Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

JCNaR
Journal of Chemical Natural Resources

Analysis of Iron (Fe), Copper (Cu), and Zinc (Zn) on Param Traditional Medicine

Destaria Brahmana[1], Harlem Marpaung[2], and Zul Alfian[3*]

[1,2,3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Jalan Bioteknologi No.1 Kampus USU Medan 20155, Indonesia

Abstract. Param is well known traditional medicine for keeping healthy and treating diseases used by Karo Ethnic groups in North Sumatera. Param is a powder made of various nutritious plants and therefore its contents of the heavy metal were determined by using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) for qualitative analysis and Atomic Adsorption Spectrophotometry (AAS) for quantitative analysis. The result obtained for the analysis param taken from two samples were 11.814mg/kg and 25.4 mg/kg for Fe, 0.658 mg/kg and 4.536 mg/kg for Cu, and 12.728 mg/kg and 15.184 mg/kg for Zn. Param used as external medicine the content of Fe was 29.36 mg/kg, Cu was 7.368 mg/kg, and Zn was 27.688 mg/kg. The content of all was found in metal, fulfilling the Standart of the Food and Drug Regulatory Agency.

Keywords: Heavy Metals, Param, Traditional Medicine, AAS

Received [29 October 2019] | Revised [3 December 2019] | Accepted [28 January 2020]

1 Introduction

Indonesia is a tropical country rich in various plant species. There are approximately 940 species of plants that have medicinal properties from plants that have been developed and about 250 species that have been used. (Sari, 2008). The richness of this plant species includes the rich diversity of traditional medicines or more commonly known as herbal plants. Traditional medicine has been known and widely used for generations by the community. Generally, the use of traditional medicine is more of an effort to maintain health.

The popularity and development of traditional medicine are increasing along with the slogan "back to nature" which is increasingly echoing. In the use of traditional medicine, there are several aspects that need to be considered in making or consuming traditional medicine according to the decision of the Head of the Food and Drug Supervisory Agency of the Republic of Indonesia Number: HK.00.05.4.2411 of 2004, including heavy metal contamination, pesticide residues, aflatoxins, and contaminating microorganisms. In the community, traditional

*Corresponding author at: Department of Chemistry, Faculty of Mathematics and Natural Sciences Universitas Sumatera Utara, Medan, Indonesia.

E-mail address: zul20@usu.ac.id

Journal Homepage: http://jcnar.usu.ac.id

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

medicine is also used by the community including param, param which is used to maintain health and treat disease. Param is made from leaves, flowers, fruit, and seeds of plants. Where the growth in plants contained in organic active substances also contains metals where these metals include dangerous metals, namely heavy metals originating from the soil which is absorbed by plants if the param is used for a long time, the metal can accumulate in the human body. and can cause side effects even though the effects are not felt immediately because the slowly accumulated metal can cause disease and damage organs.

Metal and metal analysis can be carried out using Flame Spectroscopy methods including Atomic Absorption Spectroscopy and Plasma Optical Emission Spectrometry (ICP-OES) which are inductively combined. Qualitative analysis of metal content in param was carried out with ICP-OES and metal in param using Atomic Absorption Spectrophotometry method because this method is more sensitive and specific in determining metal content in samples containing various compounds.

2 Materials and Methods

2.1 Equipments

The tools used in this study were: analytical balance Mettler PM 400, rubber ball, glassware, the crucible, oven, furnace, spatula, matt pipette, distilled water bottle, Whatman No. 42 filter paper, pestle and mortar, desiccator, vaporizer cup, Perkinelmer 5100 PC Atomic Absorption Spectrophotometer, Inductively Coupled Plasma-Optical Emission Spectrometer Variant 715-ES.

2.2 Materials

The materials are used in this study: HNO_3, H_2SO_4, $KMnO_4$, H_2O_2 30%, NH_4OH, Aquadest, $Fe(NH_4)_2(SO_4)_2.6H_2O$, $CuSO_4.5H_2O$, and $ZnSO_4.5H_2O$.

2.3 Preparation of sample

The param was mashed with a pestle and mortar then dried in an oven at a temperature of ± 105°C for 5 hours and put into a desiccator. 5 g of param powder was pyrolyzed at 550°C and transferred to the ash into beaker glass. 10 mL of concentrated HNO_3 and 2 mL of concentrated H_2SO_4 were added and mixed evenly to obtain a sample solution. The sample solution was added with 5 mL of concentrated HNO_3 and 3 mL of 30% H_2O_2 then heated on a hot plate for 30 minutes and then cooled. The results of the digestion were filtered with Whatman No. 42 filter paper then the filtrate was diluted with distilled water to the marked line in a 100 mL volumetric flask and adjusted to pH=3. Then qualitative and quantitative analysis was carried out by using ICP-OES and atomic absorption spectrophotometer (AAS), respectively.

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

3 RESULT AND DISCUSSION

3.1 Qualitative analysis of Sample by using Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)

The qualitative analysis of metal in param was carried out by using the ICP-OES with the results shown in Table 1.

Table 1. The result of qualitative analysis of metal in param

No	Metal	Wavelength (nm)
1	B	208.959
2	Ba	455.403
3	Cd	228.802
4	Cr	267.716
5	Cu	324.754
6	Fe	259.940
7	Mn	257.610
8	Ni	221.647
9	Pb	220.353
10	Zn	213.856

3.2 Quantitative analysis of Sample by using atomic absorption spectrophotometer (AAS)

After qualitative analysis, the metals contained in the sample were then analyzed quantitatively by the Atomic Absorption Spectrophotometry method.

3.2.1 Iron (Fe) content

Table 2. The absorbance of Fe standard solution series

No.	Sample (ppm)	Absorbance
1	0.00	0.0000
2	0.50	0.0098
3	1.00	0.0209
4	1.50	0.0307
5	2.00	0.0420
6	2.50	0.0510

The absorbance of the Fe standard solution series shows in Table 2. The regression line equation is derived using the Least Square method, where the concentration of the standard series solution is expressed as Xi and the absorbance is expressed as Yi so that the calibration curve is obtained as shown in figure 1.

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

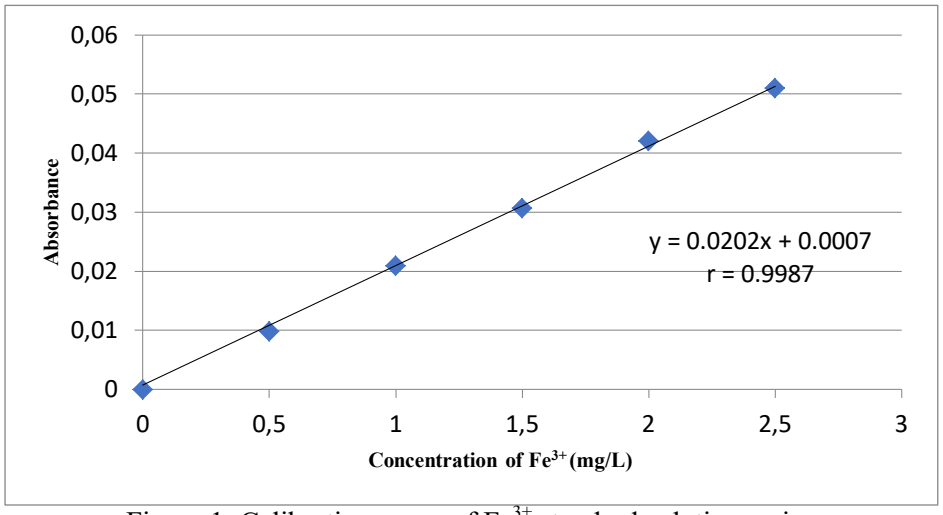

Figure 1. Calibration curve of Fe^{3+} standard solution series

By substituting the Y value (absorbance) of the sample solution into the regression line equation Y=0.0202X + 0.0007, the Fe metal content in the sample is obtained as shown in table 3.

Table 3. Fe content in Param as traditional medicine

No.	Sample	Content (mg/L)	Content (mg/kg)
1	Consumed param	0.5907 ± 0.0006	11.814
2	Consumed param	1.27 ± 0.0013	25.4
3	Param as external medicine	1.468 ± 0.0013	29.36

3.2.2 Copper (Cu) content

Table 4. The absorbance of Cu standard solution series

No.	Sample (ppm)	Absorbance
1	0.0000	0.0000
2	0.0200	0.0049
3	0.1000	0.0139
4	0.2000	0.0258
5	0.3000	0.0377
6	0.4000	0.0496

The absorbance of the Cu standard solution series shows in Table 4. The regression line equation is derived using the Least Square method, where the concentration of the standard series solution is expressed as Xi and the absorbance is expressed as Yi so that the calibration curve is obtained as shown in figure 2.

By substituting the Y value (absorbance) of the sample solution into the regression line equation Y=0.0202X + 0.0007, the Cu metal content in the sample is obtained as shown in Table 5.

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

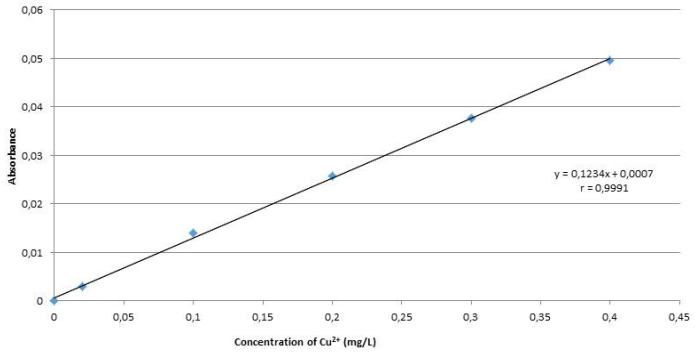

Figure 2. Calibration curve of Cu^{2+} standard solution series

Table 5. Cu content in Param as traditional medicine

No.	Sample	Content (mg/L)	Content (mg/kg)
1	Consumed param	0.0329 ± 0.00047	0.6580
2	Consumed param	0.2268 ± 0.0003	4.5360
3	Param as an external medicine	0.3684 ± 0.0005	7.3680

3.2.2 Zinc (Zn) content

Table 6. The absorbance of Zn standard solution series

No.	Sample (ppm)	Absorbance
1	0.00	0.0000
2	0.50	0.0796
3	1.00	0.1537
4	1.50	0.2389
5	2.00	0.3223
6	2.50	0.3813

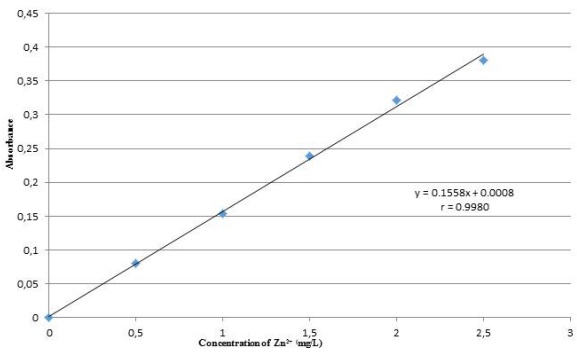

Figure 3. Calibration curve of Zn^{2+} standard solution series

Journal of Chemical Natural Resources Vol. 02, No. 01, 2020| 1 – 7

The absorbance of the Zn standard solution series shows in Table 6. The regression line equation is derived using the Least Square method, where the concentration of the standard series solution is expressed as Xi and the absorbance is expressed as Yi so that the calibration curve is obtained as shown in figure 3.

By substituting the Y value (absorbance) of the sample solution into the regression line equation Y=0.0202X + 0.0007, the Zn metal content in the sample is obtained as shown in Table 7.

Table 7. Zn content in Param as traditional medicine

No.	Sample	Content (mg/L)	Content (mg/kg)
1	Consumed param	0.6364 ± 0.0017	12.728
2	Consumed param	0.7592 ± 0.0003	15.184
3	Param as external medicine	1.384 ± 0.0018	27.688

Heavy metal analysis of iron, copper, and zinc has been carried out in param. Sample preparation was carried out by dry destruction method then the ash was dissolved by adding concentrated HNO_3 and H_2SO_4. Qualitative analysis was carried out using Inductively Coupled Plasma, then quantitative analysis was carried out using the AAS method with wavelengths of Fe=248.33 nm, Cu=324.75 nm, and Zn=213.86 nm.

The presence of Fe, Cu, and Zn metals in param can enter the body through the skin pores because it is applied and through the digestive tract because it is consumed for a long time so that if the param is used continuously the metal can accumulate in the body where the accumulated metal can cause disease and damage organs because it exceeds the threshold value, in the body the excess metal is stored in the liver and kidneys. The presence of Fe, Cu, and Zn metals in the param comes from the soil where the plants grow that are used to make the param. Where plants absorb metals from the soil where they grow so that these metals accumulate in plants, metal accumulation in plants does not only depend on the metal content in the soil but also depends on the geographical location of the soil, soil chemistry, metal type, soil pH and sensitive plant species. to certain heavy metals (Darmono. 1995)

4 Conclusion

From the results of the analysis, the content of iron, copper, and zinc in param consumed were 11,814 mg/kg and 25.4 mg/kg, 0.658 mg/kg and 4.536 mg/kg, 12,728 mg/kg. kg and 15.184 mg/kg, respectively. Meanwhile, the content of iron, copper, and zinc in param which are used as external medicine were 29.36 mg/kg; 7.368 mg/kg; 27.688 mg/kg., respectively. According to BPOM 2004, the standards for Fe, Cu, and Zn used as external drugs and consumed are as

follows, namely Iron at 30 mg/kg, Copper at 150 mg/kg, and Zinc at 100 mg/kg. Thus the levels of Fe, Cu, and Zn are still safe for consumption.

References

Almatsier, R. 1987. *Sample Pretreatment and Separation*. John Wiley and sons. New York.

Anwar, F. 2009. *Makan Tepat Badan Sehat*. PT. Mizan Publika. Jakarta.

Aprianto, A. 1989. *Analisis Pangan*. Departemen Pendidikan dan Kebudayaan. Direktorat Jendral Pendidikan Tinggi Pusat antar Universitas Pangan dan Gizi. Bogor.

Atkins, D. 2007. *Seri Diet Korektif*. PT.Alex Media Komputindo. Jakarta.

Bangun, R. S. 2010. *Kuning pada Masyarakat Karo*. Skripsi. Departemen Antropologi Sosial FISIP Universitas Sumatera Utara. Medan.

Basset,J.1994. *Kimia Analisis Kuantitatif Anorganik*. Edisi Keempat. Penerbit Buku Kedokteran. Jakarta.

Devi, N. 2010. *Nutrition and Foot*. PT. Kompas Media Nusantara. Jakarta.

Darmono. 1995. *Logam Dalam Sistem Biologi Mahluk Hidu*p. UI-Press. Jakarta.

Effendi, H. 2003. *Telaah Kualitas Air*. Penerbit Kanisisun. Yogyakarta.

Ginting, E. P. 1999. *Religi Karo*. Abdi Karya. Kabanjahe.

Holloway, P.H. and Vaidyanathan, P.N. 2010. *Characterization of Metal and Alloys*. Momentum Press. New York.

Marks, D. B. 1996. *Biokimia Kedokteran Dasar*. Penerbit Buku Kedokteran EGC. Jakarta.

Nasoetion, A. H. 1995. *Matahari, Manusia, dan Makanan*. Balai Pustaka. Jakarta.

Noorkasiani dan Heryati. 2007. *Sosiologi Keperawatan*. Penerbit Buku Kedokteran. Jakarta.

Postawa, A. 2012. *Best Practice Guide on Sampling and Monitoring of Metal in Drinking Water*. IWA Publishing. London

Sari, W dan Indrawati, L. 2008. *Care You Self Hepatitis*. Penerbit Penebar Plus. Jakarta.

Sembiring, N. 2010. *Terapi Sari Air Laut*. Penerbit Penebar Plus. Jakarta.

Sudarmadji,S, Haryono, B dan Suhardi. 1989. *Analisis Bahan Makanan dan Pertanian*. Erlangga. Jakarta.

Suhardjo dan Kusharto, C.M.1992. *Prinsip-Prinsip Ilmu Gizi*. Kanisius.Yogyakarta

Taylor, H.E. 2001. *Inductively Coupled Plasma Mass Spectrometry*. Academic Press. New York.

Underwood, J. C. E. 1996. *Patologi Umum dan Sistematik*. Edisi Kedua.Volume I. Penerbit Buku Kedokteran. Jakarta.

Watson,G.D.2007. *Analisis Farmasi*. Penerbit Buku Kedokteran. Jakarta.

Winarno, F. G. 1995. *Kimia Pangan dan Gizi*. Gramedia. Jakarta.