CHAPTER I

INTRODUCTION

The plants in the Zingiberaceae (Ginger family) are mostly perennial herbs with freshy rhizomes and thicken roots. The rhizomes usually contain secretion sacs which are filled with volatile oil or yellow pigment of curcuminoids (Youngken,1950). Among the plants in this family, turmeric has been known and used for thousand years as a spice, coloring agent in food, household medicine, insect repellent and cosmetic (Helen *et al*, 1982). Turmeric rhizome is obtained from *Curcuma longa* Linn. (Syn. *Curcuma domestica* Val.) (Zingiberaceae). It is not a true spice but rather a condiment that has been used in the preparation of curries, pickles and many spicy foods. It is also one of the chief ingredient of curry powder. This plant is cultivated widely in most southeast asia and some asian countries, especially India, China and Indonesia (นิจศิริ เรืองรังษี,2534;Sastri *et al.*, 1950; Youngken, 1950).

For medical purposes, turmeric has been used for wound healing in peptic ulcer (Ammon and Wahl, 1990; Mehra, 1984; Rafatulah, 1990) and relief of dyspepsia (Ammon and Wahl,1990; Vitsanu., *et al.*,1989). It has also

been used as carminative (Ammon and Wahl, 1990; Bhavanishankar and Sreenivasa, 1985), antiinflammatory (Ammon and Wahl, 1990; Chawla *et al.*, 1987; Kunchandy and Rao,1990; Satoskar *et al.*, 1986), antispasmodic (Ammon and Wahl, 1990), antitumor (Ammon and Wahl, 1990; Kuttan *et al.*, 1985; Kuttan *et al.*, 1987; Kuttan *et al.*, 1989), anticoagulant (Kosuge, Ishida and Yamazaki, 1985; Wagner, Wierer and Bauer, 1986), antihepatotoxic (Kiso *et al.*, 1983; Shalini, Srinivas and Leela, 1987), antibacterial (Dahl *et al.*,1989; Shankar and Murthy, 1979; Shashikanth and Hosono, 1986; Tonnesen *et al.*, 1987) and antifungal (Ammon and Wahl, 1990; Lutomski, Kedzia and Debska, 1974; Singh *et al.*, 1984). Turmeric mixed with slaked lime is known as a household remedy for the treatment of sprain and swelling caused by injury (Ammon and Wahl, 1990). In Thailand, powdered turmeric has been manufactured in form of capsule for relief of dyspepsia. For other purposes, powdered tumeric has been used as coloring agent in many food products such as mustard, curries, butter and yogurt. Turmeric paper is used for testing of boron or boric acid and it has also been used as Natural Yellow 3, Color Index Number 75300 (Reynolds, 1989).

Pharmacological studies have shown that the active constituents of turmeric are curcuminoids and volatile oil. Curcuminoids are diarylheptanoids or diferuloylmethane. They are yellow pigments which are accumulated in the

parenchyma cells of cortex in turmeric rhizomes. The principle component is curcumin [1,7-bis (4-hydroxy-3-methoxyphenyl)1,6 heptadiene 3,5 dione]. Curcuminoids and the volatile oil are found in turmeric rhizomes with the contents of about 5% w/w and 5% v/w respectively. The volatile oil is accumulated in endodermis cells as oil droplets. It has been reported that turmeric oil consists of 10% monoterpenes, 25% sesquiterpenes and 65% sesquiterpene ketones (นิจศิริ เรืองรังษี, 2534). The oil has been found to contain α-pinene, β-pinene, camphene, terpinolene, α-phellandrene, β-phellandrene, 1,8-cineol, α-caryophyllene, β-caryophyllene, α-zingiberene, α-curcumene, bisabolene, β-sesquiphellandrene, ar-turmerone, α-turmerone and β-turmerone (Guenther, 1952; Helen *et al.*, 1982). It has also been reported to contain protein, cellulose, pentosans, starch, oleoresin and mineral elements (Parry, 1969).

Pharmacological actions of turmeric curcuminoids and volatile oil have been studied intensively both *in vivo* and *in vitro.* The alcoholic extract of turmeric,especially curcumin, has been found to inhibit leukotriene-B_4 formation which is related to the high antiinflammatory activity (Ammon and Wahl, 1990). Curcumin has been reported to increase the mucin content of gastric juice and inhibit intestinal gas formation (Ammon and Wahl, 1990; Bhavanishankar and Sreenivasa, 1985). Recently, it has

also been reported to have antitumor activity owing to its inhibition of tumor formation and increase survival rate of mice injected Dalton's lymphoma cells (Kuttan *et al.*, 1985, Kuttan *et al.*, 1987). For turmeric oil, it has been shown to have antifungal (Lutomski *et al.*, 1974), antibacterial (Ramprasad and Sirsi, 1956), antiinflammatory (Wagner *et al.*, 1986) and antitumor activities (Itokawa *et al.*, 1985). It has been used as insect repellent in wheat and rice store (Jilani, Saxena and Rueda, 1988; Jilani and Su, 1983; Helen *et al.*, 1982) and also used as dyestuff (Coyle, 1982).

Since the quality of turmeric is based directly on the contents of the curcuminoids and volatile oil. It is of interest to determine the amounts of these two components in turmeric, particularly those obtained from various areas of Thailand where turmeric can be grown easily. According to the literatures, a number of methods have been developed for quantitative analysis of curcuminoids, including uv-vis spectrophotometry (Public Health, Ministry, 1990), fluorospectrophotometry (Diaz and Peinado,1992),thin-layer chromatography (Sasri, 1981; Russell, 1988) and high-performance liquid chromatography (Russell, 1988; Smith and Witowaska, 1984; Tonnesen and Karlsen, 1983). While the uv-vis-and fluorospectrophotometric methods can be used easily to quantitate the total curcuminoid contents,they do not give

information on each of the curcuminoid. For TLC-spectrophotometric method (Sasri, 1981), the quantitation is very time consuming since it is accomplished by scraping off the respective spots, dissolving, centrifuging and finally reading the absorbance at 420 nm. For the HPLC method, the system to facilitate complete separation of the three curcuminoids have been reported by using an amino-column and fluorescence detector (Tonnesen and Karlsen, 1983). However, amino-columns generally do not have a long useful lifetime as C_{18} columns and the separated peaks usually have tailing and broaded peaks.

This study, therefore, aims to develop a new and simple method using TLC-densitometric technique for simultaneous determination of the three curcuminoids, and also aim to use the well established standard method of Association of Official Analytical Chemist (AOAC) for quantitative analysis of volatile oil content (Kenneth, 1990) in Thai turmeric. GC and GC-MS techniques were also carried out for determination of volatile oil components in turmeric and selected zingiberaceous plants. The information is expected to be useful for quality evaluation of turmeric from various locations in Thailand and for export.