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Abstract

Nanoparticles of Rh(Rm), Pt(Rm), Pd(Rm) were prepared in reverse micelle solution. Also nanoparticles of Rh(PVP), Pt(PVP), Pd(PVP) were prepared in aqueous solution, using PVP(poly-N-vinyl-2-pyrrol-idone) to prevent the nanoparticles from aggregation. It was found that the nanoparticles in aqueous solution were well-dispersed. By TEM, the particle size was found to be about 10nm for the particles in the reverse micelle solutions and about 5nm for the particles in the PVP aqueous solution.

Under an electric field of 1000V/cm, the nanoparticles of Rh(Rm), Pt(Rm), and Pd(Rm) were electrophoretically deposited on Ti substrates, followed by heat treatment, was produced nanostructured Rh(Rm), Pt(Rm), and Pd(Rm) electrodes, respectively. FE-SEM confirmed that there were nanoparticles deposited on the nanostructured electrodes.

The nanostructured Rh(Rm)+Rh(PVP), (Pt(Rm)+Pt(PVP) or Pd(Rm)+Pd(PVP)) glucose biosensors were prepared by coating a mixed solution of glucose oxidase (GOx), Nafion, and nanoparticles Rh(PVP)
(Pt(PVP) or Pd(PVP)) on the nanostructured Rh(Rm)(Pt(Rm) or Pd(Rm)) electrodes. By replacing the mixed solution of GOx, Nafion, and nanoparticles Rh(PVP) with that of GOx and Nafion, the nanostructured Rh(Rm)(Pt(Rm) and Pd(Rm)) glucose biosensor could also be prepared by the same method.

In amperometric detection of glucose, it was found that upon increasing the Nafion loading of the biosensors, the linearity of detection increased, while the detection current decreased. In addition, over 2.8mg, the enzyme loading of the biosensors had little effect on both the linearity and the detection current.

The Rh(Rm)+Rh(PVP) biosensor had larger activity for glucose detection, with a specific current density 0.61mA/cm2-mg, than other biosensors of this study. Then in order of activity, we have the following： Rh(Rm) with 0.24, Pt(Rm)+Pt(PVP) with 0.13, Pt(Rm) with 0.0776, Rh(Ep)(prepared by electroplating of Rh on Ti substrates from RhCl3 aqueous solution) with 0.0505, Pd(Ep) with 0.0106, Pd(Rm)+Pd(PVP) with 0.00804, Pd(Rm) with 0.00693, and Pd(Ep) with 0.00618 mA/cm2-mg.

The linearity of the biosensors of this study is in the range of 1 ~ 3 mM glucose, which is approximately equal to that of the biosensors reported in other studies[53, 55, 56].

It was found that Rh(Rm)+Rh(PVP) biosensor had the longest lifespan of 50 days. Then came Pt(Rm)+Pt(PVP) with 34 days, Pd(Rm)+Pd(PVP) with 26days, Rh(Rm) with 13 days, Pt(Rm) with

6 days, Rh(Ep) with 3 days, and Pt(Ep) and Pd(Rm) both with 1 days in that order. The result shows that by loading metal nanoparticless, which are dispersed in PVP aqueous solution, into detection membrane, the lifespans of glucose biosensors could be increased due to the three-dimensional distribution of the catalytic sites.
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