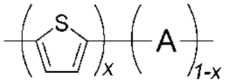
CLAIMS

1. A method for producing hydrogen peroxide, comprising combining a film of a catalyst for light absorption and oxygen reduction (hereinafter referred to as a light-absorbing oxygen reduction catalyst film) that consists of a thiophene polymer with a catalyst for water oxidation (hereinafter referred to as a water-oxidizing catalyst), immersing the combination in alkaline water, and irradiating the light-absorbing oxygen reduction catalyst film with light.

2. A production method according to claim 1, wherein the thiophene polymer is a copolymer of thiophene and an aromatic compound (hereinafter referred to as a thiophene copolymer) having a structural unit represented by the following formula (I):

[Formula 1]



(I)

wherein

A represents a constitutional unit derived from an aromatic compound;

x and 1-x represent a composition ratio of the constitutional units of the copolymer; and

x is $0 < x \leq 1$.

3. The production method according to claim 1 or 2, comprising connecting an electric conductive plate having a surface coated with the light-absorbing oxygen reduction catalyst film and an electric conductive plate having a

surface coated with a film of the water-oxidizing catalyst (hereinafter referred to as a water-oxidizing catalyst film) via a conductor, immersing the connected plates in alkaline water, and performing light irradiation.

4. The production method according to claim 1 or 2, comprising immersing an electric conductive plate that has one side coated with the light-absorbing oxygen reduction catalyst film and the other side coated with the water-oxidizing catalyst film in alkaline water and performing light irradiation.

5. The production method according to claim 1 or 2, comprising immersing microparticles of the water-oxidizing catalyst having the surface mostly coated with a thiophene copolymer in alkaline water and performing light irradiation.

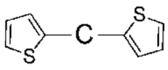
6. The production method according to any one of claims 2 to 5, wherein the thiophene copolymer is obtained by previously synthesizing a dimer or a trimer of thiophene and an aromatic compound represented by the following general formula (II) or (III) and polymerizing the dimer or trimer to form a copolymer of thiophene and the aromatic compound:

[Formula 2]



(II)

[Formula 3]



(III)

wherein B and C represent an aromatic compound.

7. The production method according to any one of claims 1 to 6, wherein the water-oxidizing catalyst comprises manganese oxide, cobalt oxide, or ruthenium oxide.

8. The production method according to any one of claims 1 to 7, wherein the light irradiation is performed using natural sunlight, artificial sunlight, or ultraviolet or visible light as a light source.

9. The production ~~A~~ method according to claim 6, ~~for preparing a light-absorbing oxygen reduction catalyst film,~~ comprising applying the synthesized ~~a~~ dimer or ~~a~~ trimer ~~synthesized according to claim 6~~ on an electric conductive plate and exposing the plate to iodine vapor to obtain a thiophene copolymer.

10. A plate for producing hydrogen peroxide, wherein the plate is an electric conductive plate that has one side coated with a light-absorbing oxygen reduction catalyst film that consists of a thiophene polymer and the other side coated with a water-oxidizing catalyst film.

11. A microparticle for producing hydrogen peroxide, wherein the microparticle is a water-oxidizing catalyst that has catalytic activity for water oxidation and has a surface coated with a light-absorbing oxygen reduction catalyst film that consists of a thiophene polymer.

12. A combination structure of electric conductive plates for producing hydrogen peroxide, wherein the combination is formed by combining an electric conductive plate having a surface coated with a light-absorbing oxygen reduction

catalyst film that consists of a thiophene polymer and an electric conductive plate having a surface coated with a water-oxidizing catalyst film and connecting the plates via a conductor.