The influence of anodizing conditions on the activity of urease immobilized to anodized sheet aluminum

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The application of inorganic carrier materials for enzyme immobilisation is of advantage because they cannot be degraded by bacteria. Recently we have shown that anodized sheet aluminum is a suitable carrier for enzymes (1).
The activity of enzymes adsorbed to this material is dependent on the anodizing conditions as it is shown in this paper with urease as an example. Important parameters are the acid concentration, the applied voltage and current density, the anodizing temperature T_a, the anodizing time t_a, and the contact time between the anodized sheet aluminum and the enzyme solution. The results of our experiments exhibit that the optimum anodizing conditions are sulfuric acid concentrations of 17wt% and 26 wt%, t_a values between 40 and 50 min., a current density of 50 to 85 mA/cm^2, and an anodizing temperature of 308 K. The optimum contact time depends on the applied current density.
The kinetic behaviour of urease adsorbed to anodized sheet aluminum is similar to that of the unbound enzyme, though the K_M value for the immobilized enzyme is slightly increased; the temperature stability, however, is markedly risen.
If the enzyme supply is varied, an adsorption isotherm is obtained, that does not obey the Langmuir theory. The activity of the catalysts goes through a maximum at medium enzyme supply which is probably due to a concentration-dependent orientation of the enzyme molecules towards the surface of the carrier.
As the surface structure of anodized sheet aluminum can be altered in a definite way by varying the parameters of anodizing, this procedure will offer the opportunity to study the adsorption of proteins under well-defined conditions.

1) Grunwald, P., Gunßer, W., Pfaff, K.P., Krause, R., and Lutz, K., (1980), Z. Naturforsch. 35c, 819