ABSTRACT

Vetiver grass is a viable vegetative absorbent and erosion barrier; in addition the valuable oils extracted from its roots are playing an increasing role in the perfume, food and pharmaceutical industries. The quantity and quality of oil extracted from the vetiver grass depends strongly on location of growth, and the extraction and separation techniques adopted. The aim of this research project is to evaluate whether the harvesting and extracting of essential oils from locally grown vetiver grass would be a feasible business idea, as well as, which extraction technique will give the highest yield of vetiver oil.

The extraction methods tested are solvent extraction, hydro distillation and supercritical carbon dioxide extraction. Due to the lack of supercritical fluid extraction equipment available a large portion of the research project was on the design and setup of a supercritical fluid extraction unit.

The experimental investigations undertaken using solvent extraction in a soxhlet apparatus with hexane as the extracting agent gave an average yield of $\pm$ 1.6% for a 5 hour run which is slightly lower than the yield of 1.91% for a 5 hour run stated in literature. According to the experimental results, yields of up to approximately 2% for hexane extraction can be achieved by increasing the extraction time to 12 hours.

The vetiver roots were also hydro-distilled in a clevenger apparatus for 16 hours (extraction time); this produced a yield of approximately 0.18 to 0.35%. According to literature hydro distillation of vetiver roots in a similar apparatus resulted in an average yield of 1.8% for a 16 hour run. This showed that the heavier components of the vetiver oil were not released during the hydro-distillation extraction.

Research shows that supercritical carbon dioxide extraction (SCE) produces the highest yields ranging from 2.9 to 3.74% when using the recommended parameters of 190 bar and 50°C. Experimentally a yield of approximately 2.3% was achieved by SCE at 180 bar and 40°C. This yield is lower than that seen in literature due to the lower operating temperature and pressure; however SCE gives a higher yield than the other methods tested in this investigation.

The composition of the vetiver oil extracts were analysed using gas-chromatography techniques and this showed that a large percentage of nootkatone is present when using the hydro-distillation technique, whilst a large percentage of zizanoic acid was present when using the solvent extraction technique. However a minimal percentage zizanoic acid with higher percentages of nootkatone and khusimol are present in the SCE extracts.

The solvent extraction technique gives high yield with high percentage invaluable zizanoic acid whereas hydro-distillation gives very low yields but no zizanoic acid with high percentages valuable nootkatone and khusimol. SCE gives slightly higher yields of vetiver oil than solvent extraction and it contains very minimal zizanoic acid with higher percentages of nootkatone and khusimol. It was therefore concluded that SCE would be the best extraction method for these particular vetiver roots.

For a pilot scale SCE extractor the total annual sales was estimated as R 453 420 and the total operating costs per annum were estimated to be R 4 839 813. Therefore from this preliminary feasibility study it is seen that the total operating costs far exceed the total annual sales and hence the business is not profitable.