

# 鱼肝铁蛋白铁核表层接受电子能力的研究

黄河清<sup>1,2</sup>、林庆梅<sup>3</sup>、罗大民<sup>1</sup>、朱斌琳<sup>1</sup>

1 厦门大学生命科学学院细胞生物学与肿瘤细胞工程教育部重点实验室

2 厦门大学固体表面物理化学国家重点实验室

3 厦门大学海洋与环境科学教育部重点实验室

采用直接电化学技术研究 鱼肝铁蛋白(Liver Ferritin of *Dasyatis akajei*, DALF)铁核表层接受还原电子的快慢速率和释放铁的动力学级数及规律。实验结果表明,在有氧环境下,DALF铁核表层以两相行为的方式快速地从铂电极上获得还原电子且用于释放铁反应,其释放铁的还原电位分别为-125mV和-375 mV(vs. NHE,下同)。在控制还原电位为-200mV和-500mV的条件下,DALF铁核表层释放铁的速率分别为 $11.1 \text{ Fe}^{3+}/(\text{DALF} \cdot \text{min})$ 和 $33.3 \text{ Fe}^{3+}/(\text{DALF} \cdot \text{min})$ ,因而认为DALF从铂电极接受电子和释放铁的速率快慢与还原电位高低有关。血红素不仅能络合于DALF蛋白壳(DALF<sub>h</sub>)上,而且还能加速DALF<sub>h</sub>释放铁的速率,但无法增加DALF<sub>h</sub>释放铁的总量。DALF铁核结构中的磷铁组成存在着非均匀性。DALF铁核表层磷铁结构具有接受来自于蛋白壳电子隧道所提供的还原电子能力。

## STUDIES ON CAPACITY OF PICKING UP ELECTRONS ON THE SURFACE OF IRON CORE FORM THE FERRITIN OF FISH LIVER

The fast and slow rates of the reduction electrons on the surface of iron core in liver ferritin of *Dasyatis akajei* (DALF) were studied by direct electrochemical technology which was also used to study the kinetic order and law of iron release. In aerobic environment, the experimental results showed that DALF, as a form of biphasic behavior, not only picked the electrons up from the platinum electrode, but also used them for iron releasing. Moreover, two-reduction potential of -125 mV and -375mV vs. NHE for iron release were determined. Using reduction potentials of -200 mV and- 500mV vs. NHE, two rates of iron release on the surface of iron core in DALF measured were  $11.1 \text{ Fe}^{3+}/\text{DALF}/\text{min}$  and  $33.3\text{Fe}^{3+}/\text{DALF}/ \text{min}$  respectively, suggesting that the fast and slow rates of DALF picking the electrons up from the platinum electrode are tightly related to the reduction potentials. It was seen that the heme not only bound to the protein shell of DALF, but also accelerated the rate of iron release. However, the content of iron release was not increased by the heme in DALF<sub>h</sub>. The structure composition of phosphate and iron within the DALF core were heterogeneous. The surface structure of iron core in DALF is capable of picking up the electrons come from the electron tunnel of protein shell, which are used for iron releasing.

### 关键词

鱼肝铁蛋白(Liver of *Dasyatis akajei*); 直接电化学(Direct electrochemistry); 释放铁(Iron release); 铁核结构(Structure of iron core); 释放铁动力学(Kinetics of iron release)