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Comparative study of some Ashes of vegetables used in the traditional Preparation of the Soap in Benin

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Abstract

To improve the quality of the traditional soap, the physico-chemical parameters of ashes of some vegetables (stalks of Sorghum caudatum, rachis of Elaeis guineensis Jacq ., cakes of Gossypium hirsutum, raids of Zeas mays and sheets of Musa paradisiaca) were determined. By the electronic microscopie with scanning coupled with a spectrometer dispersive of energy, elements such as Na, K, Ca, Mg, Zn, Cu, and Mn were characterized. The results showed that all the alkaline ashes have a content brought up in mineral elements notably there K (Gossypium hirsutum - 526500 ppm), Ca (Vitellaria paradoxa - 597700 ppm), and Mg (Vitellaria paradoxa - 153600 ppm). So, ashes of Musa paradisiaca, Vitellaria paradoxa and of Carica papaya would not thus be indicated for the preparation of a better soap considering their strong alkalinity capable of irritating the skin.

Keywords: Ashes, vegetables, traditional soap, Benin.

Introduction

The rich and diversified African flora abounds in dozens thousand botanical species the interest of which for the humanity is not to be any more demonstrated. Formerly the black populations exploited it rationally. Ashes obtained various parts of vegetables allowed the traditional preparation of the soap used for the hygiene generally and in human therapy[1-3]. One of the main activities of income in most of the rural zones of Benin is the preparation of the soap collectively called in Fon "Koto", "Akoto" in Adja[4]. It is the product prepared based on natural ingredients that is vegetable oil (oil of palm, Shea butter, etc.) and ashes of the vegetables from which we extracted the basic solution. Therefore, we think that the composition in minerals and trace elements of the ash thus turns out to be very important in this preparation. We can consider that 70 % of the Beninese population use the traditional soap often appreciated for its especially therapeutic properties in dermatology because of the nourishing wealth of these basic ingredients[5,6]. In spite of the permanent competition of industrial soaps which are better packed and more attractive, soaps made by craftsmen are always present on the market what translates all its importance. But nevertheless certain difficulties notably bound to the quality of vegetable ashes are several times recorded during its preparation. Numerous studies were realized on the antifungal and antibacterial properties of the soaps of traditional manufacture[4,7] but we have to admit that few works are led with the aim of the physic-chemical characterization of the ashes and extracted washings used to prepare these traditional soaps. The general objective of the present study is to value vegetable ashes used in the preparation of the traditional soap in Benin with the aim of the improvement of the soap quality. This present work is then dedicated to the valuation of vegetable ashes used in the traditional manufacture of the soap in Benin with the aim of the improvement of its quality. The physico-chemical parameters of studied ashes were determined and compared to identify the most adequate ashes to obtain a soap of better quality.

Material and Methods

Preparation of the samples of ashes: The collection of the rachis of the tree Elaeis guineensis, the sheets of Musa paradisisca was made in the municipality of Porto Novo. The trunks of Carica papaya, the raids of Zea mays were collected in the municipality of Bohicon. The cakes of the seeds of Gossypium hirsutum are collected in the municipality of Banikoara then the stalks of Sorghum caudatum and the barks of Vitellaria paradoxa were collected in the municipality of Copargo. Banikoara, Bohicon Copargo and Porto Novo being from cities situated respectively in the North, in the Center, Northwest and in the Southeast of Benin, table-1. This plant material was dried during 15 days in 20°C and reduces to powder by means of a mixer. The powder is put in a porcelain melting pot beforehand cleaned with some hydrochloric acid with warmth for a half an hour then cremated in an oven NABERTHERM C290 in 500°C during 24 hours. The color varied by some got back ashes depends on the origin of the plant material. The basic solutions were prepared at the rate of 5 grams of ashes for 50 ml of distilled water. The filtrat to analyze is obtained by using a filter with paper of porosity 2µm[8-10].

Table-1
Used plant Materials

Scientific name	Surname	used Parts	Codes
Sorghum caudatum	Grasses	Stalks	E_1
Gossypium hirsutum	Malvaceae	cakes	E_2
Musa paradisiaca	Musaceae	Raids	E_3
Zea mays	Grasses	Sheets	E_4
Elaeis guineensis Jacq.	Arecacées	Rachis	E_5
Vitellaria paradoxa	Sapotaceae	Barks	E_6
Carica papaya	Caricaceae	Trunk	E_7

Determination of the pH of the substrata of ashes: The pH was measured by WTW pH with a probe WTW 34^0i calibrated with two solutions plug the guaranteed pH of which is: 4,00 and 7,00 in 25°C. For every measure, the probe is rinsed at first with some distilled water then with the washings of ashes to be analyzed. The probe is then plunged into the washings and the various parameters are read and recorded, table-2.

Dosage of the mineral elements: The mineral elements were measured by means of an electron microscope with scanning coupled with a spectrometer dispersive of energy (MEB / EDS). The tool which we used within the framework of this work is the MEB / EDS with Variable Pressure MEB FEG above 40 VP Zeiss. This electron microscope with scanning is equipped with a detector of beams - X (oxford instruments) connected with a platform of micro analyzer EDS (Inca Dry Cool, without liquid Nitrogen) with the next characteristics[11-15]:

Swelling: 12 X in 1 000 000X, Resolution: 2 nm, Variable voltage: 0.1 keV to 30 keV.

The statistical analysis of the obtained data was made with the Microsoft software Excel 2007 office.

Table-2
Physico-chemical Parameters of the studied samples

Samples	Ash (%)	pH
E_1	8,75±0,50	9,7±0,1
E_2	11,7±0,3	9,4±0,1
E_3	10,2 ±0,7	11,7±0,1
E_4	8,97±0,45	9,5±0,1
E_5	12,2±0,6	9,8±0,1
E_6	12,8±0,4	11,8±0,1
E_7	10,75±0,55	11,5±0,1

Results and Discussion

The comparison of ashes of the stalks of Sorghum Caudatum, cakes of Gossypium hirsutum, raids of Zeas Mays, sheets of Musa paradisiaca, rachis of Elaeis guineensis Jacq ., barks of Vitellaria paradoxa and the trunks of Carica papaya was made by taking into account the pH, table-2 and the mineralogical composition of every sample, table-3.

Table-3
Concentrations (ppm) mineral elements of analyzed vegetable ashes

	E_1	E_2	E_3	E_4	E_5	E_6	E_7
Na	-	-	7300 ±125	3900 ±120	137000 ±125	-	182500±130
Mg	80100 ±120	119300±135	83000 ±125	42400 ±126	53700 ±130	153600±150	64600 ±130
K	452200 ±500	526500±500	245000 ±500	418100 ±500	184600 ±200	121000±150	207400±250
Ca	95500 ±300	134100±155	330800 ±350	24700 ±120	90600 ±350	597700±450	199700±250
P	8500 ±65	101600 ±95	30100 ±100	95100 ±200	34000 ±155	20900 ±125	84000 ±145
Al	14800 ±350	11100 ±300	27600 ±400	21800 ±250	35100 ±400	-	6400 ±350
Si	315000±1200	69100±1100	204600±1300	317700±1350	327700±1500	36100 ±950	33300 ±900
S	11200 ±400	24200 ±450	16900 ±350	20700 ±450	61800 ±650	16000 ±350	114600±1560
Fe	8200 ±90	6500 ±60	13500 ±125	9100 ±95	15600 ±125	7600 ±75	5000 ±60
Zn	2400 ±50	-	700 ±25	-	3100 ±65	1600 ±45	1400 ±50
Mn	4200 ±85	900 ±30	10500 ±250	-	4700 ±90	13900 ±300	800 ±30
Cu	3100 ±65	3700 ±65	2800 ±65	3200 ±65	-	3400 ±65	127 ±30
Ti	4700 ±95	-	-	-	4800±90	-	-
Ni	-	-	800 ±70	-	-	-	-
Ba	-	-	-	-	-	16300 ±150	-

The exam of the table-2 leads to some remarks: i. in the majority of the cases the content of ashes is brought up, equaling or exceeding the 10 % rate in five cases; ii. also, the pH of the aqueous solution of these ashes is alkaline and reached by the exceeding values 10 in ashes of Musa paradisiaca (E_3) (pH 11,7), Vitellaria paradoxa (E_6) (pH 11,8) and Carica papaya (E_7) (pH 11,5). We thus think that this alcalinity registered at the level of the substrata of ashes would certainly be due to the presence in high concentration of certain alkaline and alcalino-earthy elements such as the sodium, the potassium, the calcium and the magnesium in them cendres[16]. The analysis of the table-3 reveals that the Potassium is the element the most abounding in studied ashes (121000 ppm-526500 ppm). It is to note that seven ashes contain an interesting concentration in Potassium; the most important concentration is observed in the ash E_2 stemming from Gossypium hirsutum with 526500 ppm and the one who contains it less is the ash E_6 of Vitellaria paradoxa with 121000 ppm.

The Calcium is relatively plentiful notably in the ash E_6 of Vitellaria paradoxa which presents the concentration the most brought up with 597700 ppm. The Magnesium is relatively present in all the ashes; the ash E_4 of Zea mays contains 42400 ppm and E_6 of Vitellaria paradoxa 153600 ppm. The sodium is the least plentiful element, it is present only in four ashes the concentrations of which divide up in the following way: E_3 contains 7300 ppm, E_4 3900 ppm, E_5 137000 ppm and E_7 182500 ppm. The presence in high quantity of elements such as K, Na, Ca and Mg in ashes indeed confirms their alcalinity and this is certainly due to their concentrations brought up[17]. In the previous studies[18], it was shown that all the alkaline ashes of vegetable origin are characterized by a concentration brought up in alkaline or alcalino-earthy elements, what come to confirm then our results. We can then assert that all our ashes are alkaline because they are rich in it K, Na, Ca and Mg. Let us note that the absence or the weak concentration in Sodium of certain ashes could explain by the fact that our plant material consists of ground plants and not of navy plants which are as for them very rich in Sodium[19]. It is to note also that all the ashes are rich in silicon in the form of silica with a content going of 33300 ppm to 327700 ppm. The alkalinity of the substrata of analyzed ashes is major for the preparation of the traditional soap. But with a very alkaline substratum the risk of obtaining soap susceptible to irritate the skin is brought up[20]. According to the standards Beninese[21], only soaps having a pH lower than 10 could be marketed. Ashes of Musa paradisiaca, Vitellaria paradoxa and of Carica papaya could not thus served for preparing good quality soaps. Only ashes of Sorghum caudatum, Gossypium hirsutum, Zea mays and of Elaeis guineensis would be thus adequate for the preparation of quality soaps. Besides, certain studies[22-24] proved the efficiency of creams and soaps rich in manganese, zinc and copper in the treatment certain dermatosis and also confusions of it cicatrisation[25], we thus think that soaps prepared with these ashes could be used to treat certain dermatosis as acne and the eczema.

Conclusion

The comparative study of ashes stemming from various vegetables is made. The physico-chemical parameters allowed showing that ashes of Sorghum caudatum, Gossypium hirsutum, Zea mays and of Elaeis guineensis are adequate for the preparation of traditional quality soaps. These soaps could be also used in the treatment of certain dermatosis as acne and the eczema considering their copper content, zinc and manganese. On the other hand, ashes of Musa paradisiaca, Vitellaria paradoxa and of Carica papaya are not indicated to prepare good traditional soaps. By allowing making an efficient choice of ashes, this work has so just resolved one of the major difficulties met in the preparation of the traditional soap in Benin.

References

1. Adjanohoun E.J., Eymé J., Dramane K.L., Fouraste I., Lo I., Keïta A., Le Bras M., Lejoly J., Boukef K., On'okolo P., Revue de médecine et pharmacopées africaines, *ACCT*., **5(2)**, 56-60 **(1991)**

2. Abayomi S., Medicinal Plants and Traditional Medicine in Africa. 2nd Edition, Karthala:, Lagos, Nigeria **(2010)**

3. Picard H., Therapeutic use of oligo-elements. 1st Edition. Maloine, Paris **(1993)**

4. Amoussouga H., " Acoto " or " Black soap " studies of the properties antiseptics. Doctoral thesis: pharmacy: Bordeaux II : N°75 (**1992**)

5. Gaye M. L., Manufacture of Cleaners from the Oil Plants of the Bay of Guinea., INPT, ENSCT : Toulouse, France (**1998**)

6. Spitz L., Soap and Detergents, A Theorical and Pratical Review, 3rd Edition, SPITZ L., AOCS Press, USA (**1996)**

7. Hanna L. and Raimo A., Pyrolysis of vegetable oil soaps-Palm, olive, rapeseed and castor oils, *Journal of Analytical and Applied Pyrolysis*, **91(1),** 154-158 (**2011)**

8. Chantereau P., Charrier A., Jacquot M.,Hamon S., & Nicolas D., The improvement of the tropical plants, Centre of International Cooperation in Agronomic Research for the Development (CIRAD) and French Institute of Scientific Research for the Development in Cooperation (ORSTOM), 565-590, Montpellier, France (**1997)**

9. Mendham J., Denney R.C., Barnes J.D., Thomas M.J.K**.,** Quantitative chemical analysis of Vogel, 6th edition. De Boeck University (**2005)**

10. Atkins P. W., The concepts of physical chemistry, Dunod Ed, ISBN : 2-10-003944-X (**1998)**

11. Goldstein J.I, Newbury D.E and Joy D.C et al., Scanning Electron Microscopy and X-ray Microanalysis, 3rd Edition, New York, éd. Kluwer Academic/Plenum Publishers (**2003)**

12. Robaut F., Crisci A., Spectrometry X by dispersal of wavelength: technological aspects, Meeting of December of the GN MEBA (**2005)**

13. Brisset F., EDS technology, summer School of the GN MEBA, Saint Martin of Hères (**2006)**

14. Normalize ISO: instrumental Specifications for spectrometers with X-rays with selection of energy with detectors with semiconducting diodes (EDX), 15632 (**2002)**

15. Wollman D.A, Irwin K. D, Hilton G.C, Newbury l. l, Martinis J.M., High resolution energy-dispersive microcalorimeter spectrometer for X-ray microanalysis, *J. of Microscopy*, **188**, 196-223 (**1997)**

16. Laroche L., Larouche and M. Giroux., Amendment of the ground with wood ashes. No project 23-817258-12006. Auxiliary agreement Canada-Qébec. 27 (**1997)**

17. Butkuvienè E., Wood ash for plants fertilization, In Technology of progressive farming. *Lituaniann Institute of Agricultute*, 421-428 (**2005)**

18. Merino I., Aevalo L.F., Rometo, F., Characterization and possible uses of ashes from waste water treatment plants, *Waste Management*, **25**,1046-1054 (**2005)**

19. ADEME : Valuation of ashes of Boiler BIOMASS **2001** et (**2005)**

20. Thes, P. M.; Zirihi, G. N.; Kra Adou, K. M.; Soumahoro, I. A.; Guede, G. F**.,** Action of the made soap has to leave oil of Mitracarpus Scaber (Rubiaceae) - "Misca", Mareya Micrantha (Euphorbiaceae) - "G243" and of Cassia Alata (Caesal Piniaceae) on the in vitro growth of Candida Albicans and Trichophyton Mentagrophytes. Newspaper of the Pharmaceutical and biological Sciences, **7(1)** 28-36 **(2006)**

21. CEBENOR : Soap-Specifications, sampling and method of analysis of knowledges in breads, Catalog of the Beninese Standards*,* 18-21 **(2002)**

22. Bolzinger M.A., The atopic dermatitis: knowledges and experiences. Recueil-Malmaison *: Arnette*, 179-181 **(2006)**

23. Deffuant C., Memory of D.E.A, Cutaneous Biology and Beauty care, University of Nantes (**1992)**

24. Dodin A., Antiseptics - medical surgical encyclopedia, Infectious diseases **6** (**11**), 215-222 (**1988)**

25. Haider S, Naithani V, Barthawal J, Kakkar P., Heavy metal content in some therapeutically important medicinal plants, *Bull. Environ.Contam. Toxicol*, **72(5),** 119–127 **(2004)**