NOTE ON THE FORMATION OF MAGNESIUM CARBOHYDRATE COMPLEXES

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Magnesium like other trace elements plays an important therapeutic role; and its importance in diet has been amply proved by McCollum *et al.*[1] It is closely related to calcium and phosphate in the physiology of human body and serves as a catalyst for some of the biochemical reactions especially those connected with carbohydrate metabolism. Wendt[2] found that magnesium is required in an amount of 0.7 mg. per day by a 70 kg. for man's growth and maintenance, while a child requires more of this metal, in proportion to his size.

In view of the importance of magnesium in the physiology of the human body and the fact that this metal is present in a huge amount in karela (*Momordica charantia*) which shows antidiabetic properties, it was decided to prepare complexes of magnesium with carbohydrates. The present paper deals with the formation of some of the stable complexes and the conditions under which they are formed.

Materials and Methods

The technique employed is the same as reported by Mahdihassan and his collaborators for the preparation of complexes of various trace elements with carbohydrates.[3,5] The starting material was magnesium chloride ($MgCl_2.6H_2O$) and the sugars used were glucose, sucrose, lactose, maltose, and dextrin (B.D.H.).

The method consisted in dissolving 8.3 mg. of $MgCl_2.6H_2O$ (equivalent to 1 mg. elemental Mg), in about 50 ml. of water in a beaker of 1 l. capacity at room temperature. To this was added a 5% solution of caustic soda with stirring, until a white precipitate of magnesium hydroxide was formed. The precipitate was washed free of electrolytes with distilled water. The removal of electrolytes was found to be essential as it was observed that if traces of electrolytes were present, the complex formation was not complete and the final product became unstable.

To the wet mass of the hydroxide, sugars in calculated quantities were added. Sodium hydroxide solution (15%) was further admixed with it and the contents were transferred to a porcelain dish and were heated in an electric oven at 180°C. The heated complex appeared as a dark coloured cake. On dissolving, the cake gave a clear solution which remained stable even on autoclaving.

Results and Discussion

Table 1 shows complexes of various sugars with magnesium. Although a number of experiments were tried to prepare stable complexes, yet only those are given in the table which were stable at the least sugar and alkali level but which on analysis gave maximum amount of magnesium in the complex. With dextrin, however, no stable complex could be formed.

TABLE I·

S. No.	Name of sugar	Magnesium: Sugar alkali in g.	Percentage of Magnesium in the complex	pH. of the complex	Iso-electric points	Density & Viscosity of Solution containing 1% elemental magnesium	
1.	Sucrose	1:8:1.5	90	8.6	3.2	1.089	0.0106
2.	Glucose	1:8:1.2	95	7.8	3.1	1.088	0.0116
3.	Laetose	1:8:1.5	90	7.8	2.8-3.4	1.090	0.0102
4.	Maltose	1:8:1.5	90	8.2	2.6-3.2	1.090	0.0102

If magnesium is to be administered intravenously to adjust the calcium/magnesium ratio in the body, a magnesium preparation which is non-dialysable for all practical purposes would be a good choice as in this form it could be retained by the system. Accordingly 20 ml. of the magnesium sugar complex containing 200 mg. elemental magnesium were dialysed for 72 hours, against running water, and it was noted that only 20 mg. magnesium was lost during dialysis. It, therefore, appears that the magnesium carbohydrate complex prepared by the method given above is non-dialysable under the experimental conditions.

In the absence of thorough pharmacological testing the importance of these complexes cannot be properly understood, but if their toxicity is less than that of magnesium sulphate, they can be a better vehicle of supplying magnesium than any of the available ionic salts.

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ULTRASONIC DEGRADATION OF VINYL BENZOATE

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Introduction

Vinyl benzoate breaks down thermally (*ca* 450°–550°C) by three competitive routes. Ritchie and co-workers[1,2] have devised the following reaction scheme:

$$\text{Ph. Co}_2\text{.CH:CH}_2 \begin{cases} \text{Ph.Co. CH}_3 + \text{CO..R/C}^1\ 76\% \\ \text{Ph.CH: CH}_2 + \text{CO}_2\text{..C}^2\ 15\% \\ \text{Ph.CO}_2\text{.H} + \text{CH}\vdots\text{CH..A}^2\ 6\% \end{cases}$$

The major formation of acetophenone from vinyl benzoate was postulated[3] to proceed by two steps: (1) primary thermal rearrangement to benzoylacetaldehyde and the (2)decarbonylation of benzoylacetaldehyde, but hitherto there has been no direct evidence of this labile precursor survives in the pyrolysate owing to its thermal instability. Some evidence of its presence was obtained by Muir[4], who found that the pyrolysate from vinyl benzoate showed the colour reaction with alcoholic ferric chloride characteristic of the enolic group, .(C(OH):CH, which occurs in benzoylacetaldehyde. Yousufzai and Ritchie,[5] however, obtained an indirect confirmation of its presence by labelling the carboxyl C atom of vinyl beneoate (Ph. $C_{14}O_2$.CH:CH_2-) and following the activity in the pyrolysate.

In the present work vinylbenzoate was subjected to ultrasonic vibrations. It has been found that it converts to benzoylacetaldehyde in good yields which was isolated as copper chelate. Other reactions characteristic to aldehyde were also made.

Experimental

Ultrasonic apparatus of Schocllar (Germany) model USLG 300 was employed for carrying out experiments. The vibration frequency of the crystal was 300 Kcls/Sec.

The total output of the apparatus could vary from 18 to 345 watts and the area of vessel used for filling the sample was 30 cm^2. The total output was set at 33 watts, which was equivalent to 1.1 watts/cm^2 on the (50 ml. vinyl benzoate) filled in the vessel. Vinylbenzoate was prepared by the known Adlemans[6] ester-interchange method.

The experiment was run for 37 hours at 33°C±2°C.

Pyrolysate reduces the Fehling solution. 2:4 dinitrophenylhydrozone isolated from the pyrolysate had a m.p. of 148-150°C. Prism-like crystals of benzoylacetaldoxime prepared from the pyrolysate melted at 86°C (lit., 7 86°C) Further work on these lines is in progress.

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