Utilization of Vitamin A in Water Emulsion

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The utilization of vitamin A is to a large degree dependent upon the quality of its carrier oil, in which it is dissolved (*3*). The utilization of vitamin A in vegetable oil and in water emulsion was studied during an investigation of the effect of peroxides on vitamin A absorption in chicks.

The vitamin A was derived from two different gray fish-liver oils of similar potency. Oil #1 was freshly prepared, while oil #2 had undergone considerable oxidation during long storage. The characteristics of the oils (*2*) are collected in Table 1.

TABLE 1

Physicochemical Characteristics of the Two Gray Fish-Liver Oils

	Oil #1	Oil #2
Vitamin A estimate at 325 μ (unsaponifiable)...	8,330	8,271
Ratio E $\frac{1\%}{1cm}\frac{260}{325}$ "	0.236	0.330
" " $\frac{280}{325}$ "	0.347	0.446
" " $\frac{300}{325}$ "	0.656	0.728
" " $\frac{350}{325}$ "	0.466	0.478
Vitamin A estimate at 328 μ (whole oil).....	8,160	9,000
Ratio E $\frac{1\%}{1cm.}\frac{260}{328}$ "	0.326	0.738
" " $\frac{280}{328}$ "	0.420	0.807
" " $\frac{300}{328}$ "	0.690	0.883
" " $\frac{350}{328}$ "	0.574	0.565
Peroxide value.....	0	16.7
Free fatty acid.....	0.23	0.67

Each of the oils was diluted with refined sunflower seed oil (peroxide value, 2.75; f.f.a., 0.3 per cent) and with water to potencies of both 50 and 150 units/cc., based on the vitamin estimate on the unsaponifiable fraction. The water emulsions were prepared by using 1 per cent "methocel" (400 centipoise) as the emulsifying agent. The oils and water for the preparations were deaerated, saturated with nitrogen, and stabilized with 0.05 per cent mixed tocopherols and 0.1 per cent soybean lecithin. In addition, the water phase of the emulsions was stabilized with 0.05 per cent gallic acid. Oils and water emulsions were stored in a cool place until ready for use. The emulsions were thoroughly shaken before use to ensure uniformity.

To determine the efficacy of the vitamin A in the carriers a biological assay was carried out with chicks, using essentially the technique described by Biely and Chalmers (*1*). Nine groups of 15 New Hampshire pullet chicks were standardized by weight at 7 days and then fed the vitamin A solutions by pipette (per os) every other day. Four of these groups were fed at the rate of 25 units/day, four others received 75 units/day, and the remaining one was kept as a negative control (Table 2). The chicks which were fed the water emulsions of vitamin A were given 1 cc. of sunflower seed oil, one day after vitamin A feeding, to equalize the fat intake in the different groups. The chicks were weighed once a week for 7 weeks, and a record of mortality and autopsy findings was kept. Table 2 shows the results of the experiment.

It will be seen from Table 2 that all groups of chicks receiving the vitamin A in the form of a water emulsion grew at a markedly greater rate than those fed vitamin A in oil. Since the basal diet appeared to supply all the necessary nutrients (including the vitamins) in adequate amounts with the exception of vitamin A, it would appear that the critical factor

TABLE 2

Weight of Chicks Fed Vitamin A in Different Carriers

Group	Units/cc.*	Description	Days					Total mortality
			7	30	37	44	51	
			(Grams)					
1	50	Vitamin Oil #1 in vegetable oil	67.3	279.8	326.0	383.9	400.1	1
2	50	Vitamin Oil #2 in vegetable oil	68.3	278.0	289.6	327.1	349.5	5
3	50	Vitamin Oil #1 in water emulsion	66.1	306.6	378.4	448.9	467.6	0
4	50	Vitamin Oil #2 in water emulsion	67.3	295.8	325.9	400.3	416.9	0
5	150	Vitamin Oil #1 in vegetable oil	67.3	312.7	408.6	507.4	549.3	1
6	150	Vitamin Oil #2 in vegetable oil	66.4	303.3	377.0	461.6	495.9	0
7	150	Vitamin Oil #1 in water emulsion	67.0	347.1	451.0	578.5	616.1	0
8	150	Vitamin Oil #2 in water emulsion	65.0	329.3	407.5	534.6	575.4	0
9	0	Control (no vitamin A)	67.0	All dead	—	—	—	15

* Fed 1 cc. every second day in all cases.

in these studies was the kind of carrier in which the vitamin A was supplied. Experimental data obtained in this laboratory (*4*) show also that a watery emulsion of vitamin A, when mixed in feed, produced slightly better growth in chicks over a period of 7 weeks than a feeding oil which had herring oil as a carrier.

Examination of the data also shows that fresh gray fish-liver oil, whether fed in oil or as water emulsion, resulted in somewhat greater growth than oxidized gray fish-liver oil.

The above experiment is being repeated on a larger scale in order to obtain sufficient data to determine statistically the extent of the differences between the two vitamin A carriers. The preliminary findings reported here show that the use of water emulsions of vitamin A can be of theoretical and practical importance in the biological assay of vita-

min A with either rats or chicks, and in the field of nutrition—especially in those cases where fat metabolism is disturbed.

References

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Natural Formation of Petroleum-like Hydrocarbons From "Oil Shales"

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In many localities throughout the area of the exposed lacustrine Green River facies of the continental Eocene of Colorado, Utah, and Wyoming are exposures of porous and permeable rocks containing a viscous liquid hydrocarbon. This material, soluble in CS_2, CCl_4, ether, and petroleum solvents, has apparently been produced naturally from the enveloping "oil shales."

The best of these porous and permeable beds are several thin, 2 inch to 14 inch layers of volcanic ash (*1*), now largely altered to crystalline analcite and chalcedonic silica. Several of these layers are regionally persistent, but locally there are present from 15 to 36 additional such ash layers ranging from 1/32 inch to 20 inches in thickness. These are intercalated with the organic marlstones or "oil shales" of the Green River beds. Some of these beds, ranging in porosity from 15 to 20 per cent and having a permeability of from 7 to about 30 millidarcys, are enveloped by beds of rich organic marlstone. Standard porosity and permeability tests made on samples of this rich marlstone give results approaching zero, but there is enough permeability along the bedding planes of the material in place for sodium carbonate efflorescence to form on a fresh surface in a month's time.

In areas where there has been no appreciable tectonic activity, these beds of altered volcanic ash are commonly free from all traces of either (1) petroleum-like liquid hydrocarbons soluble in the usual solvents or (2) pyrobituminous material such as is contained in the "oil shales."

However, in local areas of rather moderate folding, such as is encountered near the Grand Hogback in Colorado or along Evacuation Creek in Utah, and in some areas of more gentle dips, some of the less stable, yellowish, amorphous kerogen of the "oil shales" adjacent to these porous analcitic layers has been transformed to a dark brown, waxy, semifluid hydrocarbon. This material fills the pore spaces of the analcitic beds and also the joint cracks of the enveloping "oil shales."

This hydrocarbon is identical with the heavier cuts of shale oils produced from the Green River "oil shales" by usual retorting methods. This may be an intermediate step in the production of gilsonite by inspissation of such hydrocarbons produced by natural (geothermal?) cracking of the pyrobitumens present in the organic marlstone of the Green River lake beds. A substance identical to gilsonite can be produced in the laboratory from "oils" of the type described above.

The above occurrences are offered as field evidence of the existence of such natural "cracking" of pyrobitumens into a liquid hydrocarbon superficially resembling some types of petroleum.

Reference

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Plasma Accelerator Factor and Purified Prothrombin Activation[1]

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Recently attention was focused on the presence of a substance in plasma which accelerates the activation of prothrombin (*1*, *6*). Partial purification of this factor has made available a product useful for the study of prothrombin activation (*6*). The newly-recognized factor is a plasma globulin which we refer to as Ac-globulin.

We mentioned in 1938 that partially purified prothrombin is slowly converted to thrombin in the presence of optimum amounts of calcium and thromboplastin (*4*). Such slow activation is illustrated by curve A of Fig. 1. When a small amount of

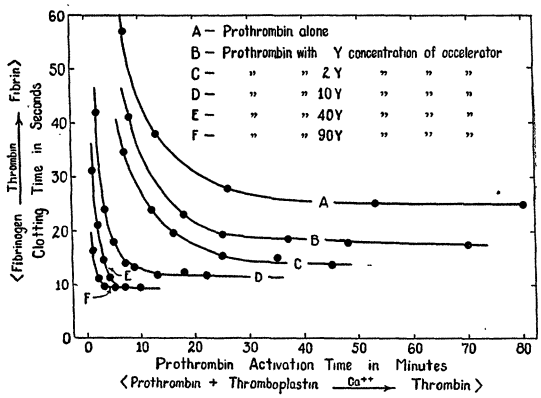

Fig. 1. Activation of purified prothrombin with optimum amount of thromboplastin and calcium. Only Ac-globulin concentration was varied.

Ac-globulin (Y concentration) is first added to the prothrombin, the activation rate of the latter is increased, as shown by curve B. With 2Y, 10Y, and 40Y concentration of Ac-globulin the activation rate is further increased, as illustrated by curves C, D, and E, respectively. Finally, with 90Y concentration of accelerator the activation rate is virtually equal to that of native plasma prothrombin itself (curve F). Heretofore it seemed likely that slow activation of purified prothrombin was the result of damage done to the fragile molecule during the purification procedures. This work shows, however, that it is necessary only to supply Ac-globulin in order to activate

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