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Pakistan J. Sci. Ind. Res., Vol. 29, No. 6, December 1986

ZINC-SORBITOL, DEXTRIN AND CITRIC ACID COMPLEX

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(Received February 27, 1985; revised April 4, 1986)

A preparation containing a complex of zinc, sorbitol, dextrin and citric acid is described. Complex formation with sorbitol alone is not satisfactory and dextrin is an essential component for its stability. The preparation is stable between pH 6 to 8.

Key words: Zinc-sorbitol, Zinc-hexitol chelate and chelate of zinc.

INTRODUCTION

Zinc is an essential trace element and is widely distributed in various tissues and organs of the human body. It acts as an activator of the enzymes, carbonic anhydrase, aminopeptidase, dipeptidases and alcohol dehydrogenases. Insulin contains 0.3 to 0.69 % of the metal.

Severe zinc deficiency [1] in male and female weanling rats resulted in extreme retardation of growth, abnormal growth hair and dermal lesions. Growth retardation was also observed in zinc deficient pigs [2]. In zinc deficiency [3] the rats had a decreased calcium balance.

Zinc along with cobalt, copper, and manganese helps the metabolization of iron. A number of multimineral iron preparations are available in the market where zinc is incorporated in the form of its salts such as the sulphate. The complexes of zinc having non-ionic nature, on the other hand, are comparatively superior, since these are least irritable. Keeping in view this consideration we report the preparation and characterization of zinc complexes with sorbitol, dextrin and citric acid in this paper.

Method and characterization of the preparation. To an aqueous M solution of zinc chloride (15.3 ml) an equivalent to I g elemental zinc and N sodium hydroxide (17.5 ml) was added dropwise with vigorous stirring to get a fine precipitate of zinc hydroxide. The precipitate was washed with distilled water by decantation to get rid of the electrolytes. The wet zinc hydroxide was taken in a porcelain dish, required quantity of sorbitol, dextrin sodium hydroxide and citric acid was mixed thoroughly. The contents were heated at different temperatures for the periods indicated in the Tables. A dark brown cake was obtained which gave clear solution when dissolved in water. The solution was centrifuged, analysed and made up to contain 0.5 '% elemental zinc. Different ratios were tried to get the ideal complex, but only successful results have been reported in the Tables. At low temperatures or when the time of heating is shorter, the solution of the final product looks brownish and turbid against reflected light. About 10% zinc was transformed into oxide, and thus the complete utilization of zinc hydroxide in the formation of complex has never been observed.

Estimation. The complex (1 ml) was carbonized in a Kjeldahl flask with concentrated nitric and sulphuric acids, transforming it into zinc sulphate. Zinc was then estimated colorimetrically by means of 0.001% dithiazone in carbon tetrachloride at 525 nm.

Stability on boiling. An aqueous solution of the complex was boiled in a sealed ampoule at 100° for 1 hr. or at 115° for 30 min. The unstable preparation formed a gel, while the stable preparation remained clear.

Stability at different pH. The stability of the complex at different pH was tested in accordance with the method of Nissim and Robson [7]. The complex precipitated with in the pH range of 5.5-42 and there was no precipitation between pH 8-6.

Stability on admixture with saline and iron saccharate. The zinc complex remained stable on admixture with saline and with iron saccharate in a ratio of 1:10.

Reaction on admixture with egg albumin. Fresh egg albumin mixed with water in a ratio of 1:6 started precipitating on admixture with 0.1 mg of elemental zinc in the form of $ZnCl_2$ (6.42%) while no precipitation took place on the addition of up to 10 mg elemental zinc in the form of a Zn complex.

Density and viscosity. The density and viscosity of the aqueous solution containing 0.5% zinc of the best sample (No. 1, Table 3) were 1.1802, 12.6749 millipoise at 19°

DISCUSSION

Zinc chloride is dissolved in boiled water for the preparation of zinc hydroxide and washed quickly with

5.

6.

7.

1:20

1:20

1:20

1:3.6

1:3.0

1:2.4

distilled water to free it from electrolytes. Complex formation does not take place if freshly prepared zinc hydroxide is not used. Zinc also forms a complex with sorbitol alone in a ratio of zinc 1, sorbitol 18 and NaOH 1.8 (Table 1) but

Expt. No.	Ratio of Zn: sorbit		Ratio of Zn: NaOH	Tempera- ture (^o C)		Time (hr)	Metal in the complex	Stability on long boiling	Final pH before boiling	Iso-elec- tric point
					Sorb	itol variable				
1.	1:10		1:1.8	200		0.45		Unstable		
2.	1:17		1:1.8	200		0.45	85%	Stable	9.9	5.5-4.2
3.	1:18		1:1.8	200		0.45	85%	Stable	9.8	5.5-4.2
					Alk	ali variable				
4.	1:18		1:2.0	200		0.45	80%	Stable	9.8	5.35-4.1
5.	1:18		1:2.4	200		0.45	72%	Stable	9.9	5.35-4.1
				Ĩ	empe	rature variab	le			
6.	1:18		1:1.8	160		0.45	No formation	on 🛼 🕐		
7.	1:18		1:1.8	165		0.45	No formation	on		
					Tin	ne variable				
8.	1:18		1:1.8	200		0.15	No formation	on		
9.	1:18		1:1.8	200		1.30	Overheated	1.2.85	5 I	
				Table	2. Zin	c dextrin con	mplex			
Expt. No.	Ratio of Zn: dextrir		Ratio of Zn: NaOH	Tempera- ture (°C)		Time (hr)		Stability on long boiling	Final pH before boiling	Iso-elec- tric point
iaider 1 o mis	the pfi at	o Inio	l'he isoelectric p	ent results. 1	Dext	rin Variable	ie (nteraction o		ile cast of i	
om or	1:12		1:2.85	200			h sarbitol as ha Fhe cor <u>n</u> plex di			
2.	1:16		1:2.85						9.5	
3.	1:20								9.4	
4.	1:24		1:2.85						8.6	

0.45

0.45

0.45

78%

80%

80%

Stable

Stable

Stable

9.9

9.8

9.4

5.5-4.2

5.5-4.2

5.5-4.2

200

200

200

Table 1. Zinc sorbitol complex

Tal. from electrolyses. Complex forme-	able 3. Zinc sorbitol dextrin and citric acid complex
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Expt. No.	Ratio of Zn: S:D:C*	Ratio of Zn: NaOH	Tempera- ture (^o C)	Time (hr)	Metal in the complex	Stability on long boiling	Final pH before boiling	Iso-elec- tric point
1. 1	1:18:10:3.5	1:2.85	200	0.45	85%	Stable	9.2	5.1-2.6
2.	1:18:10:4.0	1:2.85	200	0.45	85%	Stable	8.0	5.1-2.6
3. 1	1:18:10:5.0	1:3.4 00 00	200	0.45	89%	Stable	7.0 In el	3.5-2.6
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*S = Sorbitol; D = Dextrin; C = Citric acid.

Expt. No.	Ratio of Zn: sucrose	Ratio of Zn: NaOH	Tempera- ture (^o C)	Time (hr)	Metal in the complex	on long	Final pH before boiling	(^)) ()) () ()	Iso-elec- tric point
	ε.			Sucrose variable					
1.	1:15	1:2.85	200	0.45	88.8%	Stable	8.2		4.0-3.6
2.	1:14	1:2.85	200	0.45	88.5%	Stable	9.0		4.0-3.8
				Temp. variable					
3.	1:15	1:2.85	170	0.45		No formation	ı —		
4.	1:15	1:2.85	165	0.45		No formation	u —		
				Time variable					
5.	1:15	1:2.85	200	0.15	_	No formation	. —		
6.	1:15	1:2.85	200	1.30	_	Over Heated			

Table 4. Zinc sucrose complex

on keeping for 2-3 weeks, its zinc content dropped to 62% due to sedimentation. In conjunction with dextrin and citric acid the complex remained stable and the zinc concentration did not change. This phenomenon was also observed in the case of iron [9]. The interaction of iron with sorbitol took place smoothly with sorbitol as has been observed with other carbohydrates. The complex did not show gel formation or any other indication of instability even on long boiling but deteriorated on storage. In other carbohydrate complexes [10] it was observed that their stability can be varied by changing the time of heating, temperature or the proportion of the ingredients. In the case of zinc sorbitol complex, however, this technique did not work. Various ratios, change in temperature and time were tried without success.

In conjunction with dextrin and citric acid in ratio of Zn 1, sorbitol 18, dextrin 10, citric acid 5 and NaOH 3.4

(Table 3), the pH of the final product is 7 and the isoelectric point 3.5-2.6, while in the ratio of Zn 1, sorbitol 18, dextrin 10, citric acid 3.5 and NaOH 2.85 the pH is 9.2 and isoelectric point 5.1-2.6. Both the ratios are giving excellent results. The isoelectric point or the pH at which precipitation takes place is a more reliable measure of stability and the lower is the pH of precipitation the more stable would be the complex. This is due to the fact that these complexes are alkaline and the binding of zinc with sorbitol is more firm if the pH of the precipitation is lower towards the acidic side. Zinc forms a complex with dextrin alone as well, in a ratio of Zn 1, dextrin, 24, NaOH 2.85.

An intramuscular preparation of iron-sorbitol, dextrin and citric acid is very popular. Iron forms a stable complex with dextrin alone, but this preparation is not used for intramuscular use, since it is painful [10]. Dextrin is essential for the stability of the sorbitol complex. Tests with egg albumin substantiate the findings that metal ions interact with proteins while non-ionic complexes do not. Zinc chloride in concentrations of 0.1-0.2 mg precipitated the egg albumin while the zinc complex up to 2 mg did not have any effect.

Acknowledgement: The authors acknowledges with thanks the help of Mr. M. Rafi Khan and Rehana Jafri in the experimental work.

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ACT DURING THE

The impactance of studying the advence effects of water-borne observals upon ituman nepth in gamed measuritant during the post two decades. It into then established that many integrate and organic constituents enter rational maters from mouth or gam-made sources. The significance of these constituents to the quality of waters to public use depends on many interdependent parameters. Studies on sources and sources interdependent parameters.

metals have shown that man is constantly exposed to potentially fraumful districtule present its waters [1]. Mananum acceptable exponent invest for the imaganic constituents and those for trace metals are well document ed. [2, 4]. There is today a dire used to estimistic enforceable sumdards for drinking waters in order to limit the concentration of chemical/trace metals below levels (bal produce hamful effects, found data pertaining to quality waters have been produced by various governmental bodies in advanced coentries [4, 6].

Several liquid-liquid extraction procedures have been evolved in conjunction with the minimation of tracs metals by atomic elemention metrans [7-9].

In line with the previous study on the public utility waters of MWEP, the present work satails a follow up of the satist work based on the character cated above. Water samples sates collared from science, areas of the Punjab failing within a radius of \$3 km from blumbad. This area has retently started andergoing fast originalization and has

The shore of sampling and she shorted terrative Springs, walks and mak applies were selected for examination is they zerve a large population to respective areas. Complet with field estimations laborators suckees were conducted both in terms of withortions of quality control paracterist and mere metal largin following the procedure fail down in Part 1.

Details on simpling and analytic institution five/wed

NUMBER OF AND DUBLICESS AND

The sampling site datribution for the present study is appear in Table 1. The recessored physical channel perimeters appear in Table 1. Maximum competitions in encontraster to the case of sample 5.5 taring origin in a deep well The pH cases of sample 5.5 taring origin in a deep well range of 0.5 %.5 (nos sit watton are basic in nature, with alkaining values spreading between 170 and 477 (ng/1 is $CaCO_2$, a range within the eductated had of 500 mg/1 is for domestic watters between 170 and 477 (ng/1 is 3.23 and 5.24 have moderate bachesis (19 s 20, 5-21, 3.23 and 5.24 have moderate bachesis whereas the cost of sengle 5.35 that have a backness of 166 mg/1 CaCO₂, in sample 5.35 that have a backness of 166 mg/1 CaCO₂ in sengle 5.35 that have a backness of 166 mg/1 CaCO₂ in sengle 5.35 that have a backness of 166 mg/1 CaCO₂ in sengle 5.35 that have a backness of 166 mg/1 CaCO₂ in storage of total dissolved rable (TBS). Thus, 160 mg/1 equipate of total dissolved rables (TBS). Thus, 160 water is

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