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Analysis of Some Macro and Micro – Elements of Synthetics Salts Licks and Some Natural Salts Obtained From Western Sudan

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ABSTRACT

This study aimed to determine the characteristics and elemental composition of some natural salts and deposits collected from Darfour and Northern Kurdufan, that usually used by domestic animals and wildlife suffering salts hunger and compare them with the characteristics and elemental concentration of some imported synthetic salt licks used for mineral supplementation in farm animals. From the results obtained there is a large similaritywhen comparingpH between natural and synthetic salts,except for two samples, there is alsosimilarity in concentration of macro-elements in most samples specially Na element which showed higher concentration in all samples. A clear difference was noticed between synthetic salts and some natural salts in the concentration of carbonate and bicarbonate, where showed weak concentration of (1-2%) for carbonate and bicarbonate in synthetic salts, and high concentration in natural salts samples of 9.5-23.3% for carbonate and 9.3-10.8 for bicarbonate was observed. The concentration of chloride seems to be higherand almost equal in synthetic samples (50%), but showed difference in natural samples.The micro-elements showed similar concentration in all samples. The study showed that the synthetic samples are free from toxic elements, such as Pb, but low concentration in natural saltswas observed.All samples showed low concentration of Cd except one sample of natural salts, no radioactivity pollution was detected in all samples.
Key Words: Salt licks, macro-minerals, micro-minerals, animals, natural, synthetic.

INTRODUCTION

Salt hunger is an observable phenomena in ruminant, that leaddeers and wild life in animals in general to visits soil licks at certain time. Domestic ruminant when desiring salts they may cry especially sheep or chew woods, bones and/ or lick dirt, also they may consume poisonous plants that are not normally eaten (Jin Xialiang, Li Cheng, Li, C.F. (1996). Geophagy in herbivores is the symptom of certain elements ions deficiency. The macro elementssuch as phosphorous, calcium, sodium, and to less extend magnesium and sulpher, and micro-elements such as cobalt and copper will lead to geophagy in herbivores (Eksteen and Bornman, 1990).The majority of natural minerals deficiency cases is associated with certain areas and closely related to the soil characteristics of the area, the deliberate intake of soil by herbivores has led to various studies in the past, the site of the deliberate soil intake have named natural licks (Holl, S.A.,Bleich, V.C, (1987), mineral licks were studied by John F.Kennedy et al.(1995).
According to Eksteen and Bornman, (1990), licks form when runoff water collected in low areas and evaporate leaving the dissolved minerals above impermeable clay sub-soils. The accumulation of salt on flat surface which mainly attributed to the accumulation on slopes, are mentioned by Momer and Thomas (1986)., these facts also mentioned by (Stark M.A 1986), ruminants attained the majority of their nutritional needs through the plant material they ingest, however some nutrients that are required in relative large quantity by animals are not required or required in low amount by plants (Rowe,J.B, 1991). Sodium(Na), is the best example of such elements(Doyle et al, 1992), Na is needed during lactation,where Na lost through lactation,andalso when forages arehigh in potassium in early growing season or following fertilization(McDowell,2003).Herbaceous terrestrial plant other than halophytes do not accumulate Na and thus forages most of the world rarely sufficient sodium to meet the nutritional requirement of ruminants(Botkin et al., 1973; Denton, 1982;McDowell,2003). Sodium is typically is synthetically supplied to ruminants in agricultural forage by consuming Na rich soil or water at natural mineral licks. Although sodium in natural licks considered the primary attractant, some argue that elements such as Ca and Mg are equally important in attracting animals(Knight and Mudge, 1967).Furthermore little is known about the attractive importance of trace elements e.g (Co, Cu) in natural minerals licks. Observation of herbivores consuming soil (i.eGeophagia) from natural mineral licks has reported throughout North America (Frosile, 1980, Ushakova 1984; Knight and Mudge, 1967; Herbert and Cowan). Some studies has identified sodium as the mineral element and abundant at ungulatelicks(Knight and Mudge, 1967).

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However, often minerals (e.gsulpher, calcium, magnesium) also can attract animals to licks (Underwood F.J,1971; Jones and Hanson,1985), the intake of K and water causes excessive sodium loss resulting in temporary deficiency. According toWalter and Deluca (2007), andJones and Hanson(1985)sodium deficiency in free-ranging ungulates throughout North America occurs mainly during spring and summer, this allow use of minerals licks and could maintain positive balance for sodium during this critical period (Williams, 1989). Sodium hunger in free-ranging ungulates is often highest during gestation and lactation(Robbings, 1993). Use of mineral licks by females and fawn in spring summer might relate to increased sodium requirements for lactation, growth or interactions between minerals that limit sodium availability. Despite the importance of sodium in nutrition, few studies have examined its concentration in milk and the relationship between sodium intake and nutritional condition of the female,determined that sodium concentration ranged from 42-57mg/100 grams from 21-140 day postpartum. Although sodium concentrations in milk wereconsidered low comparison to other minerals acquisition and retention of sodium may be energetically expensive in some regions (Robbings, 1993). The main aim of this study is to determine the mineral deficiency in animal feed with special interest to the natural pasture, since the mineral deficient diet may cause many animal diseases(Williams and Elizabeth, 1999; Whitlock et al., 1975).

MATERIALS AND METHODS

Fourteen natural samples were collected from different desert area at Northern Darfour, Northern Kurdufan and synthetic samples from veterinary pharmacy from Khartoum state cleaned with a piece of cloth and kept in a clean plastic bags for further analysis. The pH values were determined using pH meter.

Macro and micro- elements concentration (Na, K, Ca, Mg, Fe, Co, Cu, Zn, Cd, and Pb) were determined using atomic absorption spectrometry instrument, while other trace elements concentrations (Ni, As, Se, Br, and Mo) were also determined using X-ray fluorescence spectrophotometer, finally physiochemical characteristics of the natural and synthetics samples were compared.

RESULTS AND DISCUSSION

The results of pH measurements of carbonate, bicarbonate and chloride are presented in Table (1), the results showed that a noticeable differences in pH between suspension and the filtrate solution almost in all samples, this could be due to the presence of some sparingly soluble components affect the pH reading in the suspension form, such components may separate with insoluble matter on the filter paper. All samples have alkaline pH values except sample (10) is almost neutral insuspension and solution form (Nina and Ushakawa, 1987)

The pH of manufactured and natural samples is almost the same especially the commercial samples 2 and 3 and the natural samples 4,5 and 14. Although CO_3^{2-}(carbonate)and HCO_3^- (bicarbonate) concentration in sample 2 and 3 is very low compared to samples4,5 and 14. At the same time the chloride concentration in sample 1,2 and 3 showed relatively very highCl^-(chloride) concentration relative to that 0f sample 4,5 and 14, the reasons for that is alkalinity in the manufactured samples may results from the presence of other components such as oxides and hydroxides (Suada and Mohamed, 1999).

Samples 8 and 10 which were almost neutral and contained no carbonate and have the same concentration in bicarbonate(0.89 %) but the chloride content of sample 8 is very high compared to that of sample (10), so the neutrality of sample (10) may be caused by the presence of other acid radicals such as SO_4^{2-} and NO_3^- ions.(William 1989)

Samples 4, 5 and 14 have relatively high content of CO_3^{2-} and $HCO_3^-$with a noticeable difference may explain the dissimilarities in their physical appear and the difference may explain the dissimilarities in their physical appearance and the different local names given by the animal grazers in Western Sudan(Fugma, Sin Elgazal, and Hagar), samples 7 and 8 which were locally known as Arab salts of Western Atroun area have a significant high chloride concentration with respect to manufactured salt licks, especially sample (8) (Suada and Mohamed, 1999). which have almost thesame concentration . Sample 12 and 13 Sharshar area (Bara a district) did not contain carbonate and have low bicarbonate and have low bicarbonate, and have a considerable chloride content 31-37.2%. Sample (6) is almost typical to sample (3) which is artificial salt licks in pH,CO_3^{2-} and HCO_3^-content but have very low Cl^- concentration.(Stark, H.A. 1986, Kabaja, E. 1989)).Radioactivity detection results presented in Table (2), gave no indication of radioactive components in all samples, so there is no risk of giving any sample to animals for licking purposes or mineral supplementation. (Hove, K, 1993, Osman Mustafa, 1991, Craft et al, 1991, Marauf et al 1998)

According to the pH measurements and titrimetric analysis for Cl^-, CO_3^{2-} and HCO_3^- determination result, it was concluded that sample 7,8,12 and 13 could be used for chloride supplementation, whereas samples 4,5 and 14 could be used for digestibility enhancement as well as sodium supplementation.

Table (3) represents macro-mineral elements concentration in ppm using Atomic Absorption Spectrometry, Na appeared to be the highest mineral in all samples, this enhance the argument considering sodium as the primary element sought by animals suffering geophagea(Beringe, H.,1988). The artificial samples showed high Na concentration (6000 ppm) compared with the natural sample except sample (7) which have higher Na content than all the other (7400 ppm). The lowest Na was observed in sample (10) (4400 ppm) which is soil lick. There is some variation macro- mineral concentrations in all samples. The occurrence of macro-minerals in samples is acceptable with respect to the formula of standard salt licks. Sample (3) showed an outstanding potassium and magnesium concentration(Table 3). According to Walters and DeLuca (*2007*),soil salinity as electrical conductance (EC), pH, organic matter content, sodium absorption ratio (SAR), and exchangeable concentrations of sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), and magnesium (Mg^{2+})are also reported.

The micro-minerals Cd and Pb showed in Figure (1), trace occurrence of Cd and Pb in some samples, the natural samples showed relatively high concentration of Cd in sample (8) and (13),where no Cd was observed in sample (10), significant concentration of Cd appeared in artificial sample. The artificial samples (1,2 and 3) and natural samples (4,6,12,13 and 14) contained no lead. (Underwood, E.J. (1971) Frosile, A.(1986);WilliansStansley et al,1991)

For micro-minerals results which is described in Table(4) Fe showed a significant concentration in all samples, the highest Fe concentration was at samples 2,3,4 and 10. Mn showed highest concentration in sample 3 and 10 as well as low concentration in most samples, Zn, Cu and Co have higher concentration in sample (2). Figure (2) represents the trace occurrence of Ni, As, Se, Br, and Mo although Ni is relatively higher in sample (3).Figure (2) showed the concentration of some micro-minerals that are required or possibly be required by one or more animal species in percentage (w/w). Ni concentration is relatively high in the artificial samples with respect to the natural ones, except sample (5). As occurrence was almost the same in all the samples except sample (2) was relatively high and sample (3) which was the lowest in As content, Selenium concentration of the sample was low except sample (2) was relatively high. Br showed higher occurrence in sample 3, 12, and 13 where 12 and 13 are natural samples from one area. Mo was appeared to be of the least occurrence in all samples. (John F. Kennedy et al 1995, Klein A.P, 1998, Mohamed Eltayeb, 1984)

One dealing with literature survey the researcher found out there is a high opportunity of studies on natural salts, soil licks and salt deposits, therefor more studies should be further studied in Western of Sudan, some radical should also be determined such as NO_3^-, SO_4^{2-}, PO_4^{3-} and I^-, the use of natural licks such as sample (7) should be encouraged for use as alternative of exported salt licks after some physical and chemical treatment. (Srark, M.A. (1986)

Table (1) pH Carbonate, Bicarbonate and Chloride Ions Percentage

No	pH (Suspension)	pH(Filtrate)	CO_3^{2-}%	HCO_3^-%	Cl^-%
1	8.5	7.5	1.13	2.30	59.46
2	10.5	9.2	1.32	2.30	55.47
3	10.2	9.7	1.39	000	52.81
4	10.0	9.9	23.30	19.30	2.22
5	10.1	9.8	13.33	10.80	1.78
6	10.3	9.2	1.80	Nil	1.20
7	9.9	9.8	0.65	4.97	33.73
8	7.6	7.5	Nil	0.89	51.48
9	9.1	8.0	Nil	1.45	2.66
10	7.0	7.6	Nil	0.89	1.24
11	9.6	8.0	Nil	1.70	1.53
12	9.7	7.6	Nil	1.22	31.0
13	9.4	8.0	Nil	0.79	37.12
14	10.0	10.0	9.45	10.79	7.10

Table (2)Radioactive Detection Using Gieger Muller Tube

Reading Number	Detection in cpm
Back ground	10,12,15,13
1	16,13,21,14
2	14,13,17
3	20,17,27
4	9,17,17
5	14,14,10
6	17,16,13
7	20,13,12
8	11,12,20
9	17,10,15
10	20,23,22
11	14,21,18
12	12,17,13
13	13,12,15
14	15,20,20
End back ground	11,16,20

Table (3)Macro- mineral elements concentration in ppm using Atomic Absorption Spectrometry

Sample No.	Na	K	Ca	Mg
1	6200	210	173	70
2	6000	1240	554	370
3	6500	5700	263	900
4	5600	1300	97	40
5	4900	290	12	20
6	5800	220	306	170
7	7400	1140	52	250
8	5600	650	61	70
9	5400	300	348	110
10	4400	280	268	220
11	5400	300	475	30
12	5600	470	159	280
13	5900	450	77	310
14	5000	490	13	10

Table (4)Micro- minerals concentration in ppm using Atomic Absorption Spectrometry

Sample No.	Mn	Fe	Co	Cu	Zn
1	|2.21	6.84	0.74	0.64	0.33
2	0.04	1.30	138	19.00	5.00
3	25	18.00	1.24	12.00	0.02
4	0.88	26.00	0.24	0.20	21.00
5	0.20	4.72	0.26	0.49	0.16
6	1.28	3.52	0.20	0.16	0.14
7	0.09	0.60	0.43	0.16	0.09
8	0.54	21.00	0.50	0.46	0.21
9	1.22	1.13	0.16	0.31	0.16
10	14	28.00	0.32	0.46	0.31
11	1.45	0.37	0.15	0.15	0.06
12	1.01	2.23	0.43	0.76	0.13
13	0.53	2.61	0.45	1.26	0.23
14	0.36	6.00	0.24	0.64	0.16

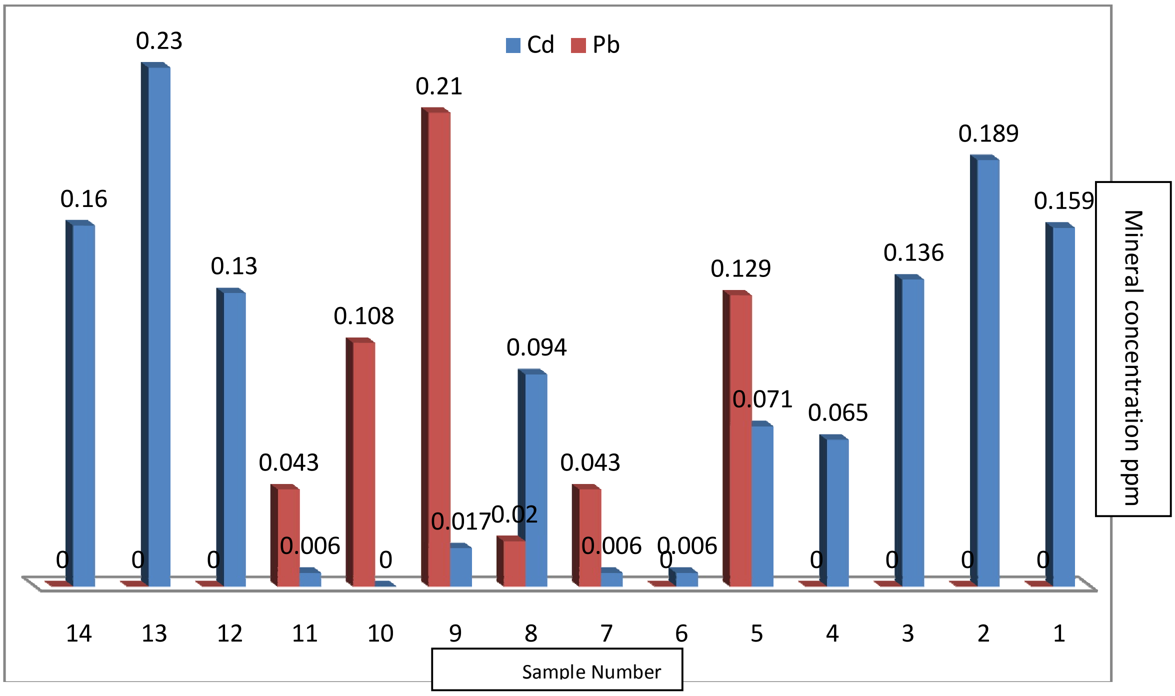

Figure (1) Micro-mineral (CdandPb) concentration ppm

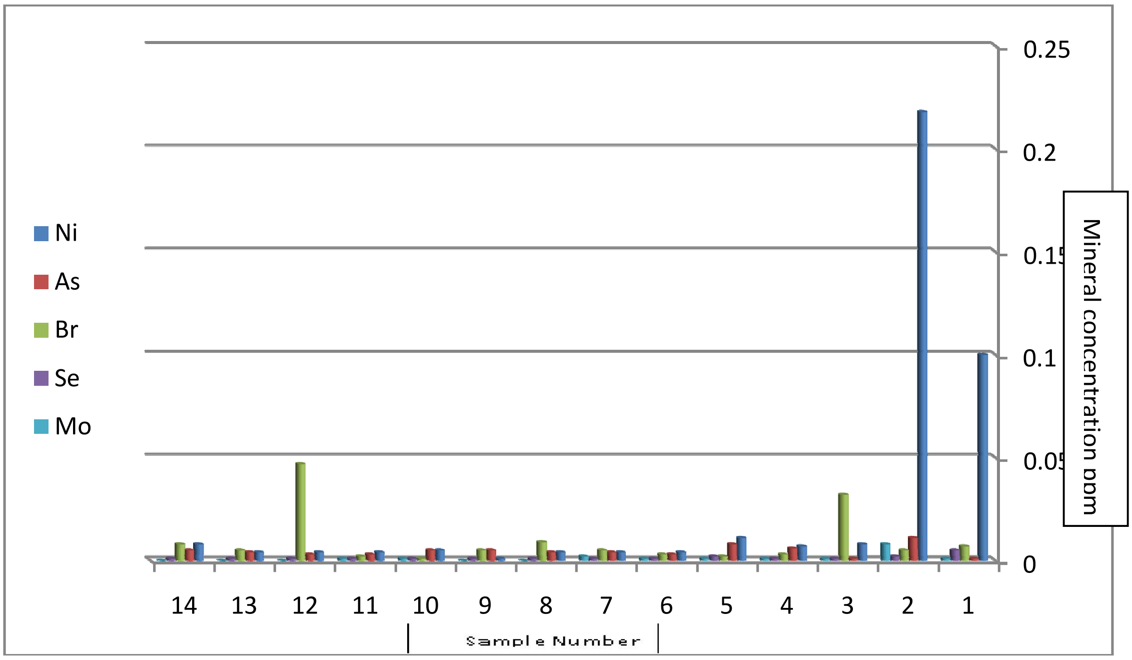

Figure (2) Determination of micro-mineral concentration (w/w)

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