# 嘉南藥理科技大學專題研究計畫成果報告

## 中草藥化妝品開發子計畫(7)—含多氫氧基二苯乙烯與含雙Cu(I)類核酪胺酶之作用機轉探討

計畫類別：□個別型計畫　　■整合型計畫

計畫編號：CNIC93-01

執行期間：93 年 1 月 1 日至 93 年 12 月 31 日

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執行單位：化粧品應用與管理系

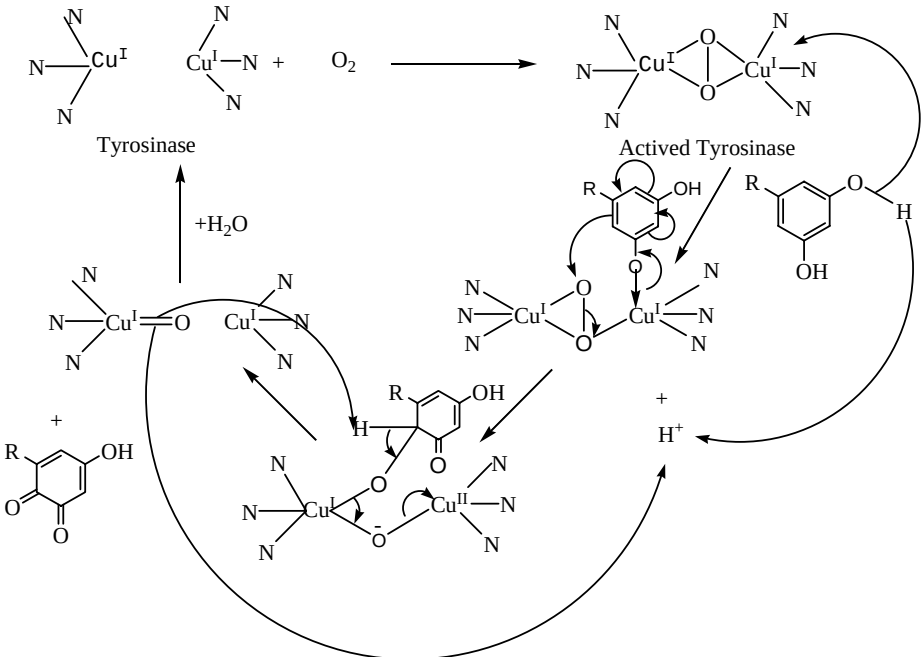
Abstract

The TPA Cobalt metal ion complex was synthesized latterly. Besides It is currently

my interesting that the complex can be using to enhance the sensitivity of platinum electrodes. The complex is used to be instead of which the enzymes such as Tyrosinase to study the mechanisms of the catalysis of some of whiting active compounds with Tyrosinase like catalyst also is my target. Here we report that the complex which has been synthesized. And it was already determined with X-ray diffraction, Elemental Analysis, and cyclovoltammetry methods. Among the results, the X-ray data shows that the structure of the TPA Cobalt metal ion complex is packing in space group $P2_{1/c}$ and it possess a good leaving group on Cobalt atom. It meant that when the whiting active compounds would be a chance binding on Cobalt atom. And besides According to the cyclovoltammetry data this complex is very easily to reduce due to it has low energy (it could be reduced at –510mv ) to be reduced with reducers such as the whiting active compounds. Even thought the reactions of whiting compounds with TPA Cobalt metal ion complex not performed yet. We are already proposing that it is must to reach any way. So we shell be test it in the future.

Introduction:

Reactions of the whiting effect compounds such as Vitamine C, catachol, cysteine, and stilbene derivatives with Tyrosinase are well-known in the literatures recently. They are reducer on Chemistry. According to the literatures, Tyrosnase bind molecular oxygen and active for catalysis whiting compounds that they are mentioned. And the mechanism had been discussed which is showed in the Figure 1. This process has been found in the basis epidermal layer it is called Melanogenesis. However the skin whiting effect compounds that we mentioned can inhibit Melanogenesis because




of the hiting their , especially in Taiwan. The catechol derivatives are some of popular chemicals. Usually you could found them in the mushrooms. By the literatures study,

we found that some research groups focused their attention on the cancers therapy, and some of them focused on the whiting effect on the Cosmetics area. Because of the sensitivity also have attracted many research groups. That's why we paid attention and researched it in this project. Every one who used the electrochemical equipments to perform the experiments must knew that on the surface of some metal that they are to be a electrodes. Something must bather them. The naked surface of the metal electrode has been cumulated with the electrochemical oxidation products
of whiting compounds. It cause that the signals still decay whatever linear scan or differential pulse method.. Therefore most of research groups had been using modified surface electrodes to measure the concentration of the whiting compounds solution. They had been modified with TiO2 particles, metal ion complexes, or something that it could conduct
electricity, especially dicopper ions complexes are more popular to currently use. However they had been synthesized to spent a lot of money and besides they are too difficult to buy. So in order to avoiding the cumulation phenomenon this project, a simple complex that TPA $(HClO_4)_3$ reacted with $CoCl_2$ to obtain TPACo $(ClO_4^-)$ were synthesized. The complex was further determined with X-ray, Elemental Analysis, and Cyclovoltammetry. The mechanisms of reaction of complex with polyhydroxy stilbene derivatives would be further to perform in the next period of time.

Results and Discussion

According to the X-ray report, metal ion is chelated with TPA ligend and a Cl anion in a distortion triangle di-pyramid structure is also bounded on Co atom. The Co atom has keeping formal charge 1+ which is obviously known with one accompanied perchlorate counter anion. The crystal is packing in $P2_{1/c}$ group space. The X-ray data is showed below (see Figue2 and Table 1, and 2)

The Elemental analysis report show that it's consist with the X-ray data. Even thought there are a little residue mixing together.(Table 3)

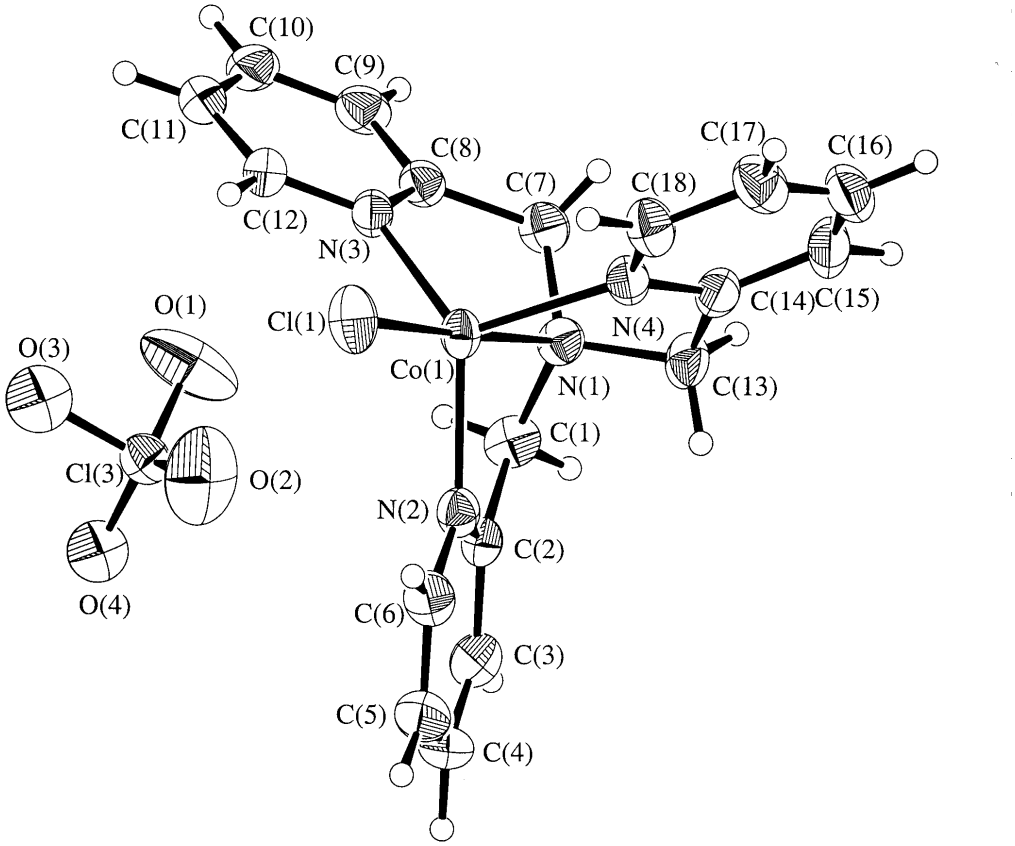
Cyclovoltammetry was also performed. By the results, it has a reduction signal at –510mv in aqueous solution. It meant that it's a very easily to reduce compound. In my opinion, it must be easy combined with the whiting compounds. So we shell be further to apply it enhancing the sensitivity of the platinum electrodes surface.

The experimental section

**The materials：**

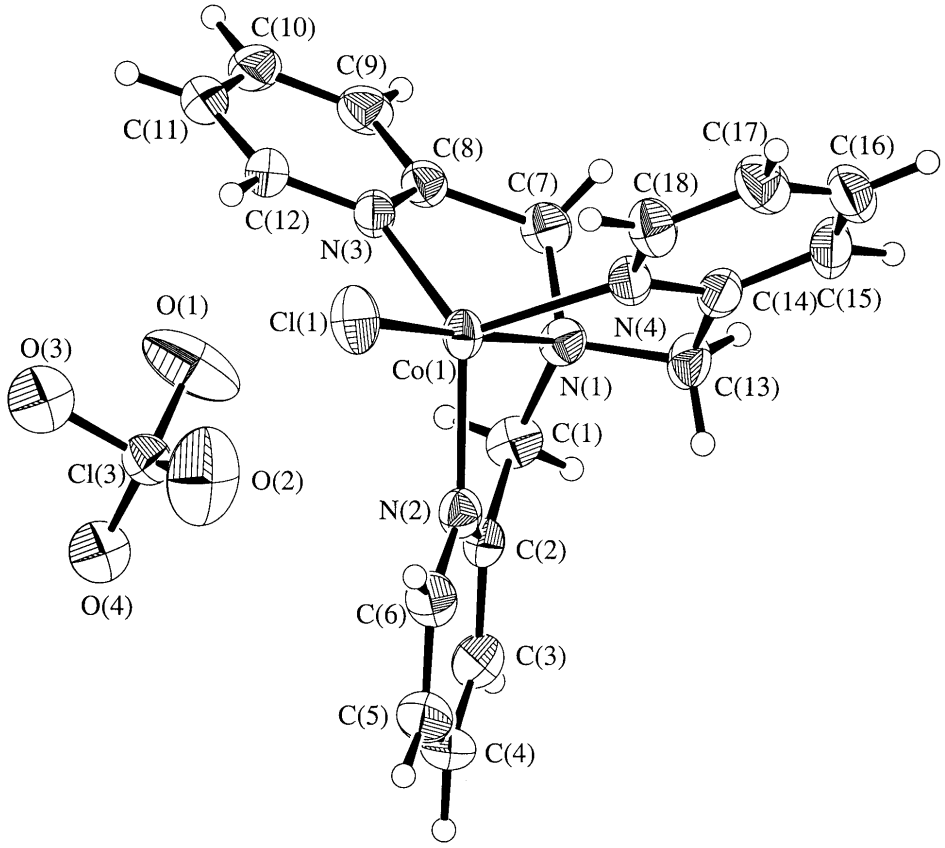
All the chemicals were purchased in commercials and has been dewater and keeping in a closed container to store.

**The synthesis of TPA**：




**The measurement of X-ray**

The X-ray data was collected by the Expensive equipments center of NSYSU which is showing in Figue 2 and Table 1, and 2.




Fugure 1

**The experiment of cyclovoltammetry**

The three electrodes system was used to measured the cyclovoltammetry of TPA Cobalt complex with BAS100 potential stat in KCl aqueous solution. The reduction signal was obtained at –510mv.

Table 1 The crystal datas of TPACo

| | |
|---|---|
| Empirical Formula | $C_{18}H_{18}Cl_2N_4O_4$ |
| Formula Weight | 484.20 |
| Crystal Color, Habit | green plate |
| Crystal Dimensions | 0.2×0.38×0.6mm |
| Cell Determinations (2θ range) | 25(15.2-24.4) |
| Omega Scan Peak Width | |

| | |
|---|---|
| At Half-height | 0.26° |
| Lattice Parameter | a = 14.685(5)Å<br>b = 9.410(2)Å<br>c = 29.794(4)Å<br>β = 90.64(2)°<br>V = 4117(1) $Å^3$ |
| Space group | $p2_{1/c}$ |
| Z value | 8 |
| $F_{000}$ | 1976.00 |
| μ(MoKα | $11.26cm^{-1}$ |
| Residuals | 0.044; 0.052 |

Table2 Bond Angle (º) and Bond length(Å)

| | | | |
|---|---|---|---|
| Cl | Co | N(2) | 104.5(2) º |
| Cl | Co | N(4) | 102.5(2) º |
| N(1) | Co | N(3) | 77.6(2) º |
| N(2) | Co | N(3) | 120.4(2) º |
| N(3) | Co | N(4) | 114.9(2) º |
| Co | | N(1) | 2.192(5)Å |
| Co | | N(2) | 2.055(5)Å |
| Co | | N(3) | 2.066(5)Å |
| Co | | Cl | 2.282(2)Å |

Table 3 The Elemental Analysis Data

| | N% | C% | H% |
|---|---|---|---|
| Experimental Data | 10.94 | 43.79 | 4.32 |
| Calculatio Data | 9.46 | 43.98 | 3.66 |

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