvent extraction. This is contrary to other extraction efficiencies, such as those used for olive and avocado oil[3], raising the question as to the cellular localisation of the oil.

Sample material was collected from different processing stages: unprocessed, whole nuts (control) (Sample 1), ground kernel meal without any further processing (Sample 2), meal after SFE was performed (Sample 3), meal after hexane (Soxhlet) extraction (Sample 4). Kernel meal used for Sample 5 had been subjected to two SF extractions. Samples for microscopy were prepared by fixing kernel meal in a 1:1 mixture of 2.5% glutaraldehyde and 2.5% formaldehyde buffered in 0.075 M PO_4 (pH 7.3). After washing in PO_4 buffer, samples were post-fixed in 1% OsO_4, dehydrated in ethanol, and embedded in Quetol 651. Monitor sections for light microscopy were stained with Toluidine Blue O. Ultrathin sections were viewed with a Philips 301 TEM.

The oil in the endosperm tissue of marula kernels fills the total intracellular contents, with the nucleus, plastids and protein bodies dispersed in it (Fig.1a). The efficiency of hexane extraction is evident from Figure 1b. Oil displaced during SFE saturate interstitial spaces, resulting in trapped fractions, which accounts for the lower yield compared to hexane extraction (Fig. 1c). This can be corrected after a second extraction with carbon dioxide. This study clearly showed that the lower extraction efficiency of SFE is as a result of the effect of the matrix and not because of differences in cellular oil location of the marula kernel. Current studies include the effect of modifier additions as a possible means to increase the solubility properties of the supercritical fluid.

References:

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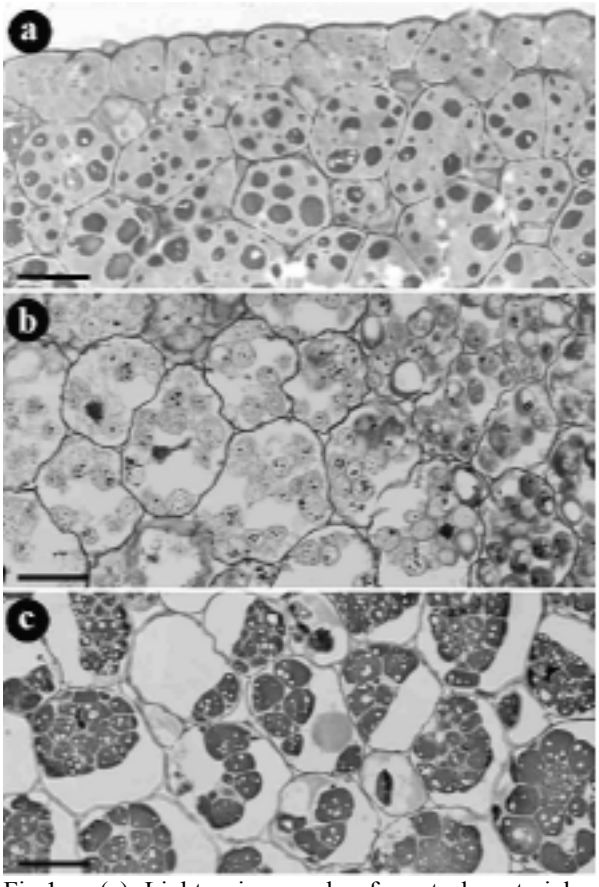

Fig.1. (a) Light micrograph of control material of marula endosperm. (b) Light micrograph of marula endosperm subjected to hexane extraction. (c) Light micrograph of marula endosperm subjected to super critical fluid extraction. Scale bar = 10 µm.

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