

## CHAPTER 4

### CONCLUSIONS

The investigation on antioxidative and cytotoxic activities of the fresh rhizomes of *Alpinia galanga*, *Boesenbergia pandurata*, *Curcuma longa*, *Kaempferia galanga* and *Zingiber officinale* were achieved in the present work. The methanol extracts of the rhizomes of *A. galanga*, *C. longa* and *Z. officinale* showed strong antioxidative activity against DPPH radical whereas the water extracts exhibited rather weak activity. The five volatile oils, although lacked of antioxidative effect, showed pronounced cytotoxic activity against LS174T and MCF7 cell lines with IC<sub>50</sub> values ranging from 12.0-47.8 µg/ml. The methanol extract of *C. longa* was found to be the most cytotoxic against LS174T and MCF7 with IC<sub>50</sub> values of 6.4 and 14.2 µg/ml, respectively.

AGM1 (*p*-coumaryl-9-methyl ether) was isolated as novel antioxidative and cytotoxic compound from the methanol extract of *A. galanga*. Four compounds, ar-turmerone (CLM01), curcumin (CLM02), demethoxycurcumin (CLM03) and bisdemethoxycurcumin (CLM06), were isolated from the methanol extract of *C. longa*, among which demethoxycurcumin showed significant cytotoxic activity on both tumour cell lines (IC<sub>50</sub> < 4 µg/ml). Curcumin and demethoxycurcumin exhibited strong radical scavenging activity against DPPH with EC<sub>50</sub> values of 2.0 and 2.8 µg/ml, respectively, which considerably more active than those of bisdemethoxycurcumin and ar-turmerone. Three compounds, 6-shogaol (ZOM0), 6-dehydrogingerdione (ZOM1; also known as 1-dehydrogingerdione) and 6-gingerol (ZOM3), were isolated as antioxidative and cytotoxic constituents from the methanol extract of *Z. officinale*, among which 6-shogaol showed pronounced activities on both assay systems. Chemical structures of the eight isolated compounds were determined by spectroscopic methods, particularly 2D-NMR techniques. The unambiguous <sup>1</sup>H and <sup>13</sup>C NMR assignments of *p*-coumaryl-9-methyl ether (AGM1) and 6-gingerol (ZOM3) were described for the first time in the present work.

Beside ar-turmerone and the volatile oils, the other seven isolated compounds possess both antioxidative and cytotoxic activities suggesting that these compounds could act as both preventive and cytotoxic agents as far as the cancer is concerned. The obtained results from the present work suggest that the rhizomes of the five Zingiberaceous plants commonly used as spices in Thailand are potential sources of antioxidants (by acting as free radical scavengers) and/or cytotoxic agents against tumour cells, particularly *A. galanga*, *C. longa* and *Z. officinale*. Further study in animal model is strongly recommended in order to evaluate whether these medicinal plants are of promising for clinical trials.