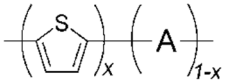
CLAIMS

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.

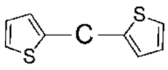
6. The production method according to any one of claims 2 to 5, wherein the thiophene copolymer is obtained by previously synthesizing a dimer or a trimer of thiophene and an aromatic compound represented by the following general formula (II) or (III) and polymerizing the dimer or trimer to form a copolymer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