

Study on electrooxidation of urea-urease complex  
at carbon electrodes

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Urease decomposes urea to ammonia and carbon dioxide, however, we found that urea is electrooxidized to nitrogen and carbon dioxide via hydrazine. During electrooxidation of urea in urease solution, the electrooxidation of urease is also taken place and the electrocatalytic activity of oxidized urease has been investigated. The oxidation rate of urea should be changed if the electrocatalytic activity of urease changes by oxidation. Fig. 1 shows that the oxidation rate of urea at +0.8 V vs SCE using glassy carbon and plastic formed carbon electrodes. The oxidation current of urea obtained by PFC is significantly larger than that obtained by GC. This fact indicates that the oxidation current was increased by adsorption of enzyme, but no oxidation current was observed when urease is not added. The oxidation current was not decreased at least 3 hours, and the electrocatalytic activity maintains for a long time. Fig.2 shows the cyclic voltammograms of urea oxidation at each temperature. The oxidation current of urea was interestingly disappeared completely when temperature decreased to about zero degree, although that increases as temperature increases up to 80. This data were obtained by 0.1 M ammonium carbonate solution containing 5 mg of dialyzed enzyme. The maleimide reacted urease did not exhibit electrocatalytic activity, because maleimide reacts with SH group located in the active site. Fig.3 shows the proposed oxidation scheme of urea catalyzed by oxidized urease.

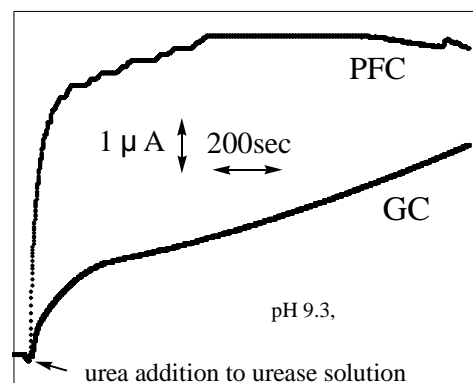


Fig.1 Comparison of the oxidation currents of urea-urease complex obtained by glassy carbon and plastic formed carbon electrodes

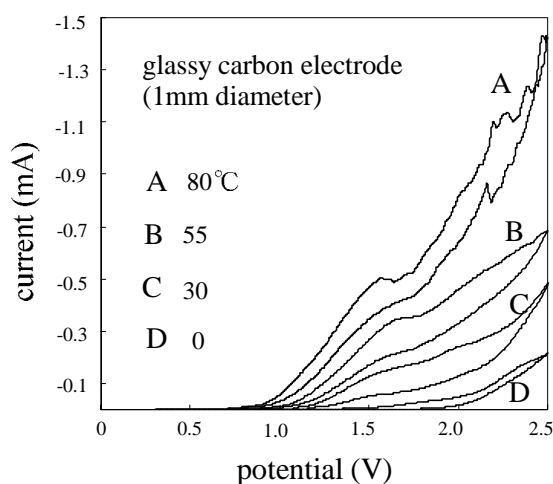


Fig. 2 Effect of temperature on the cyclic voltammogram of urea solution containing urease

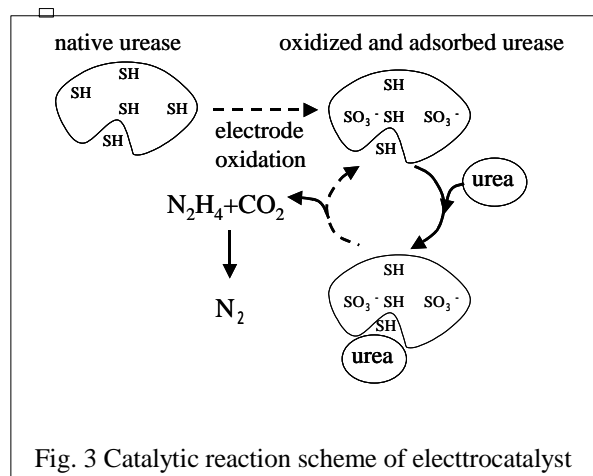


Fig. 3 Catalytic reaction scheme of electrocatalyst