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NUTRITIVE VALUE OF ALGAL PROTEIN: BIOCHEMICAL BASIS OF THE HIGH LYSINE CONTENT OF CHLORELLA VULGARIS GROWN IN PIG SLURRY SUPERNATANT

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A major constraint upon the exploitation of waste grown algae as ingredients in animal diets has been the low digestibility of most of the species studied. In the present study the alga Chlorella vulgaris strain 211-1e lacks sporopollenin from its cell walls. The nitrogen digestibility and availability of the amino acids of the algal product grown in synthetic medium using a continuous culture system were assayed using in vivo (rats) and in vitro trials and the results (Strain 1976) compared favourably with literature values (Priestly 1976). It was interesting that the product of algal culture in the liquid phase of slurry contained unusually high levels of lysine (10.8g/16g N) compared to cells grown in various axenic cultures (5.9 - 6.6g/16g N). Preliminary experiments had indicated that the presence of n-hexanoic acid in the slurry was correlated with the high lysine values (Garrett et al. 1976). The results of further work will be presented in order to elucidate the biochemical basis of the high levels of lysine.

Hexanoate did not seem to function as a precursor in the biosynthesis of lysine, since no ^{14}C-lysine was found in cells growing in a medium containing n- (1-^{14}C)-hexanoate. The incorporation of radioactive label into lysine from 2-amino (1-^{14}C)-adipate (AAA) but not from 2,6-diamino -(G-^{3}H)-pimelate (DAP) by actively growing cells indicated that this strain of C. vulgaris, in contrast to previous reports in the literature (Rothstein & Saffron 1963; Vogel 1964) did not appear to synthesise lysine by the DAP pathway but rather by the AAA pathway. In a further treatment L-lysine decarboxylase was used to trap L-lysine synthesised from ^{14}C-AAA by an in vitro system using freeze-thawed cells of C. vulgaris. More $^{14}CO_2$ (from L-lysine) was released from the in vitro incubation containing hexanoate. Therefore, hexanoate was stimulating lysine biosynthesis, probably by activation of an enzyme subequent to AAA in the pathway. Finally, a modification of the classical experiment of Vogel (1964), using the labelled potential metabolic precursors (1-^{14}C)-alanine, (4-^{14}C)-aspartate and (2-^{14}C)-acetate was attempted using C. vulgaris cultures grown with CO_2 as the main carbon source and measuring the effect of hexanoate upon the incorporation of ^{14}C into lysine. In the treatments, the specific activity of all the amino acids were measured by separating them by ion exchange chromatography and recovering the fractions for liquid scintillometry. The labelling patterns obtained seemed to indicate that glyoxylate and glutarate may react to form oxaloglutarate and hence AAA in C. vulgaris.

GARRETT, M.K., STRAIN, J.J. & ALLEN, M.D.B. (1976) J. Sci.Fd. Agric.207:603
PRIESTLY,G. (1976) in "Food from Waste", p.114 Ed. Birch, G.G., Parker, K.J. & Worgan, J.T. (Applied Science, London).
ROTHSTEIN, M. & SAFFRON, E.M. (1963) Arch. Biochem. Biophys. 101:373
STRAIN, J.J. (1976) Ph.D. Thesis. The Queen's University of Belfast.
VOGEL, H.J. (1964) Am. Natural XCVlll:435

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