pyridine–water (4:1) as solvent) as the sulfur-containing fragment in LBF hydrolysates.

Methyl pantothenate (1.5 moles), β-mercaptoethylamine (1.5 moles) and acetamide (0.0025 mole) were refluxed in two liters of methanol for eleven hours. Assay[2,4] showed 2400 LBF units per mg. of product. Excess methyl pantothenate was hydrolyzed by treatment for one hour at room temperature with *N* methanolic KOH. After neutralization with methanolic HCl and removal of the solvent, the residue was partitioned between *n*-butanol and water. The butanol contained 18,000 LBF units per mg. of solids. After drying, the butanol solution was poured onto a Superfiltrol column (20 g. adsorbent per g. of solids), the latter washed thoroughly with butanol, then developed with water-saturated butanol. The most active fractions contained 29,000 to 30,000 LBF units per mg. of solids.

Though non-crystalline, this product appears essentially pure, and is indistinguishable from LBF prepared from natural sources in (a) R_F values on paper from water-saturated butanol (0.93) or *n*-amyl alcohol (0.76) and (b) activity for *Lactobacillus helveticus*, *Saccharomyces carlsbergensis*, and *Lactobacillus arabinosus*.[2] Both products give an immediate nitroprusside test only after reduction with NaCN; activity for *L. helveticus* was unchanged by such reduction. Both products are destroyed by digestion with a liver enzyme with release of 0.03 μg. of calcium pantothenate per LBF unit. Thus LBF may exist as N-(pantothenyl)-β-aminoethanethiol or as the corresponding disulfide.

Anal. Calcd. for $C_{11}H_{22}O_4N_2S$: N, 10.07; S, 11.52; Found: N, 10.2; S, 12.0. *Pantetheine* and *pantethine* are suggested as names for the thiol and disulfide forms, respectively, of the growth factor. Its relation to coenzyme A was indicated previously.[2]

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AN EFFICIENT SEPARATION OF DYSPROSIUM AND YTTRIUM[1]

Sir:

A rapid and efficient separation of the difficultly separable rare earth pair, dysprosium and yttrium, has been accomplished by elution with 5% ammonium citrate solution at room temperatures on Nalcite H.C.R. resin. This is achieved because of a shift in the order of elution of yttrium relative to the other rare earths. With 0.1% citrate solution, the order of elution is Dy-Y-Tb,[2] while the order observed with 5% citrate is Dy-Tb-Y. Previously, it had been reported[3] that elution at 100° of tracer amounts of rare earths with 5% citrate showed yttrium eluting ahead of dysprosium.

When eluting with 5% citrate at *p*H values greater than 2.8, the rare earth band immediately precedes the hydrogen band on the column, and results in a square-type band front. At lower *p*H values, the ammonium ions pass the rare earth ions and consequently the rare earths are on an ammonium bed. The resultant band front at these lower *p*H values is sloping and the elution curves resemble those previously obtained with other rare earths using similar conditions.[4] At all *p*H values when 5% ammonium citrate is used as eluant, the observed order of elution is Dy-Tb-Y.

A load of 7.6 g. of oxides was placed on a column containing 450 g. of resin and eluted with 5% citrate. The resin bed length was 60 cm. and the diameter was 4 cm. These oxides, obtained by column fractionation of R_2O_3 from gadolinite ore, had the composition 10% Dy_2O_3, 89% Y_2O_3, 0.5% Ho_2O_3, 0.5% Tb_4O_7. Analyses were made by spectrophotometric and spectrographic methods. At a *p*H value of 2.80, 85% of the available Y_2O_3 was obtained spectrophotometrically pure (>99%). Previous work using 0.1% citrate at *p*H values of 5.5–6.0, eluted less than 10% of the available Y_2O_3 with comparable purity. The total time of a run using 5% citrate at a *p*H of 2.80 is only one-third that required with 0.1% citrate. The concentration of rare earths in the eluate using 5% citrate is correspondingly higher.

It appears that the most efficient way to obtain pure Y_2O_3 and pure Dy_2O_3 from an ore concentrate involves two ion exchange procedures: (1) first a preliminary elution using 0.1% citrate with *p*H values between 5.8 and 6.1, which separates dysprosium and yttrium from the other rare earths; (2) elute the yttrium–dysprosium fractions so obtained with 5% citrate using a *p*H value of 2.8, to obtain the pure salts.

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[1] This work was performed in the Ames Laboratory of the Atomic Energy Commission.

[2] F. H. Spedding, E. I. Fulmer, J. E. Powell, T. A. Butler, and I. S. Yaffe, paper presented before the Sept. 1950 meeting of the American Chemical Society in Chicago.

[3] B. H. Ketelle and G. E. Boyd, THIS JOURNAL, **69**, 2800 (1947).

[4] F. H. Spedding, A. F. Voigt, E. M. Gladrow and N. R. Sleight, *ibid.*, **69**, 2777 (1947).

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THE STRUCTURE OF THE CARYOPHYLLENES

Sir:

An optically inactive α-caryophyllene (humulene), n^{20}_D 1.5035, was prepared from hop oil by fractionation in an efficient column with sub-