CLAIMS

1. A catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

2. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the *Escherichia coli* is an insertion variant in which the transposon for the gene ypjD (b2611) is inserted.

3. A catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays, wherein the porphyrin is free of any coordinated transition metal at the center of the porphyrin ring.

4. A catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function in an alkaline solution, while irradiating the same with light rays, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

5. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is a tetrapyrrole compound carrying

a methyl group and an ethyl ester group or an acetate group (propionic acid group) on the porphyrin ring.

6. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is a tetrapyrrole compound carrying four methyl groups and four ethyl ester groups or acetate groups (propionic acid groups) on the porphyrin ring.

7. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is one having, in the molecule, a carboxyl group.

8. The catalyst for the decomposition of lignin as set forth in claim 7, wherein the porphyrin is one having, in the molecule, two, four or eight carboxyl groups, in total.

9. The catalyst for the decomposition of lignin as set forth in claim 7, wherein the porphyrin is at least one member selected from the group consisting of uroporphyrin, protoporphyrin and coproporphyrin.

10. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the catalyst comprises a culture medium containing a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium.

11. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the *Escherichia coli* is an insertion variant in which the transposon for the gene ypjD (b2611) is inserted.

12. A method for the preparation of alcohols and organic acids, which comprises the steps of irradiating lignin with light rays and then making alcohols and organic acids release from the light-irradiated lignin, wherein a catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays; which can show its

catalytic function in an alkaline solution; or which can show its catalytic function in an alkaline solution, while irradiating the same with light rays is acted on lignin, then the lignin is irradiated with light rays and separating and isolating the alcohols and organic acids released from the lignin, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

13. The method for the preparation of alcohols and organic acids as set forth in claim 12, wherein the step for the irradiation with light rays is carried out by the irradiation with ultraviolet rays or solar rays.

14. A method for making hydrogen ions release comprising the steps of acting a lignin decomposition catalyst comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays; which can show its catalytic function in an alkaline solution; or which can show its catalytic function in an alkaline solution, while irradiating the same with light rays on lignin or a solution containing lignin and an alkaline compound, irradiating the solution with light rays to thus make hydrogen ions release therefrom, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

Claims

1. A catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted and wherein the porphyrin is free of any coordinated transition metal at the center of the porphyrin ring.

2. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the *Escherichia coli* is an insertion variant in which the transposon for the gene ypjD (b2611) is inserted.

3. A catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function in an alkaline solution, while irradiating the same with light rays, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

4. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is a tetrapyrrole compound carrying a methyl group and an ethyl ester group or an acetate group (propionic acid group) on the porphyrin ring.

5. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is a tetrapyrrole compound carrying four

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methyl groups and four ethyl ester groups or acetate groups (propionic acid groups) on the porphyrin ring.

6. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the porphyrin is one having, in the molecule, a carboxyl group.

7. The catalyst for the decomposition of lignin as set forth in claim 6, wherein the porphyrin is one having, in the molecule, two, four or eight carboxyl groups, in total.

8. The catalyst for the decomposition of lignin as set forth in claim 6, wherein the porphyrin is at least one member selected from the group consisting of uroporphyrin, protoporphyrin and coproporphyrin.

9. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the catalyst comprises a culture medium containing a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium.

10. The catalyst for the decomposition of lignin as set forth in claim 1, wherein the *Escherichia coli* is an insertion variant in which the transposon for the gene ypjD (b2611) is inserted.

11. A method for the preparation of alcohols and organic acids, which comprises the steps of irradiating lignin with light rays and then making alcohols and organic acids release from the light-irradiated lignin, wherein a catalyst for the decomposition of lignin comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays; which can show its catalytic function in an alkaline solution; or which can show its catalytic function in an alkaline solution, while irradiating the same with light rays is acted on lignin, then the lignin is irradiated with light rays and separating and isolating the alcohols and organic acids released from the lignin, wherein the porphyrin is a tetrapyrrole

compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

12. The method for the preparation of alcohols and organic acids as set forth in claim 11, wherein the step for the irradiation with light rays is carried out by the irradiation with ultraviolet rays or solar rays.

13. A method for releasing hydrogen ions comprising the steps of acting a lignin decomposition catalyst comprising a porphyrin which can show its catalytic function through the irradiation thereof with light rays; which can show its catalytic function in an alkaline solution; or which can show its catalytic function in an alkaline solution, while irradiating the same with light rays on lignin or a solution containing lignin and an alkaline compound, irradiating the solution with light rays to thus make hydrogen ions release therefrom, wherein the porphyrin is a tetrapyrrole compound having a porphyrin ring structure, which is obtained by cultivating *Escherichia coli* in a culture medium and then isolating the same from the medium and wherein the *Escherichia coli* is one which cannot express the gene ypjD (b2611) due to the variation thereof or which is in such a condition that the function thereof for the expression of the gene ypjD (b2611) is partially or completely deleted.

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