

**CHEMICAL INVESTIGATION AND ANTIBACTERIAL
STUDIES ON SOME MYANMAR INDIGENOUS
MEDICINAL PLANTS AND FORMULATIONS**

Ph.D. DISSERTATION

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ABSTRACT

Myanmar indigenous medicinal plants and formulations investigated were: Traditional Medicine Formulation (TMF)-01, Myet-mon-nyin (*Cyperus rotundus*), Ba-de-gaw-gyee (*Alpinia galanga*) and Kun (*Piper betle*) used in the treatment of tuberculosis; TMF-06, Na-nwin (*Curcuma longa*), Sa-mon-net (*Nigella Sativa*), Pe-gyee-pyar (*Dolichos lablab*) and Hta-not-pyar (*Borassus flabellifer*) used in the treatment of dysentery and diarrhoea; Anti-malarial plant (*Artemisia annua*), Na-nwin-khar (*Curcuma comosa*) and Nge-phone-say (*Aristolochia tagala*) used in the treatment of malaria; Pauk (*Butea frondosa*), Taung-zee-phyu (*Phyllanthus amarus*), Kyeik-hman (*Eclipta alba*) and Kyah-moke-seik (*Tacca integrifolia*) used in the treatment of Hepatitis B. In all these samples, determination of potassium had been conducted through its natural ^{40}K activity by high purity germanium gamma counter and by NaI(Tl) selective channel and 'Aloka' gross gamma scintillation counters. Quantitative determination of the two elements (Na, K) and nine elements (Mg, Ca, Cr, Fe, Cu, Zn, As, Cd, Pb) in these samples were carried out by flame photometry and atomic absorption spectrophotometry (AAS), respectively. In addition, elemental analysis in these samples was determined by using energy dispersive X-ray fluorescence (EDXRF) spectrometry. Moreover, organic compounds present in water extracts of TMF-01, Ba-de-gaw-gyee, TMF-06 and Sa-mon-net were studied by phytochemical examinations. The antituberculous activities of different water extracts of Ba-de-gaw-gyee were determined by Ogawa method. The different water extracts of TMF-01, Ba-de-gaw-gyee, TMF-06 and Sa-mon-net were also screened for the antibacterial activities employing 20 species of bacteria by using agar disc diffusion method. The minimum inhibitory concentration (MIC) of active water extracts of Ba-de-gaw-gyee was determined by using microplate dilution method.

The main results obtained for different diseases were as follows:

In the treatment of tuberculosis, sodium (9.74 %) and magnesium (1.52%) were found as major elements in TMF-01 and found as minor elements [sodium (0.07 – 0.21 %); magnesium (0.25 – 0.42 %)] in medicinal plants. Potassium was

found as major element (1.01 – 4.22 %) in all the samples. Calcium was found as major element in TMF-01 (1.23 %) and Myet-mon-nyin (1.31 %), and found as minor element (0.07 – 0.08 %) in other plants. Iron was found as minor element (0.03 – 0.14 %) in all the samples. Chromium (17 – 31 ppm), zinc (24 – 50 ppm) and arsenic (87 – 1786 ppb) were found as trace elements in all the samples.

From the study on antituberculous activities by Ogawa method, the growth of *Mycobacterium tuberculosis* on all strains indicated that the different water extracts of Ba-de-gaw-gyee were not effective on *Mycobacterium tuberculosis*. But water extract of ash (AW) and water extract of ash from water (WAW) extract of Ba-de-gaw-gyee (*Mycobacterium tuberculosis* was grown after three weeks) slowed down more the growth of *Mycobacterium tuberculosis* than water (W) extract of Ba-de-gaw-gyee (*Mycobacterium tuberculosis* was grown after two weeks).

From the study on antibacterial activities by agar disc diffusion method, it was found that W extract of TMF-01, AW and WAW extracts of Ba-de-gaw-gyee showed significant inhibition zones against all types of bacteria. W extract of TMF-01 showed the highest significant inhibition zone against *Staphylococcus aureus* (26 mm). W extract of TMF-01 was the most effective in the treatment of disease caused by *Staphylococcus aureus*. In W extract of TMF-01, both water-soluble organic and inorganic compounds tend to show antibacterial activities on all the bacteria. Water-soluble organic compounds such as α -amino acids, glycosides and saponins which were found to be present in TMF-01, were effective on all the bacteria.

From the elemental analysis, potassium (5.229 – 90.572 %) was observed in all the extracts. In TMF-01, W extract of TMF-01 exhibited antibacterial activity but AW and WAW extracts did not show antibacterial activity. From these observations, it was inferred that antibacterial activity was not due to potassium. Its role might be only of supporting nature in the treatment of tuberculosis. Sodium was detected in AW and WAW extracts of TMF-01 which did not show antibacterial activity. From this observation, it was inferred that antibacterial activity was not due to sodium. Aluminium was detected in W

extract of TMF-01 which showed the antibacterial activity. From this observation, it was inferred that antibacterial activity was due to aluminium.

From the determination of minimum inhibitory concentration (MIC) by microplate dilution method, it was found out that the lowest MIC of WAW extract of Ba-de-gaw-gyee (0.078 mgcm^{-3}) was observed with *Escherichia coli* ETEC. From this observation, WAW extract of Ba-de-gaw-gyee might be most effective for the treatment of disease caused by *Escherichia coli* ETEC.

In the treatment of dysentery and diarrhoea, sodium was found as major element in TMF-06 (11.71 %), Pe-gyee-pyar (3.52 %) and Sa-mon-net (1.02 %), and found as minor element in Hta-not-pyar (0.64 %) and Na-nwin (0.14 %). Magnesium was found as major element in TMF-06 (3.27 %) and found as minor element (0.04 – 0.33 %) in the plants. Potassium was found as major element in Hta-not-pyar (2.89%), TMF-06 (2.66 %) and Pye-gyee-pyar (1.99 %), and found as minor element in Na-nwin (0.37 %) and Sa-mon-net (0.24 %). Calcium was found as major element in TMF-06 (2.68 %) and found as minor element (0.04 – 0.46 %) in plants. Iron was found as minor element (0.02 – 0.64 %) in all the samples. Chromium (8 – 97 ppm), zinc (6 – 79 ppm) and arsenic (121 – 655 ppb) were found as trace elements in all the samples.

From the study on antibacterial activities by agar disc diffusion method, it was observed that AW and WAW extracts of TMF-06 showed slightly significant inhibition zones against some bacteria. Water-soluble organic compounds such as flavonoids, glycosides and saponins which were found to be present in TMF-06, were not effective on all the bacteria. WAW extract of TMF-06 showed the highest significant inhibition zone against *Shigella sonnie* species (15 mm). In TMF-06, AW and WAW extracts exhibited antibacterial activity on some bacteria but W extract of TMF-06 slightly show antibacterial activity only three bacteria. Potassium was found in relative large amount (36.74 – 82.68 %) in these extracts. From this observation, it was inferred that antibacterial activity was not due to potassium. Its role might be only of supporting nature in the treatment of dysentery and diarrhoea.

Potassium was found as major element (1.03 – 2.79 %) in all the samples studied which were used in the treatment of malaria. Sodium (0.14 – 0.28 %), magnesium (0.17 - 0.49%), calcium (0.07 – 0.96 %) and iron (0.02 – 0.11 %) were found as minor elements and chromium (12 – 37 ppm), zinc (29 – 72 ppm) and arsenic (198 – 1465 ppb) were found as trace elements in all the samples.

Potassium was found as major element (1.17 – 4.49 %) in all the samples studied which were used in the treatment of Hepatitis B. Sodium (0.06 – 0.29 %), calcium (0.07 – 0.62 %) and iron (0.01 – 0.13 %) were found as minor elements in all the samples. Magnesium was found as major element in Kyah-moke-seik (1.04%) and found as minor element (0.15 – 0.19 %) in other plants. Chromium (9– 59ppm), zinc (38 – 91 ppm) and arsenic (75 – 722 ppb) were found as trace elements in all the samples.

In general, from chemical investigation, it was found that sodium was present as minor element (0.06 – 0.64 %) in most of the plants and as major element in the TMFs (9.74 – 11.71 %), Pe-gyee-pyar (3.52 %) and Sa-mon-net (1.02 %). Magnesium was present as minor element (0.04 – 0.55 %) in most of the plants and as major element in TMFs (1.52 – 3.27 %) and Kyah-moke-seik (1.04 %). Calcium was present as minor element (0.04 – 0.96 %) in most of the plants and as major element in TMFs (1.23 – 2.68 %) and Myet-mon-nyin (1.31%). Potassium was present as major element (1.01 – 4.49 %) in most of the plants and TMFs used for the treatment of diseases such as tuberculosis, dysentery and diarrhoea, malaria and hepatitis B. From the antibacterial studies, it can be concluded that the role of potassium is only of supporting nature.