CHAPTER 1

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

Fats and oils are present in all our foods in varying amounts. The uses of animal and plant oils for edible purposes are numerous. The fats and oils contribute considerably to the taste, flavour and quality of the food. Should the oil be rancid or off-flavoured, the whole product would be spoiled. The quality of the fats and oils used is thus of utmost importance. The initial quality of the oil is of importance but also the stability of the oil as it indicates the resistance of the oil to possible future changes.

The stability of oils in processed foods is of importance for two reasons (Rossel, 1994). Processed food often has long distribution runs via regional warehouses and it is thus essential to have a longer shelf-life. The other reason is as a result of public awareness of nutritional issues. Foods with higher levels of polyunsaturated oils and reduced levels of food additives such as synthetic antioxidants are being created and demanded. There is also more awareness of trans fatty acids, which are formed during the hardening procedure. Stable, more solid oils, without trans fatty acids are in demand. The warm climate, along with the long transport distances and often unlimited periods of unfavourable storage conditions of South Africa, necessitates the use of stable oils in the country. There is thus a need to be able to estimate the shelf-life of oils and oil containing food to ensure realistic shelf-life dating.

The main oilseed crop produced and consumed in South Africa is sunflower. The oil is used as household oil as well as in the food industry as frying oil or as ingredient of various food products. Sunflower is high in polyunsaturated acids and thus very susceptible to oxidation (Sonntag, 1979a). It also important to take note that according to Sonntag (1979a), it is generally accepted that oil quality depends on the quality of the seed and production procedures. Antioxidants are often added to retard oxidation. The oil should be used soon after production to ensure a good stable food product. Low quality sunflower oils are on the market from either local producers or cheap imports and care should be taken to avoid the use of them.

The other oil of increasing importance in South Africa is palm oil. The oil is imported from countries such as Malaysia and Indonesia. Palm oil contains significant amounts of saturated palmitic acid and monounsaturated oleic acid and is thus very stable to oxidation (Sonntag, 1979a) although the extended transport periods after refining might affect the quality of the oil. Different fractions of the oil are used for various applications but the most commonly used is palm-olein oil. The oil is more stable than sunflower oil due to its higher level of saturation but is more expensive to use. Less or no antioxidants are needed. These are important cost saving factors for the industry.

There are various factors that influence the oxidative stability of oils. These include the level of natural antioxidants such as tocopherols present in the oil, which protects the oil against oxidation by acting as free radical scavengers (Frankel, 1996). Artificial antioxidants such as tertiary-butylated hydroquinone (TBHQ), butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) are often added to further protect against oxidation (Giese, 1996). The degree of unsaturation of the fatty acids in the oil plays a big role in the susceptibility to oxidation where the more unsaturated fatty acids oxidise more rapidly (Hamilton, 1994). Trace metals such as Fe and Cu also act as pro-oxidants (Berger, 1994).

Quality tests such as free fatty acids (FFA), peroxide value (PV), anisidine value (AV) and oil stability index (OSI) give an indication of the overall oil quality (Rossell, 1994) but do not predict the probable shelf-life of the oil. There is information about predicting the shelf-life or the resistance to oxidation of oils using accelerated oxidation techniques (Odumosu, Sinha, Hudson, 1979). However, there is a need to correlate and standardise the storage time at ambient temperatures against the accelerated tests. At high temperatures the mechanisms of peroxidation are different from those at low temperatures (Méndez, Sanhueza, Speisky, Valenzuela, 1996; Frankel, 1996) and the conclusions drawn from the results at elevated temperatures can be misleading as the conditions differ from that of oils stored at normal storage conditions. It has been found that the stability index of three oils (soybean oil, sunflower oil and canola oil) at different temperatures varied markedly (Frankel, 1993b). PV was used as measure of lipid oxidation. At 60°C the soybean oil was the most stable, followed by canola oil and sunflower oil. However, the OSI at 100°C indicated that the canola oil was the most stable, followed by soybean and sunflower oil. The results based on the 60°C PV tests correlated with the sensory evaluation of rancidity. This indicates that there

is a need to compare OSI data with oils stored at lower temperatures to give a true indication of oxidative stability and thus the shelf-life of oils and high fat containing products.

The contribution of other quality and characteristic parameters of the oil need to be taken into account to assess if they can contribute to the rapid prediction of the shelf-life of the oil or product.

1.2 OBJECTIVES

The primary objective of this investigation was to establish which oil quality parameters could contribute to create rapid prediction models that would be able to predict the shelf-life of two oil types, sunflower seed oil (polyunsaturated oil) and palm-olein oil (monounsaturated oil).

Secondary objectives were: To determine the correlation between accelerated tests (Rancimat) and ambient storage conditions. To determine the effects of added pro-oxidants and synthetic antioxidants on oil stability.