

PROCESSING POTENTIAL OF PEPPERS OF THE
CAPSICUM GENUS (*CAPSICUM ANNUUM* L.)

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ABSTRACT

Processing Potential of Peppers of the *Capsicum* Genus
(*Capsicum annuum* L.)

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In this study of the processing potential of peppers, two major types of extracts, the oleoresin and the volatile oil of several varieties of peppers of the *Solanaceae* family, classified as *Capsicum annuum* L., were evaluated using the following four methods: (a) Supercritical Fluid Extraction (SFE); (b) Solvent Extraction; (c) Entrapment during Vacuum Drying; and (d) Steam Distillation. To date, there has been no such systematic studies conducted on *Capsicum* peppers reported in the literature.

The initial characterisation of the peppers involved both proximate and chemical analysis of the extracts, with the emphasis being placed on the chemical analysis. Reversed phase High Performance Liquid Chromatography (HPLC) was used to separate and quantify the major components of the pungency principles and also to trace development of these components during the ripening process. Acetone extraction, followed by HPLC analysis of the extract, was deemed to be a suitable technique for quantifying pungency in dried peppers. ¹H NMR spectroscopy of the extract of the red Bell pepper indicated a capsaicin:dihydrocapsaicin ratio of 71:29. A comparison of the results with published work indicated that the Bell peppers grown in Trinidad possessed a pungency far greater than those reported elsewhere in the world.

Gas Chromatography/Mass Spectrophotometry (GC/MS) analysis was used to identify the volatile flavour components. A Mininert valve was the appropriate system used to sample the volatile oil with the vapours collected being subjected to GC and GC/MS analyses to identify the various components. The data acquired, when compared to the published data, indicated some common compounds, but there were also some significant differences.

The major work in this research on the processing potential utilized SFE. This work was carried out on both fresh and dried peppers. The objective of the work on fresh peppers was to collect both the volatile oil and oleoresin in the same run. Various collection systems were tested; the preferred technique utilizing three cooled vials connected in series. The first two vials, which were initially empty, collected the oleoresin containing the pungent principles, with the volatile oil being dissolved in either ethanol or propylene glycol solution in the third vial. This is a novel concept and technique, and to date, no reports of

collecting two products simultaneously in the same run during SFE was located in the literature. The experiments disproved the general contention (Brogle 1982) that volatile oils could be extracted by operating at lower pressures followed by extraction of the oleoresin at higher pressures, since significant quantities of the oleoresin were extracted even under mild conditions (100 bar pressure, 40°C).

Statistical analyses were conducted on the data acquired from the SFE experiments to determine the relationship between the measured capsaicinoid content and factors such as: location, maturation stage and variations of pressure, temperature, moisture content, time and the use of an entrainer.

These analyses indicated that the maximum SFE extraction from fresh peppers with 100% acetic acid as an entrainer, occurred at 100 bar pressure and 40°C for 60 min to release the volatile oil with the bulk of the oleoresin. The remaining oleoresin was extracted operating at a pressure of 150 bar and temperature of 60°C for a further period of at least 90 min. Propylene glycol was the best solvent to enable the entrapment of volatile components as evidenced by the GC chromatograms.

The experimental work on the SFE of dried peppers investigated the effects of adding an entrainer to aid extraction, as well as the effects of operating temperature and pressure. The results showed that the addition of acetic acid improved extraction yields, but that the effects of temperature and pressure were not significant when operating with the entrainer.

The work on the Supercritical Fluid Extraction from *Capsicum annuum* L. peppers, as described in this thesis, could be used as the basis for further development of processes for the production of commercial products, such as food flavourings and additives, pharmaceuticals and security sprays.

Keywords: Rosalie Lystra Holder; *Capsicum annuum* L.; SFE; Flavour; Oleoresin; Capsaicinoid content; Volatile oil; Statistical analyses