FP:("swedish biofuels")

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1. 20050112739 METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS FROM BIOMASS US - 26.05.2005

Int.Class C12P 7/06 Appl.No 10970835 Applicant Swedish Biofuels AB Inventor Golubkov Igor

The present invention generally relates to biochemical and chemical industry, and more particularly to a method which can be used in fermenting carbohydrate substrates of plant origin for producing C_1-C_5 alcohols, and for synthesis of higher alcohols, other oxygen-containing compounds and hydrocarbons as well as for the production of motor fuel components from biomass. Since C_6 and higher alcohols, ethers, acetals, and higher hydrocarbons are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein by-products of fermentation are as raw materials for said synthesis.

2. 1680509 METHOD OF PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS FROM BIOMASS INCLUDING FERMENTATION WITH ADDITION OF AMINO ACIDS (LEU, ILE, VAL) LT - 25.03.2020

Int.Class C12P 7/04 Appl.No 04793835 Applicant SWEDISH BIOFUELS AB Inventor GOLUBKOV IGOR

3. PI0415619 MÉTODO PARA INTENSIFICAR A FERMENTAÇÃO DE SUBSTRATOS DE CARBOIDRATOS E AUMENTAR O RENDIMENTO DE ÁLCOOIS BR - 12.12.2006

Int.Class C12P 7/02 Appl.No PI 0415619-6 Applicant SWEDISH BIOFUELS AB Inventor GOLUBKOV IGOR

4. 2006/02864 METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS ZA - 31.10.2007

Int.Class C12P Appl.No 2006/02864 Applicant SWEDISH BIOFUELS AB Inventor GOLUBKOV IGOR

for synthesis of higghcr alcohols, and other oxygen-containing oorapoands. Since C« and higher alc=»hols are notobtainable y a direct biochemical route, it is proposed to synthesize these using known ««heaiical reactions, wherein the raw material for synthesis is biogas and lower Cj-Cs a_Jcohols obtained by the inventive method whesrein the amino acids leucine, i-_soleacinc, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is osed as a t-riocatalyst at the stage of fcrmcsntarion. It is also proposed to use wasters of C.-C_3 e lcohols production for obtaining biogas. The method offers a sohidon to the following problems: to considerably increase the yield oof Ci-Cj alcohols in fermentadon of carbohydjc¾ie substrates; io increase by 1 ^5-2.0 times the productivity of the fermentation in term-! of C_2-C_j alcohols production; io utilize the protein-con-aining waste for CD.-Cj alcohols prcducdon, to reach highest efficiency ««af biomass utilization in producing higher oxy^gen-cont-iining compounds and . hydrocarbons.

5. 174793 METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS FROM BIOMASS IL - 20.08.2006

Int.Class C12P 07//02 Appl.No 174793 Applicant SWEDISH BIOFUELS AB Inventor

6. PA/A/2006/004340 METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS MX - 23.10.2006

Int.Class C12P 7/06 Appl.No PA/a/2006/004340 Applicant SWEDISH BIOFUELS AB Inventor IGOR GOLUBKOV

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems:to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates;to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production;to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

7. WO/2005/040392 METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM WO - 06.05.2005

BIOMASS

Int.Class C12P 7/06 **Appl.No** PCT/SE2004/001534 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV, Igor

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

8. **1871358** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS CN - 29.11.2006

Int.Class C12P 7/06 **Appl.No** 200480031303.4 **Applicant** Swedish Biofuels AB **Inventor** Golubkov Igor

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

9. **1020060110868** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS KR - 25.10.2006

Int.Class C12P 7/06 **Appl.No** 1020067007926 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV IGOR

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C 2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

10. **2541899** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS CA - 06.05.2005

Int.Class C12P 7/06 **Appl.No** 2541899 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV, IGOR

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein- containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

11. **1680509** METHOD OF PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS FROM BIOMASS INCLUDING FERMENTATION WITH ADDITION OF AMINO ACIDS (LEU, ILE, VAL) EP - 19.07.2006

Int.Class C12P 7/04 **Appl.No** 04793835 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV IGOR

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

12. **20060281** METHOD FOR PRODUCTION OF HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS RS - 29.09.2008

Int.Class C12P 7/06 **Appl.No** 20060281 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV IGOR

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using

known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

13. **526429** INTENSIFYING FERMENTATION OF CARBOHYDRATE SUBSTRATE FOR, E.G. PRODUCING ONE TO FIVE CARBON ALCOHOLS, INVOLVES USING AMINO ACID LEUCINE, ISOLEUCINE, AND/OR VALINE AS SOURCE OF NITROGEN — SE - 25.04.2005

Int.Class C12P **Appl.No** 0302800 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV IGOR

Intensifying fermentation of carbohydrate substrate comprises preparation of aqueous carbohydrate substrate with carbohydrate (2-20%), fermenting substrate to 1-5C alcohols, glycerin, acetaldehyde, acetic acid, and acetone (1.5-10%), and separating desired products from the fermentation medium. The carbohydrate comprises source of nitrogen. Intensifying fermentation of carbohydrate substrate comprises preparation of aqueous carbohydrate substrate with carbohydrate (2-20%), fermenting substrate to 1-5C alcohols, glycerin, acetaldehyde, acetic acid, and acetone (1.5-10%), and separating desired production from the fermentation medium. The carbohydrate comprises source of nitrogen. The amino acids leucine, isoleucine, and/or valine are added to the aqueous carbohydrate substrate as the source of nitrogen to provide amino nitrogen in carbohydrate substrate of 120-420 mg/L.

14. **200600827** METHOD FOR FERMENTING CARBOHYDRATE SUBSTRATES — EA - 27.10.2006

Int.Class C12P 7/06 **Appl.No** 200600827 **Applicant** СУИДИШ БИОФЬЮЭЛЗ АБ null **Inventor** Голубков Игорь Михайлович

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C_1-C_5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C_6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C_2-C_5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C_2-C_5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C_2-C_5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C_2-C_5 alcohols production; to utilize the protein-containing waste for C_2-C_5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

15. **046.2356** METODE PEMBUATAN HIDROKARBON DAN SENYAWA YANG MENGANDUNG OKSIGEN, DARI BIOMASSA — ID - 06.07.2006

Int.Class A61K 9/00 **Appl.No** W00200601412 **Applicant** SWEDISH BIOFUELS AB **Inventor** Igor GOLUBKOV

Metode yang dapat digunakan dalam memfermentasikan substrat karbohidrat yang berasal dari tanaman untuk membuat alkohol C1-C5, dan untuk sintesis alkohol suku tinggi, dan senyawa lain yang mengandung oksigen. Karena C6 dan alkohol suku tinggi tidak dapat diperoleh dengan cara biokimia langsung, diusulkan untuk menyintesis bahan ini dengan menggunakan reaksi kimia yang dikenal, dimana bahan baku untuk sintesis adalah biogas dan alkohol C2-C5 rendah yang diperoleh dengan metode invensi dimana asam amino leusina, isoleusina, dan valina, atau campurannya, secara bebas pilih diperoleh dari autolisat ragi, digunakan sebagai biokatalis pada tahap fermentasi. Adalah juga diusulkan untuk menggunakan limbah dari pembuatan alkohol C2-C5 untuk memperoleh biogas. Metode ini menawarkan pemecahan masalah berikut: untuk meningkatkan hasil alkohol C2-C5 dalam fermentasi substrat karbohidrat secara nyata; untuk meningkatkan 1,5-2,0 kali produktivitas fermentasi dalam hal pembuatan alkohol C2-C5; untuk menggunakan limbah yang mengandung protein untuk pembuatan alkohol C2-C5, untuk mencapai efisiensi paling tinggi dari pemanfaatan biomassa dalam membuat senyawa dan hidrokarbon yang mengandung oksigen tinggi.

16. **1816/CHENP/2006** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS — IN - 08.06.2007

Int.Class c12p 7/06 **Appl.No** 1816/CHENP/2006 **Applicant** SWEDISH BIOFUELS AB **Inventor** GOLUBKOV, Igor

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

17. **2004284364** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS, FROM BIOMASS — AU - 11.05.2006

Int.Class C12P 7/06 **Appl.No** 2004284364 **Applicant** Swedish Biofuels AB **Inventor**

A method which can be used in fermenting carbohydrate substrates of plant origin for producing C1-C5 alcohols, and for synthesis of higher alcohols, and other oxygen-containing compounds. Since C6 and higher alcohols are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein the raw material for synthesis is biogas and lower C2-C5 alcohols obtained by the inventive method wherein the amino acids leucine, isoleucine, and valine, or a mixture thereof, optionally obtained from yeast autolysate, is used as a biocatalyst at the stage of fermentation. It is also proposed to use wasters of C2-C5 alcohols production for obtaining biogas. The method offers a solution to the following problems: to considerably increase the yield of C2-C5 alcohols in fermentation of carbohydrate substrates; to increase by 1.5-2.0 times the productivity of the fermentation in terms of C2-C5 alcohols production; to utilize the protein-containing waste for C2-C5 alcohols production, to reach highest efficiency of biomass utilization in producing higher oxygen-containing compounds and hydrocarbons.

18. **20150064763** METHOD FOR PRODUCING HYDROCARBONS AND OXYGEN-CONTAINING COMPOUNDS FROM BIOMASS — US - 05.03.2015

Int.Class C12P 7/14 **Appl.No** 14534490 **Applicant** SWEDISH BIOFUELS AB **Inventor** Igor Golubkov

The present invention generally relates to biochemical and chemical industry, and more particularly to a method which can be used in fermenting carbohydrate substrates of plant origin for producing C_1-C_5 alcohols, and for synthesis of higher alcohols, other oxygen-containing compounds and hydrocarbons as well as for the production of motor fuel components from biomass. Since C_6 and higher alcohols, ethers, acetals, and higher hydrocarbons are not obtainable by a direct biochemical route, it is proposed to synthesize these using known chemical reactions, wherein by-products of fermentation are as raw materials for said synthesis.

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