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Role of some organic substrates in Cadmium uptake by a Marine Bacterium

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INTRODUCTION

It has been shown for a long time, that microorganisms are able to take up metals and particularly cadmium from their medium (Tornabene and Edwards, 1972; Gauthier and Flatau, 1980). The amount of cadmium absorbed seems to be an intrinsic characteristic of the strain rather than that of the species (Tynecka et al., 1981 a, b) and cadmium sensitive strains generally take up more cadmium than resistant ones (Gauthier et al., 1986). For a given strain however, the cellular content of cadmium also depends on extrinsic physicochemical parameters like temperature, pH (Titus and Pfister, 1982), salinity or the presence of organic matter (Flatau et al., 1986).

Saccharose (SAC), glucose (GLU), sodium succinate (SUC), gluconate (GLC), acetate (ACE), glycerophosphate (GLY), pyruvate (PYR), organic substrates eventually used as carbon sources or involved in the tricarboxylic cycle were therefore investigated to determine their possible role in the fixation of cadmium by a marine pseudomonad. As sensitivity to metals of microorganisms greatly depends on their nutritional state (Brynildsen et al., 1988), this study was carried out on freshly harvested cells (fresh cells) and starved cells.

RESULTS AND DISCUSSION

Although the presence of glucose stimulated respiratory activity in fresh cells, it induced a decrease of 27 % in the cellular amount of cadmium. In starved cells however, glucose stimulated respiratory activity and induced an increase of 27 % in the cellular amount of cadmium. This could suggest the presence of an efflux mechanism which would be activated in non limited cells only, as supposed by Brynildsen et al., (1988). On the other hand, the addition of energy and carbon (as glucose) may have energized the transport of cadmium in starved cells as it was supposed for the transport of zinc in *Escherichia coli* (Bucheder and Broda, 1974).

The other substrates had a more attenuated effect on Cd uptake by fresh cells. A trend in the inhibition of Cd uptake was supposed but could not be confirmed because of the too slight variations of the results relative to their variance.

On the other hand, a significative stimulation of Cd uptake in starved cells by the tested substrates was observed (Fig. 1), which was not correlated to the stimulation of respiratory activity.

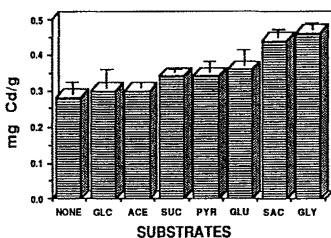


Fig. 1 : Stimulation of cadmium uptake by starved cells in the presence of gluconate (GLC), acetate (ACE), succinate (SUC), pyruvate (PYR), glucose (GLU), saccharose (SAC) and glycerophosphate (GLY), (final concentration, 2g/l).

In conclusion, the uptake of cadmium greatly depends on the nutritional state of cells at least for the tested strain. In starved cells, the supply of energy and carbon stimulated Cd uptake, probably because this latter was probably an energy-dependend mechanism (Flatau et al., 1989). On the other hand the absorption of cadmium could be limited by efflux mechanisms activated in non limited organisms.

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