

Study on the Elemental Analysis, Nutritional Values and Antimicrobial Activities of Crude Extracts from the Bark of *Salix alba* L. (Moe-ma-kha)

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Abstract: In the present work, the bark of *Salix alba* L. (Moe-ma-kha) was collected from Yankin Township, Yangon Region in Myanmar and verified its botanical name at Department of Botany, Dagon University. In this study, elemental analysis was performed to know the minerals present in the sample by EDXRF spectrometry. According to elemental analysis by EDXRF spectrometry, 87.355 ppm of Ca, 6.084 ppm of K, 2.388 ppm of Fe, 2.072 ppm of Si, 0.823 ppm of S, 0.542 ppm of Zn, 0.261 ppm of Ti, 0.220 ppm of Mn, 0.164 ppm of Sr and 0.091 ppm of Cu were found to be present in the sample. Nutritional values were carried out according to the AOAC method, resulting 11.960 % of moisture, 10.470 % of ash, 28.210 % of fibre, 4.625 % of protein, 0.820 % of fat and 43.915 % of carbohydrate respectively. The antimicrobial activities of the various crude extracts PE, MeOH, EtOAc, EtOH and watery extracts from bark of *Salix alba* L. were determined against six strains of microorganisms such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albicans* and *Escherichia coli* by agar well diffusion method. From the result, the MeOH and EtOH crude extracts showed a good activity against the *Pseudomonas aeruginosa* with the inhibition zone diameters ranged between 15-19 mm and all crude extracts did not exhibit any activity on *Candida albicans* and *Escherichia coli*.

Key Words: *Salix alba* L., EDXRF, nutritional value, AOAC, antimicrobial activity, agar well diffusion method.

1. INTRODUCTION :

Asia is a land of thousand natural herbs and medicinal plants. *Salix alba* L. (Moe-ma-kha), also known as white willow, is a tree with a long history of traditional use. Willow bark extract has been used for thousands of years as an anti-inflammatory, antipyretic and analgesic. Phytochemical investigation of crude extracts shows the presence of active constituents in the plant parts like roots, barks, leaves, flowers, fruits and seeds etc. Elemental analysis of bark of *Salix alba* L. showed essential minerals that turn to the formulation of traditional medicines. The nutrients present in the sample were important in primary health care service and essential for the physiological function of human body. So this study aims towards achieving traditional medical knowledge and contribution to natural product discovery.

2. MATERIALS AND METHODS :

In the present work, *Salix alba* L. (Moe-ma-kha) was chosen as sample to be studied. The bark of *Salix alba* L. was washed under running tap water. It was then dried under shade and ground into powder by electric grinder. The dried powder was used to investigate minerals and nutrients present in the sample for finding healing powers in plants. The relative abundance of elemental composition (Ca, K, Fe, Si, S, Zn, Ti, Mn, Sr and Cu) was analyzed by EDXRF method and nutritional values, namely moisture, ash, fibre, protein, fat and carbohydrate were carried out by AOAC method respectively.

The antimicrobial activity of various crude extracts such as Pet-ether, MeOH, EtOAc, EtOH and water from bark of *Salix alba* L. were determined against *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albicans* and *Escherichia coli* by employing agar well diffusion method.

3. RESULTS AND DISCUSSION :

People and other living organisms need certain substances of minerals and nutrients to survive. According to the result of elemental analysis, Ca, K, Fe, Si, S, Zn, Ti, Mn, Sr and Cu being essential minerals were found to be present in the sample. Among them, Ca is high content which is well known for its key role in bone health and other minerals being essential for physiology and health diet. The resultant EDXRF spectrum was shown in Figure 1 and its spectral data was illustrated in Table 1. From the result of nutritional values, the presence of the nutrients like fat, fibre, protein, carbohydrate and the physical properties like moisture and ash were described in Figure 2 and Table 2

respectively. On the basis of result observed, it means the selected sample could be used as a nutritionally valuable and healthy ingredient to improve traditional medicine formulation and to treat many diseases. According to the result of antimicrobial activity, MeOH and EtOH crude extracts exhibited potent antimicrobial activity on *Pseudomonas aeruginosa* with inhibition zone diameters ranged between 15-19 mm. This study would lead to the establishment of some compounds that could be used to formulate new and more potent antimicrobial drugs of natural origin.

Table 1. Relative Abundance of some Elements in *Salix alba* L. (Moe-ma-kha) Bark by EDXRF Method

No.	Elements	Relative Abundance (%)
1	Ca	87.355
2	K	6.084
3	Fe	2.388
4	Si	2.072
5	S	0.823
6	Zn	0.542
7	Ti	0.261
8	Mn	0.220
9	Sr	0.164
10	Cu	0.091

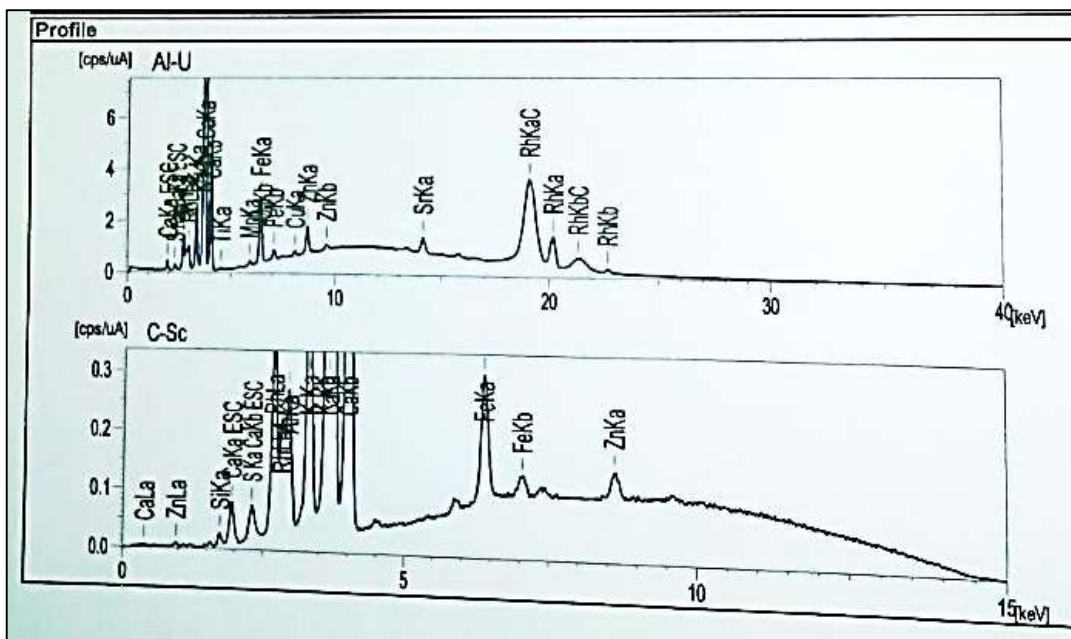


Figure 1. EDXRF spectrum of *Salix alba* L. (Moe-ma-kha) bark

Table 2. Nutritional Values of *Salix alba* L. (Moe-ma-kha) Bark

No.	Nutrients	Content (%)
1	Moisture	11.960
2	Ash	10.470
3	Fibre	28.210
4	Protein	4.625
5	Fat	0.820
6	Carbohydrate	43.915

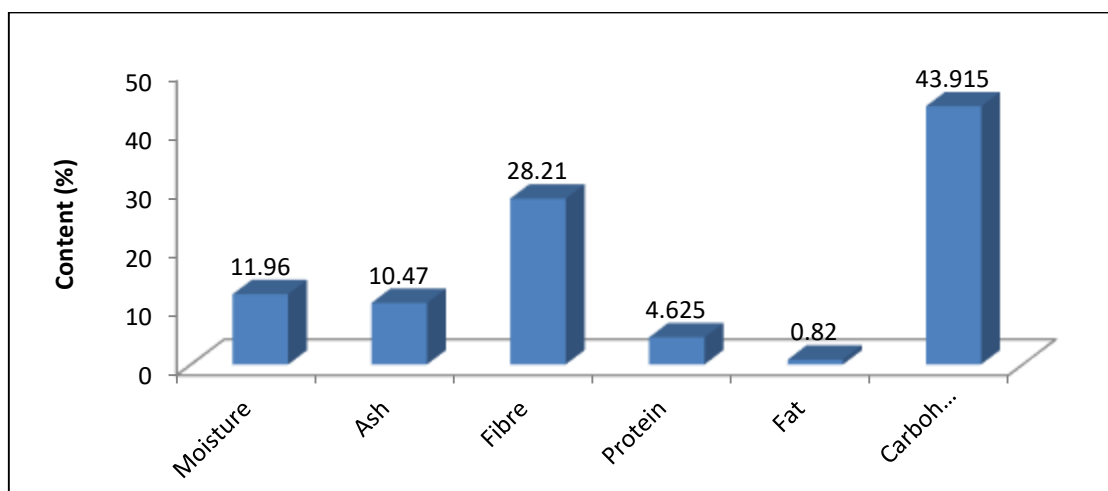


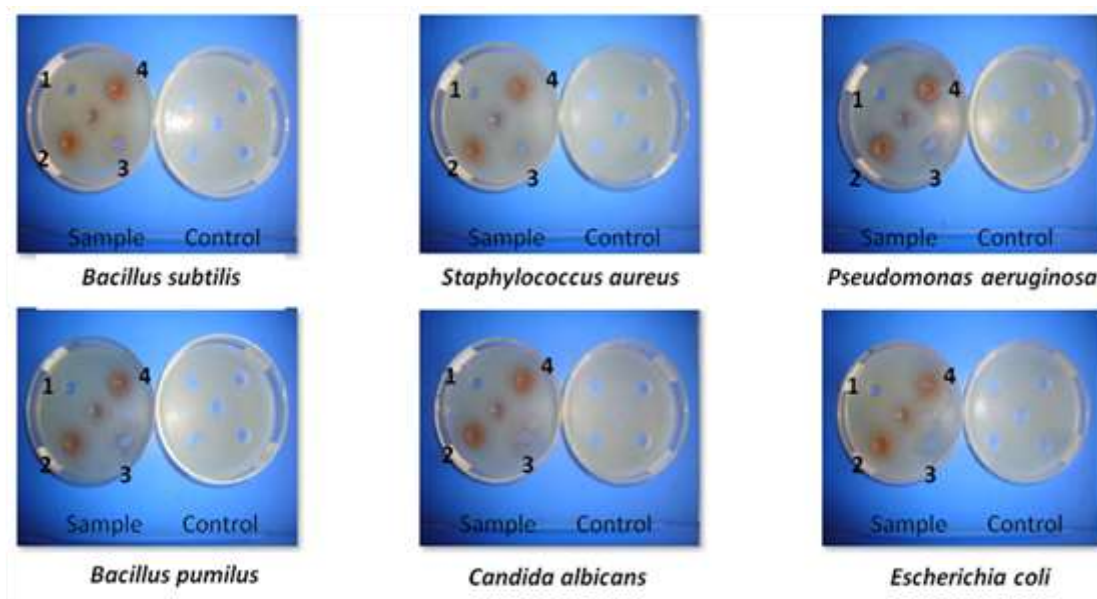
Figure 2. Nutritional values of *Salix alba* L. (Moe-ma-kha) bark

Table 3. Antimicrobial Activity of Various Crude Extracts from Bark of *Salix alba* L. (Moe-ma-kha) by Agar Well Diffusion Method

Organisms used	Diameter of inhibition zone (mm) in various crude extracts				
	PE	MeOH	EtOAc	EtOH	H ₂ O
<i>Bacillus subtilis</i>	12	15	-	14	-
<i>Staphylococcus aureus</i>	-	13	-	14	-
<i>Pseudomonas aeruginosa</i>	-	18	14	18	14
<i>Bacillus pumilus</i>	11	13	-	-	-
<i>Candida albicans</i>	-	-	-	-	-
<i>Escherchia coli</i>	-	-	-	-	-

Agar Well – 10 mm

- 10 mm ~ 14 mm - lower activity
- 15 mm ~ 19 mm - higher activity
- 20 mm ~ above - highest activity



- 1. PE extract
- 2. MeOH extract
- 3. EtOAc extract
- 4. EtOH extract
- 5. H₂O extract

Figure 3. Antimicrobial activity of various extracts of *Salix alba* L. (Moe-ma-kha) bark on six microorganisms

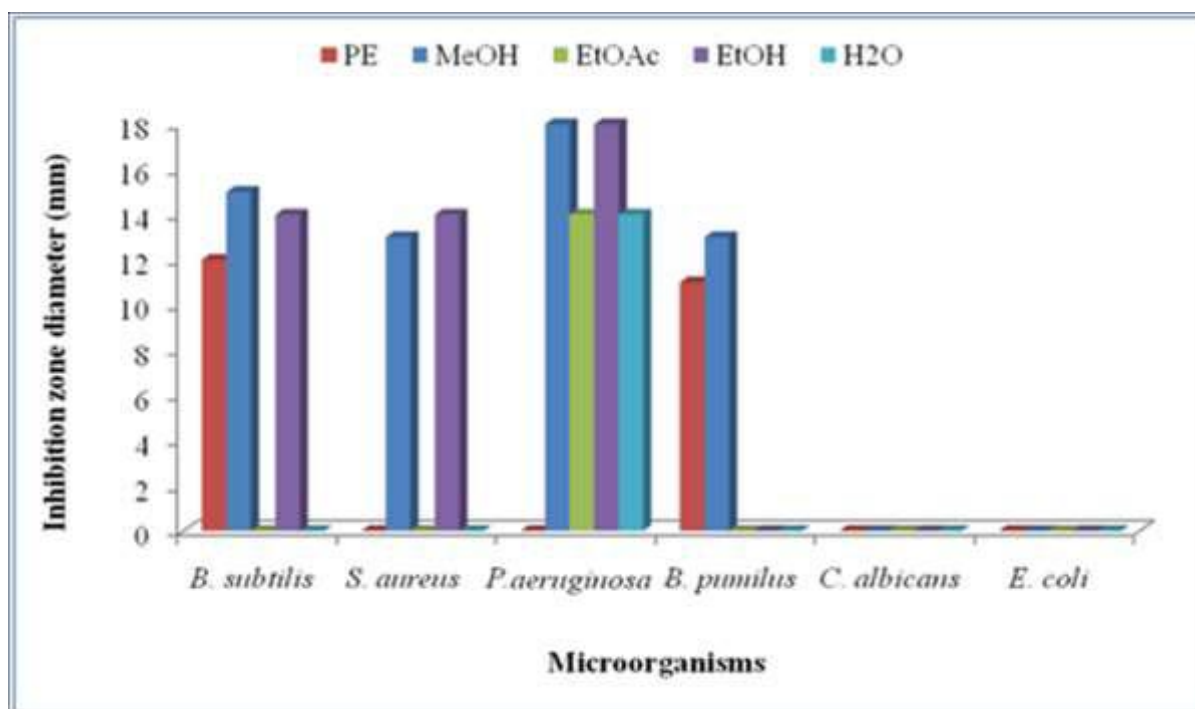


Figure 4. Histogram of inhibition zone diameters of different extracts of *Salix alba L.* (Moe-ma-kha) bark against six microorganisms by agar well diffusion method

4. CONCLUSION:

From this study, it can be concluded that the minerals and nutrients present in the sample perform hundreds of roles in the human body. Thus, it is useful for human nutrition and may also contribute to the development of formulation of natural medicine. As a conclusion, crude extracts of bark of *Salix alba L.* have great potential antimicrobial activity against microorganisms. Thus, the plant can be used in the treatment of infectious diseases caused by resistant microbes.

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